Teacher Energized Resource Manual

Class : 7th
Subject : Mathematics

CENTRAL BOARD OF SECONDARY EDUCATION

Preface

In consonance with the move towards outcome-based education where focus is on developing competencies in students, the Central Board of Secondary Education is delighted to share the *Teacher Energized Resource Manual* that will aid teachers in aligning their classroom transaction to a competency framework.

Each chapter of the Resource Manual corresponds to the respective chapters in the NCERT textbooks. The chapters have been chunked by concept; these concepts have been linked to the NCERT Learning Outcomes; and an attempt has been made to delineate Learning Objectives for each concept. Every chapter has a set of assessment items, where two items have been provided as examples for each Learning Objective. Teachers can use these to assess if the learner has acquired the related concept. Needless to say, the items are illustrative examples to demonstrate how competency-based items can be prepared to measure Learning Objectives and Outcomes. The variety in item forms is suggestive of the ways in which a particular concept can be assessed to identify if the learner has attained different competencies. We trust and hope that teachers would be able to generate many more similar test items for use in practice.

Your observations, insights and comments as you use this Resource Manual are welcome. Please encourage your students to voice their suggestions as well. These inputs would be helpful to improve this Manual as these are incorporated in the subsequent editions. All possible efforts have been made to remove technical errors and present the Manual in a form that the teachers would find it easy and comfortable to use.

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HOW TO USE THIS MANUAL

The goal of the Teacher Energized Resource Manual (TERM) is to provide teachers with competency-based education resources aligned to NCERT textbooks that would support them in the attainment of desired Learning Outcomes and development of requisite competencies of the learner. The TERM has equal number of corresponding chapters as NCERT Textbooks with listing of Concepts, Learning Outcomes developed by NCERT and Learning Objectives. Competency based test items for each corresponding Learning Objective and sample activities for enrichment have been provided.

Learning Objectives:

Each chapter has a *Learning Objectives* table. The table also lists the Concepts covered in the chapter. Learning Objectives are broken down competencies that a learner would have acquired by the end of the chapter. They are a combination of skills and what the learner would use this skill for. For example, the first Learning Objective in the table below relates to the skill of *application* and the students will use this competency to obtain the highest common factor of 2 positive integers. Teachers can use these specific Learning Objectives to identify if a student has acquired the associated skill and understands how that skill can be used.

Concepts	Learning Objectives	Learning Outcomes
Euclid's Division	Apply Euclid Division Algorithm in order to obtain HCF of 2 positive integers in the context of the given problem	Generalises properties of numbers and relations among them studied earlier, to evolve results, such as, Euclid's division algorithm, fundamental theorem of arithmetic in order to apply them to solve problems related to real life contexts
	Apply Euclid Division Algorithm in order to prove results of positive integers in the form of ax+b where a and b are integers	
Fundamental Theorem of Arithmetic	Use the Fundamental Theorem of Arithmetic in order to calculate HCF and LCM of the given numbers in the context of the given problem	
Irrational Numbers	Recall the properties of irrational number in order to prove that whether the sum/difference/product/quotient of 2 numbers is irrational or not	
	Apply theorems of irrational number in order to prove whether a given number is irrational or not	
Decimal Representation of Irrational Numbers	Apply theorems of rational numbers in order to find out about the nature of their decimal representation and their factors	

Concepts:

The important concepts in a particular chapter are listed in the first section. Most often, they follow a logical order and present a sequence in which these are likely to be covered while teaching. In case, your teaching strategy is different and presents them in a different order, you need not worry. Teach the way, you consider the best. You only need to ensure their understanding and the attainment of desired learning objectives.

Learning Outcomes (NCERT):

A mapping of Learning Outcomes developed by the NCERT and Learning Objectives is provided in last column of the table. The Learning Outcomes have been developed by the NCERT. Each Learning Objective is mapped to NCERT Learning Outcomes and helps teachers to easily identify the larger outcome that a learner must be able to demonstrate at the end of the class/ chapter.

Test items:

For each Learning Objective, at least two competency-based test items have been provided. Although, the items in this resource manual are multiple choice questions, which assess developed competencies of a student rather than only knowledge, it must be kept in mind that there can be different kinds of assessment that can easily align with competency-based education. Teachers can use these items to assess if a learner has achieved a particular Learning Objective and can take necessary supportive actions. Teachers are also encouraged to form similar questions which assess skills of students.

LOB: Apply Euclid Division Algorithm in order to obtain HCF of 2 given numbers in the context of the given problem

1. A worker needs to pack 350 kg of rice and 150 kg of wheat in bags such that each bag weighs the same. Each bag should either contain rice or wheat. Which option shows the correct steps to find the greatest amount of rice/wheat the worker can pack in each bag?

Option 1: Step 1: $350 = 2(150) + 50$
Step 2: $150 = 3(50) + 0$
Step 3: Greatest amount: 50 kg

Option 2: Step 1: $350 = 2(150) + 50$
Step 2: $150 = 2(50) + 0$
Step 3: Greatest amount: 50 kg

Option 3: Step 1: $350 = 2(150) + 50$
Step 2: $150 = 3(50) + 0$
Step 3: Greatest amount: 150 kg

Option 4: Step 1: $350 = 2(150) + 50$
Step 2: $150 = 2(50) + 0$
Step 3: Greatest amount: 150 kg

Correct Answer: Option 1

Fig: 3

Suggested Teacher Resources

At the end of each chapter, certain activities have been suggested which can be carried out by the teachers with learners to explain a concept. These are only samples and teachers can use, adapt, as well as, create activities that align to a given concept.

TABLE OF CONTENTS

1. INTEGERS

QR Code:

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction		Recall integers in order to in order to differentiate between whole numbers and integers	Applies rules for multiplication and division in order to solve problems involving two integers with same or different signs
		Represent numbers with positive and negative signs in order to apply to various situations	
Recall		Represent integers on a number line in order to perform operations and verify properties of integers	
Properties of Addition and subtraction of integers	Closure under Addition	Apply properties of addition and subtraction of integers in order to simplify arithmetic expressions.	
	Closure under Subtraction		
	Commutative Property		
	Associative Property		
	Additive Identity		
Multiplication of integers	Multiplication of a Positive and a Negative Integer	Apply rules of multiplication of integers in order to solve various arithmetic expressions and contextual problems	
	Multiplication of two Negative Integers		
	Product of three or more Negative Integers		
Properties of multiplication of integers	Closure under Multiplication	Apply properties of multiplication of integers in order to simplify arithmetic expressions	
	Commutativity of Multiplication		
	Multiplication by Zero		
	Multiplicative Identity		
	Associativity for Multiplication		
	Distributive Property		
	Making Multiplication Easier	Apply properties of addition, subtraction and multiplication of integers in order to devise methods for easier calculation and solve problems based on real life related to integers	
Division of integers		Infer division of integers as inverse operation of multiplication in order to	

		write multiplication statement into corresponding division statement	
Properties of division of Integers		Apply properties of division of integers in order to simplify arithmetic expressions	

Test items

LG: Recall integers in order to differentiate between whole numbers and integers

Level of difficulty: Medium
Bloom's Level: Remembering
1. Which among the following numbers are integers? 12, -6, 0, -8, 10, -1
   Option 1: all of the numbers are integers
   Option 2: all of the numbers except 0 are integers
   Option 3: only the numbers12 and 10 are integers
   Option 4: only the numbers 0, 10 and 12 are integers

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analyzing
2. Consider an incomplete statement. The sum of a _____ and a _____ is a whole number
   Which words when filled in the blanks make the statement correct?
   Option 1: positive integer, negative integer
   Option 2: positive integer, whole number
   Option 3: negative integer, negative integer
   Option 4: negative integer, whole number

Correct Answer: Option 2

LG: Represent numbers with positive and negative sign in order to apply to various situations

Level of difficulty: Hard
Bloom's Level: Understanding
1. A pigeon is flying 100 feet above the sea level and a fish is 50 feet below the sea level. If the elevation of pigeon is 100 feet, then what is the elevation of fish?
   Option 1: 150 feet
   Option 2: 50 feet
   Option 3:–50 feet
   Option 4: –150 feet

Correct Answer: Option 3

Level of difficulty: Medium
Bloom's Level: Understanding
2. The average monthly temperature of two cities is described below.
   City P: 5°Cbelow zero
   City Q: 32°C above zero.
   Which option lists the correct way to represent the average monthly temperature of the two cities?
   Option 1: City P: 5°C,City Q: 32°C
   Option 2: City P:−5°C, City Q: 32°C
   Option 3: City P:−5°C, City Q: −32°C
   Option 4: City P: 5°C, City Q: −32°C

Correct Answer: Option 2

LG: Represent integers on a number line in order to perform operations and verify properties of integer.

Level of difficulty: Medium
Bloom's Level: Understanding
1. The numbers below are to be arranged on a number line. 0, 5, -18, 20, -30, -12, 2 Which option lists the numbers in the order they should be arranged from left to right on a number line?
   Option 1: -30, -18, -12, 0, 2, 5, 20
   Option 2:0, -12, -18, -30, 2, 5, 20
   Option 3:0, 2, 5, -12, -18, 20, -30

Option 4: 0, -30, -18, -12, 2, 5, 20
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understanding

2. Two integers p and q are at equal distance from 0 on a number line. Which relation between p and q is correct?
   Option 1: $p = -q$
   Option 2: $p = q$
   Option 3: $p + q = 1$
   Option 4: $p - q = 1$

Correct Answer: Option 1

LG: Apply properties of addition and subtraction of integers in order to simplify arithmetic expressions.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the mathematical expressions, X and Y.

$$X: -22 + (-14 + 38) \qquad Y: [-22 + (-14)] + 38$$

   Which of the following statements is true regarding the expressions above?
   Option 1: $X < Y$
   Option 2: $X > Y$
   Option 3: $X = Y$
   Option 4: $X = -Y$

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. Consider the mathematical statement:

$$-25 + 0 = 0 - \_\_\_$$

Which of the following integers makes the above statement correct?
   Option 1: 0
   Option 2: 52
   Option 3: -25
   Option 4: 25

Correct Answer: Option 4

LG: Apply rules of multiplication of integers in order to solve various arithmetic expressions and contextual problems

Level of difficulty: Medium
Bloom's Level: Analyze the problem and apply the properties

1. The statement below is incomplete. The product of 3 negative integers, 5 positive integers and -5 is always _____. Which word completes the statement?
   Option 1: 0
   Option 2: -75
   Option 3: negative
   Option 4: positive

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analyzing

2. If a and b are integers such that $a > 0$ and $b < 0$, which of these will result in a product greater than 0?
   Option 1: $a \times b$
   Option 2: $a \times (-b)$
   Option 3: $(-a) \times (-b)$
   Option 4: $(a \times -1) \times (-1 \times b)$

Correct Answer: Option 2

LG: Apply properties of multiplication of integers in order to simplify arithmetic expressions

Level of difficulty: Medium
Bloom's Level: Applying
1. What is the value of -4 (-200+125)?
   Option 1: –1300
   Option 2:–300
   Option 3:300
   Option 4: 1300

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. What is the value of the expression below? $-5\{(-16+18)\times(-11+2)\}$
   Option 1: 18
   Option 2:-55
   Option 3:-90
   Option 4: 510

Correct Answer: Option 3

LG: Apply properties of addition, subtraction and multiplication of integers in order to devise methods for easier calculation and solve problems based on real life related to integers

Level of difficulty: Hard
Bloom's Level: Applying
1. A travel app launched an online quiz consisting of 50 questions. The information below describes how the points will be awarded to participants.
   - 2 points for each question answered correctly
   - –1 for each question answered incorrectly
   - 0 points for each question that is not answered.
   - 5 additional points for answering more than 40 questions correctly

   What would be the score of a participant who attempted all questions but answered 45 questions correctly?

   Option 1:50
   Option 2:85
   Option 3:90
   Option 4: 100

Correct Answer: Option 4

Level of difficulty: Medium
Bloom's Level: Applying
2. Consider the expression below. -21×98. Which of these can be used to find the value of the expression?
   Option 1: $-21\times 100-2$
   Option 2: $-20-1\times 100-2$
   Option 3: $-21\times -2+(-21)\times 100$
   Option 4: $-(-21)\times -2+(-21)\times 100$

Correct Answer: Option 3

LG: Infer division of integers as inverse operation of multiplication in order to write multiplication statement into corresponding division statement

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which is the correct division statement for "The product of 15 and -100 is -1500"?
   Option 1: –1500 ÷ 100 = 15
   Option 2:15 ÷ 100 = –1500

Option 3:–1500 ÷ –100 = 15
Option 4: –1500 ÷ –15 = –100
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Understanding
2. Which is the correct division statement for $-a \times 0 = 0$?
Option 1: $0 \div -a = 0$
Option 2: $-a \div 0 = 0$
Option 3:$0 \div 0 = -a$
Option 4: $0 \div a = a$
Correct Answer: Option 1

LG: Apply properties of division of integers in order to simplify arithmetic expressions

Level of difficulty: Medium
Bloom's Level: Understanding
1. What is the quotient when an integer is divided by its additive inverse?
Option 1: 1
Option 2:0
Option 3:–1
Option 4: the integer itself
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider the expression $(18 \div 5) \div (x \div 15)$ For what value of x, the expression above satisfies the commutative property?
Option 1: 18
Option 2: 54
Option 3: 5
Option 4: 28
Correct Answer: Option 2

Suggested Teacher Resources

1

Lesson Plan

Objective	Apply rules of multiplication of integers in order to solve various arithmetic expressions and contextual problems
Material Required	Red and green buttons (20 of each)
Previous Knowledge	Multiplication
Procedure	Teacher starts with a question: What does multiplication mean? Teacher need to force connection between multiplication and repetitive addition. For example, students must be familiar with 4 × 3 can be read as positive 4 repeated 3 times. With buttons it will look like this  Here green buttons are positive and red buttons are negative. Negative integers:  Positive integers:  Divide students into pairs and ask them to demonstrate following operations using above logic. Demonstrate: 1. (+4) × (+2) 2. (-2) × (+2) 3. (+2) × (-2) 4. (-2) × (-2) Note: Teacher need to push students into thinking 1. how can they read (+4) × (+2) as?

2. How do they understand this?

Answers:

1. Demonstration of (+4) x (+2)
Q. How do you read this?
Ans: This can be read as positive 2 repetitively adding 4 times.
Q) How do you understand this?
Ans: Positive 2 is clear, it means 2 green buttons. Repeating positive 4 times implies repeating four times in the same way. So, 2 green buttons are repeated four times which makes them equal 8 green buttons.

2. Demonstration of (+2) x (-2)
Q. How do you read this?
Ans: This can be read as negative 2 repetitively added 2 times.
Q) How do you understand this?
Ans: Repeating positive 2 times implies repetitively adding two times in the same way. Hence (+2) x (-2) equals -4.

Student will feel stuck on the following problem.

3. Demonstration of (-2) x (+4)
Q) How do you read this?
Ans: Positive 4 is being repetitively removed two times.
Q) How do you understand this?
Ans: Since students can't remove positive 4 as there are no buttons on the table teacher can help student by hinting what would keeping 1 red and 1 green button on the table means.
1 red and 1 green button will add up to 0. So, keeping 8 green and 8 red would also turn out to be 0.
Now students can easily remove 4 green twice. There will be only 8 red buttons left.
Hence (-2) x (+4) equals -8.

4. Demonstration of (-2) x (-4)
Q) How do you read this?
Negative 4 is repetitively removed twice.
Q) How do you understand this?
Ans: Add 8 green and 8 red buttons on the table and remove 4 red buttons twice.
Hence, we will get 4 green buttons. (-2) x (-4) = +8.

After all the students performed this activity as students to fill the following table.

Multiplication	Result
Positive × Positive	
Positive × Negative	
Negative × Positive	
Negative × Negative	

Source http://www.teachersofindia.org/en/article/fair-division

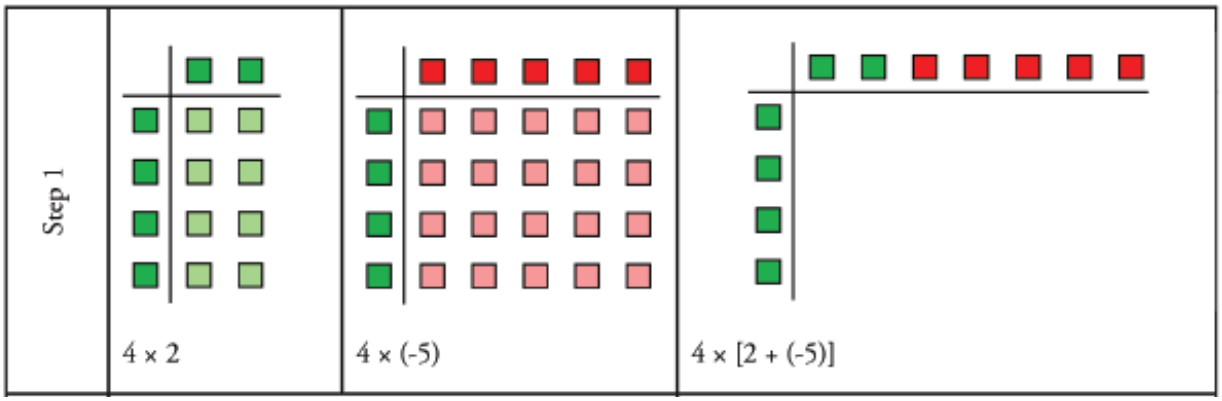
2 Activity

Objective: Students would be able to visualize distributive property of multiplication for integers.
Materials required: Red and Green buttons, multi-colour pen

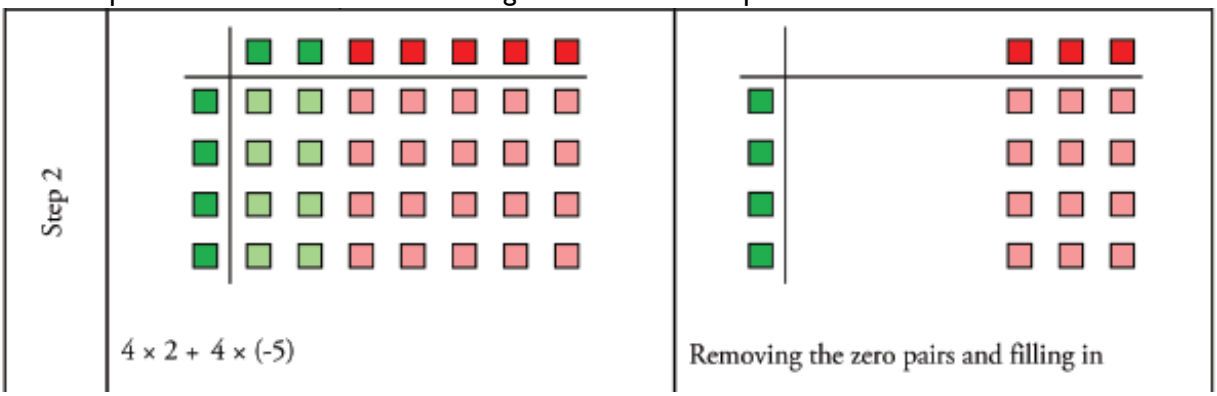
Setup: The green button represents positive one and red button represents negative one. 1 red and 1 green button would be 0 when added.


Distributive property: a × (b + c) = a × b + a × c
Where a, b, c are integers.
Teacher will demonstrate with an example.
Take 4 × [2 + (-5)] should be equal to 4 × 2 + 4 × (-5)

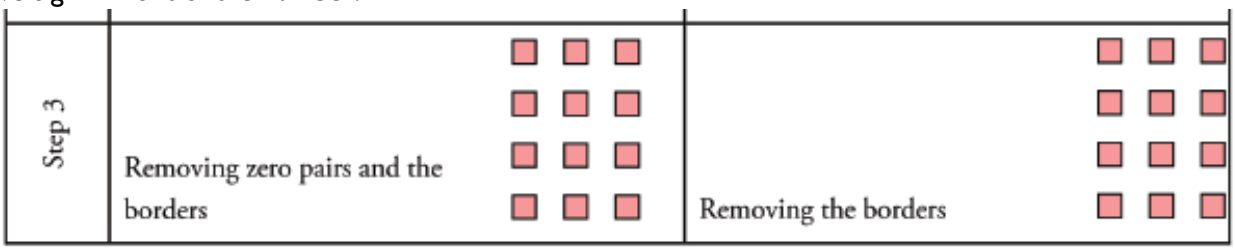
Visual representation
Steps:
1. represent the products on either side of equations as follows.



2. Remove zero pairs since we know 1 red and 1 green button adds up to zero.



3. Count the number of buttons left and if they are green then put a positive sign and if they are red then put a negative sign in front of the number.



Teacher can ask students to repeat these steps for:
1. 3 × [1 + (-4)]
2. -4 × [(-2) + (-5)]

2. FRACTIONS AND DECIMALS

QR Code:

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Fractions		Define proper, improper and mixed fractions in order to distinguish between them	Applies repeated addition and subtraction in order to interpret the division and multiplication of fractions. For example, interprets 2/3 x 4/5 as 2^ /3 of 4/5. Also 1/4 ÷1/2 is interpreted as how many 1/4 make 1/2?
		Multiply (or divide) numerator and denominator with the same number in order to write equivalent fractions	Expresses a fraction as percentages and decimals in order to solve daily life problems. For example, calculates 15% of Rs 100 to say that 100 x 0.15 = Rs 15
		Convert unlike fractions into like fractions in order to compare them.	
Multiplication of fractions	Multiplication of a Fraction by a Whole Number	Extend concept of multiplication as repetitive addition for fraction in order to multiply a fraction and a whole number.	Applies algorithms for multiplication and division in order to multiply and divide fractions/decimals. Applies appropriate mathematical operations on rational numbers in order to solve problems related to daily life situations
	Multiplication of a Fraction by a Fraction	Multiply fractions in order to solve for the operator 'of'	
		Multiply fractions in order to calculate the total number of parts	
		Multiply fractions in order to compare the value of the product with the original fractions	
Division of fractions	Division of Whole Number by a Fraction	Invert a given fraction in order to find its reciprocal	
	Division of a Fraction by a Whole Number		
	Division of a Fraction by Another Fraction	Divide two fractions in order to find the smaller parts of the fraction	
Decimal Numbers		recall and apply concept of decimal representation and expansion in order to perform mathematical operations on decimal	
Multiplication of Decimal numbers	Multiplication of Decimal Numbers by 10, 100 and 1000	Multiply decimal numbers by 10, 100 and 1000 in order to infer right shift in decimal point	

		Find the intersection of 2 decimal numbers on the grid in order to represent their product	Calculates the simple form of a fraction in order to distinguish quantities that are in proportion. For example, tells that 15, 45, 40, 120 are in proportion as 15/45 is the same as 40/120
Division of decimal numbers	Division by 10, 100 and 1000	Divide decimal numbers by 10, 100 and 1000 in order to infer left shift in decimal point	
	Division of a Decimal Number by a Whole Number	Divide decimal number by a whole number in order to solve questions related to decimals	
	Division of a Decimal Number by another Decimal Number	Convert decimals into fractions in order to divide decimal number by another decimal number	

Test items

LG: Define proper, improper and mixed fractions in order to distinguish between them

Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the following statements.
   Statement I: The numerator of an improper fraction is less than the denominator.
   Statement II: The denominator of a proper fraction is greater than the numerator.
   Statement III: A mixed fraction can be converted to a proper fraction.
   Statement IV: A mixed fraction can be converted to an improper fraction.
   Which of the given statements is/are correct?
   Option 1: only statement I
   Option 2: only statement II
   Option 3: statements II and III
   Option 4: statements II and IV

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Understanding

2. Consider the statements below.
   Statement I: An improper fraction can be expressed as a number consisting of a whole number part and a proper fraction.
   Statement II: An improper fraction can be expressed as a mixed fraction.
   Which of the statements is/are true?
   Option 1: only statement I
   Option 2: only statement II
   Option 3: both the statements
   Option 4: neither of the statements

Correct Answer: Option 3

LG: Multiply (or divide) numerator and denominator with the same number in order to write equivalent fractions

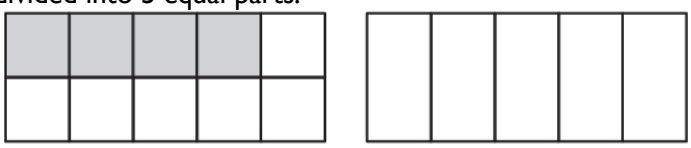
Level of difficulty: Medium
Bloom's Level: Applying

1. Which fraction is equivalent to $\frac{55}{121}$?
   Option 1: $\frac{11}{121}$
   Option 2: $\frac{110}{121}$
   Option 3: $\frac{121}{55}$
   Option 4: $\frac{\mathbf{5}}{\mathbf{11}}$

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Understanding

2. The fraction models below show two wholes of the same size. Model A is divided into two 10 equal parts and Model B is divided into 5 equal parts.



Model A Model B

How many parts in Model B should be shaded so that shaded parts in both the models represent the same fraction?
Option 1: 1

Option 2:2
Option 3:4
Option 4: 8
Correct Answer: Option 2

LG: Convert unlike fractions into like fractions in order to compare them.

Level of difficulty: Medium
Bloom's Level: Applying
1. Which comparison of the fractions$\frac{11}{24}$ and $\frac{5}{6}$is correct?
Option 1: $\frac{11}{24} = \frac{5}{6}$
Option 2:$\frac{11}{24} < \frac{5}{6}$
Option 3:$\frac{11}{24} > \frac{5}{6}$
Option 4: The fractions cannot be compared.
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. For the comparison below to be correct, what is the smallest whole number value possible for a?
$$\frac{a}{16} > \frac{3}{4}$$
Option 1: 3
Option 2:11
Option 3: 12
Option 4: 13
Correct Answer: Option 4

LG: Extend concept of multiplication as repetitive addition for fraction in order to multiply a fraction and a whole number.

Level of difficulty: Medium
Bloom's Level: Apply
1. Consider the following methods to find the value of$\frac{3}{27} \times 3$.
Method I: $\frac{3}{27} + \frac{3}{27} + \frac{3}{27}$
Method II: $\frac{3\times3}{27\times3}$
Which method is correct?
Option 1: only method I
Option 2: only method II
Option 3: Both the methods
Option 4: Neither of the methods
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying
2. A pump can $\frac{3}{18}$ of a tank in an hour. If the pump fills the same amount every hour, what fraction of the tank can the pump fill in 5 hours?
Option 1: $\frac{5}{6}$
Option 2:$\frac{1}{6}$
Option 3:$\frac{1}{30}$
Option 4: $\frac{2}{9}$
Correct Answer: Option 1

LG: Multiply fractions in order to solve for the operator 'of'

Level of difficulty: Medium
Bloom's Level: Applying

1. What is $\frac{1}{5}$ of 45?
   Option 1: 9
   Option 2:225
   Option 3:$\frac{1}{225}$
   Option 4: $\frac{1}{9}$

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Apply

2. Sakshi needs to walk 600 m to reach a bakery. After travelling $\frac{2}{6}$ of the total distance, she stops to meets her friend. How much distance does she have left to walk in order to reach the bakery?
   Option 1: 200m
   Option 2:600m
   Option 3:400m
   Option 4: 300m

Correct Answer: Option 3

LG: Multiply fractions in order to calculate the total number of parts

Level of difficulty: Hard
Bloom's Level: Analyzing

1. Rakhi cuts a cake and puts $\frac{2}{3}$ of the cake on a plate. She eats $\frac{1}{3}$ of the cake on the plate. Which of these could be the possible description of the situation?
   Option 1: Rakhi cuts the cake into 9 equal pieces. She puts 6 pieces on the plate and eats 2 of them. Rakhi eats $\frac{2}{9}$ of the cake.
   Option 2: Rakhi cuts the cake into 6 equal pieces. She puts 3 pieces on the plate and eats 3 of them. Rakhi eats $\frac{3}{6}$ of the cake.
   Option 3: Rakhi cuts the cake into 3 equal pieces. She puts 2 pieces on the plate and eats 1 of them. Rakhi eats $\frac{1}{3}$ of the cake.
   Option 4: Rakhi cuts the cake into 9 equal pieces. She puts 2 pieces on the plate and eats 1of them. Rakhi eats $\frac{1}{9}$ of the cake.

Correct Answer: Option 1

Level of difficulty: Medium
Bloom's Level: Applying

2. Anita's total monthly expenses are equal to $\frac{2}{3}$ of her monthly salary. She spends $\frac{1}{4}$ of her total monthly expenses on house rent. What fraction of her monthly salary does Anita spend on house rent?
   Option 1:$\frac{1}{6}$
   Option 2:$\frac{1}{4}$
   Option 3:$\frac{1}{3}$
   Option 4: $\frac{1}{12}$

Correct Answer: Option 1

LG: Multiply fractions in order to compare the value of the product with the original fractions

Level of difficulty: Medium
Bloom's Level: Applying

1. Let $X = \frac{3}{14}$ and $Y = \frac{5}{7}$
   Which among the following is NOT correct related to the above fractions?
   Option 1: $X > XY$

Option 2: $Y > XY$
Option 3: $XY > 1$
Option 4: $XY < 1$
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Apply

2. Ishan multiplies $5\frac{5}{6}$ by a fraction X and gets the product that is less than $5\frac{5}{6}$.
   Based on his work, consider the following two statements.
   Statement I: X is the fraction less than 1.
   Statement II: The product of $5\frac{5}{6}$ and X is greater than X.
   Which statement is correct?
   Option 1: Only statement I
   Option 2: Only statement II
   Option 3: Both the statements
   Option 4: Neither of the statements

Correct Answer: Option 3

LG: Invert a given fraction in order to find its reciprocal

Level of difficulty: Medium
Bloom's Level: Understanding

1. What is the reciprocal of the mixed fraction $21\frac{3}{5}$?
   Option 1: $21\frac{5}{3}$
   Option 2: $\frac{5}{63}$
   Option 3: $\frac{5}{3}$
   Option 4: $\frac{5}{108}$

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying

2. What fraction should be multiplied by $13\frac{7}{9}$ to get the product as 1?
   Option 1: $\frac{9}{124}$
   Option 2: $\frac{9}{7}$
   Option 3: $13\frac{9}{7}$
   Option 4: $\frac{9}{91}$

Correct Answer: Option 1

LG: Divide two fractions in order to find the smaller parts of the fraction

Level of difficulty: Medium
Bloom's Level: Understanding

1. What is the missing number?
   $\frac{75}{4} \div \frac{1}{16} = ?$
   Option 1: $\frac{300}{16}$
   Option 2: 300
   Option 3: $\frac{75}{16}$
   Option 4: 4

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analyzing

2. The steps a student takes to solve a problem are described.
   Step 1: Creates 3 rectangles.
   Step 2: Shades 2 rectangles completely and half of the third rectangle.
   Step 3: Divides each rectangle into 4 equal parts.
   Step 4: Reports the total number of shaded parts as answer.
   Which of these could be the problem that the student was solving?
   Option 1: $\frac{3}{2} \div \frac{1}{4}$
   Option 2: $2\frac{1}{3} \div 4$
   Option 3: $\frac{5}{2} \div \frac{1}{4}$
   Option 4: $\frac{2}{3} \div \frac{1}{4}$

Correct Answer: Option 3

LG: Recall and apply concept of decimal representation and expansion in order to perform mathematical operations on decimal

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following is the correct decimal expansion for 55.83?
   Option 1: $5 \times 10 + 5 \times 1 + 8 \times \frac{1}{10} \times 3 \times \frac{1}{100}$
   Option 2: $5 \times 100 + 5 \times 10 + 8 \times \frac{1}{100} \times 3 \times \frac{1}{10}$
   Option 3: $5 \times 10 + 5 \times 1 + 8 \times \frac{1}{100} \times 3 \times \frac{1}{10}$
   Option 4: $5 \times 10 + 5 \times 1 + .8 \times \frac{1}{10} \times .3 \times \frac{1}{100}$

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying

2. Shikhar has nine10paise coins, five 20 paise coins and two 50 paise coins. How much money does he have in total?
   Option 1: Rs.9.20
   Option 2: Rs.2.90
   Option 3: Rs. 2.09
   Option 4: Rs.9.02

Correct Answer: Option 2

LG: Multiply decimal numbers by 10, 100 and 1000 in order to infer right shift in decimal point

Level of difficulty: Medium
Bloom's Level: Applying

1. What is the value of $0.5561 \times 100 \times 10$?
   Option 1: .0005561
   Option 2: 55.61
   Option 3: 5.561
   Option 4: 556.1

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analyzing

2. Which value among the following makes the above equation mathematically correct?
   $$.651 \times \_\_\_\_\_ = 651$$
   Option 1: 10
   Option 2: 100
   Option 3: 1000
   Option 4: None of the above

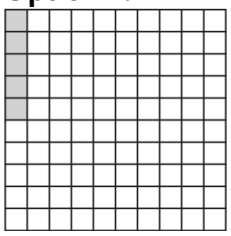
Correct Answer: Option 3

LG: Find the intersection of 2 decimal numbers on the grid in order to represent their product

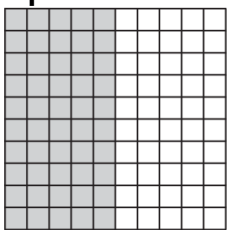
Level of difficulty: Medium
Bloom's Level: Understand

1. Which model shows the value $.5 \times .1$?

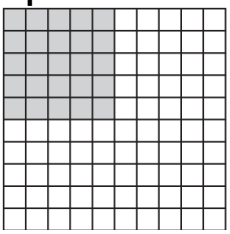
Option 1:



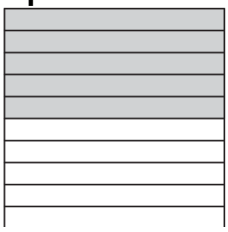
Option 2:



Option 3:



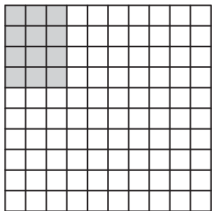
Option 4:



Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understand

2. A student creates the model below to find the product of two decimal numbers.



Which decimal numbers is the student multiplying?

Option 1: 1.2 and .01
Option 2:12 and .1
Option 3:.12 and .1
Option 4: 1.2 and.1

Correct Answer: Option 4

LG: Divide decimal numbers by 10, 100 and 1000 in order to infer left shift in decimal point

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which option describes how the decimal point in 7.3225 should be shifted when it is divided by 100?

Option 1: 2 places to the left
Option 2:3 places to the left
Option 3:2 places to the right
Option 4: 3 places to the right
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying
2. How many kilograms is 5grams?
Option 1: 0.05kg
Option 2: 0.005kg
Option 3: 500kg
Option 4: 5000kg
Correct Answer: Option 2

LG: Divide decimal number by a whole number in order to solve questions related to decimals

Level of difficulty: Medium
Bloom's Level: Applying
1. How much amount each gets If Rs.235.50 is equally divided among 5 people?
Option 1: 47.10
Option 2:23.55
Option 3:1177.50
Option 4: 47.00
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understand
2. Write the missing value? $2.25 \div 25 = ?$
Option 1:0.09
Option 2:0.1
Option 3: 1
Option 4: 9
Correct Answer: Option 1

LG: Convert decimals into fractions in order to divide decimal number by another decimal number

Level of difficulty: Hard
Bloom's Level: Applying
1. Among how many students can Rita divide 85.75 meters of ribbon so that each student gets 11.32 meters of the ribbon?
Option 1: 7
Option 2:8
Option 3:11
Option 4: 12
Correct Answer: Option 1

Level of difficulty: Medium
Bloom's Level: Understanding
2. Which gives the same value as $3.65 \div 4.2$?
Option 1: $\frac{365}{42}$
Option 2:$\frac{365}{420}$
Option 3:$\frac{365}{4.2}$
Option 4: $\frac{3.65}{42}$
Correct Answer: Option 2

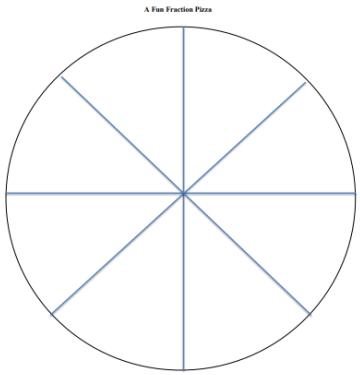
Suggested Teacher Resources

1 LESSON PLAN

Objective-: Students will evaluate and compare equivalent fractions in order to understand the portion of a whole we need.

Material Required:

- 2 copies of a circle divided into 8 pieces (Attached below)
- Markers or crayons
- Scissors
- Pencil
- Glue



Procedure-:

- Begin by playing hang-man, or a similar word game, with the word "PIZZA."
- Once students have guessed the word, the teacher will ask how many students love pizza.
- Engage the students in a think-pair-share with their favourite toppings of pizza. (First give students 30 seconds-1 minute to think about their favourite pizza topping, then let them tell a partner, then call on students to share their or their partner's favourite pizza topping.)
- Ask students if they have ever ordered a pizza with 2 toppings on it, for example, half cheese and half peperoni.
- Explain to students that this is math and fractions!
- Write on the board:
  - ½ peperoni + ½ cheese equals 2/2 which equals 1 whole pizza.
- Hand out 1 copy of the circle worksheet.
- Instruct students to draw the most delicious pizza that they can imagine. Tell them that they can do ½ and ½ or make each slice the same, or make each slice different.
- Once they have finished their pizza, ask them to write their name on each slice of pizza.
- Have students carefully cut out each slice of pizza and carefully place them on their desk.
- Have a helper collect all of the paper scraps and recycle them.
- Hand out the 2nd copy of the circle worksheet.
- Instruct students to choose 1 of their slices of pizza and glue it to their paper inside the circle.
- Tell students to get out a blank sheet of lined paper and write "Fun Fraction Pizza" on the top. In the first line, have students write "pizza 1 made = 1/8." Model this on the board.
- Now tell students to find a buddy student and trade 2 pieces of pizza.
- When students have exchanged these slices, have them come back to their seat and write, "Pizza my buddy made = 2/8"
- Now tell students to exchange 1 piece of pizza with a girl.
- Next, tell students to exchange one piece of pizza with a boy.

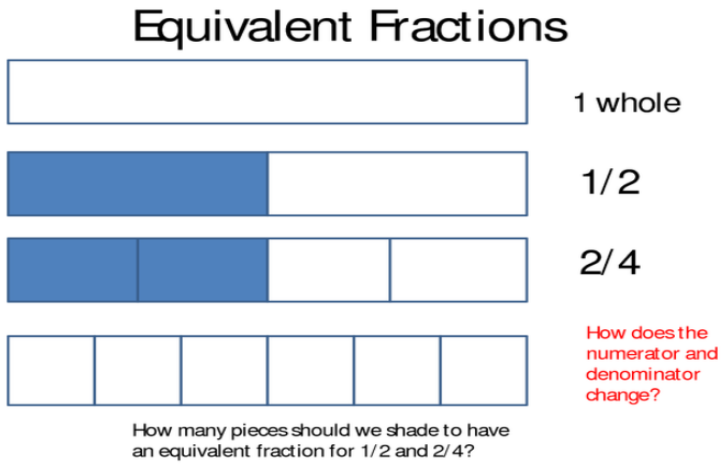
- Now tell students to exchange the remaining 3 pizzas with whomever they would like (or if you have any other classifications in your classroom, such as groups, you can also tell them to exchange with another group member, etc…)
- Once students have exchanged all of their slices tell them to go back to their seats and glue all of the pizza nicely to their paper.

Guided Practice

- Model on the board the rest of the worksheet.
  - Pizza that boys made x/8
  - Pizza that girls made x/8
  - Pizza that people in my group made x/8
  - Etc…
  - Pizza slices in total 8/8
- Once the students have completed all of the categories out of 8 slices, ask them if they know how to simplify any of the fractions.
- Guide students to simplify the fractions by dividing by 2 and/or by 4, and the whole pizza, 8/8 is equal to 1 whole.

Independent Practice- Teacher will give students a basic fraction simplification worksheet such as the example attached. This will be used as an assessment.

- After the opening activity, bring the class back together as a whole to discuss equivalent fractions. let the students know that today, we learn how to create equivalent fractions.
- Students explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models. The students use multiplication and division to find equivalent fractions. The fraction strips are used to give a visual of the equivalent fractions.



- When discussing the shaded fractions, some students might say that one side shaded was the whole (the side with the shaded 1/2) and the other side is half of the whole (the side with the shaded 2/4). Clear that up before we got any further into the lesson. Teacher question to those two students was, "How is that a whole when you shaded it from part of something?" Teacher wanted them to understand the concept of what a fraction actually means. "It is a part of a whole."
- Teacher will explain to the class that the sheet of paper is the "whole." A fraction is a part of a whole. If you have a pizza, the pizza is the whole. The slices would be a fraction of the whole pizza.
- When you are dealing with fractions, if you are trying to figure out if they are equivalent, they must have the same whole. (I hold up a piece of 8 1/2 x 11 copy paper and a piece of 9 x 12 construction paper.) We can't

use these two pieces of paper to shade 1/2 and 2/4 because the construction paper is larger than the copy paper. That is not the same whole. The 1/2 on the construction paper is larger than the 1/2 on the copy paper. (Teacher will demonstrate by folding the construction paper and comparing it with 1/2 of the copy paper.) This gives the students a conceptual understanding that we must use the same whole when finding equivalent fractions.

- Teacher will show the students fraction strips of 1/2 and 2/4. The students see from the fraction strips that these two fractions are equivalent. (This is another visual for the students to see that 1/2 and 2/4 are equivalent.)
- If we look at 1/2, 2/4, and 3/6, we should be able to notice something. The students will notice the pattern with the fractions. One student will say that the top number is counting up 1, 2, and 3. Another student notice the denominator is counting up by 2's. "If this pattern continues, what would be the next equivalent fraction?"
- Teacher give the students a minute to think about this question. If the fraction is 1/2, I can find an equivalent fraction by multiplying the top number and the bottom number by the same number.
- Teacher can use any number other than 1. Teacher will ask students "Who can tell me why we can't use the number 1 to multiply or divide?" Some students might remember their property of one, which says that any number multiplied by 1 equals that same number. If I pick the number 2, then I multiply 1 x 2 = 2 and 2 x 2 = 4. This shows you that 1/2 is equivalent to 2/4. When you do this, you must make sure you use the same number for the numerator and denominator. (The students will see the connection between multiplying to find equivalent fractions and get a visual of this when they use fraction strips for their hands-on activity.)
- Teacher will reinforce to the students that in equivalent fractions, we must refer to the same whole. If you have 1/2 of something, Teacher have 2/4, and another person has 3/6, we all have the same amount if we are talking about the same whole. "You can't have a large pizza and teacher have a small pizza, and we say we have the same amount if teacher have 2/4 and you have 1/2. That is not going to be true because you are going to have more than me if you have a large pizza and teacher have a small pizza. My 2/4 will be smaller than your 1/2. It has to be the same size and the same shape.

Closing

Hold a class discussion. Ask students to relay what they learned. Ask them how they can use this at home. (For example, when they order pizza). Ask students if there are any other kinds of foods that this could work with (cake, pie, etc…).

Source-:https://www.teacher.org/lesson-plan/fun-fraction-pizza/

https://betterlesson.com/lesson/553633/equivalent-fractions

3. DATA HANDLING

QR Code:

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction		Collect, record and present data in order to organize experiences and draw inferences from them	Represents data pictorially in order to interpret data using bar graph such as consumption of electricity is more in winters than summer, runs scored by a team in first 10 overs etc.
Collecting data			
Organising data		Organize raw data into tabular form in order to make data easier to interpret	
Representative Values		Calculate average in order to represent the central tendency of the data	
Arithmetic Mean	Range	Calculate arithmetic mean in order to find its position in the data	
		Calculate range of the data in order to know the spread of the data	
Mode	Mode of Large Data	Calculate mode of the data in order to find the observation that occurs most often in the data set	Calculates mean, median and mode in order to find various representative values for simple data from her/his daily life
Median		Calculate median of the data in order to find the observation that lies in the middle of the data set	
Use of bar graphs with a different purpose	Choosing a Scale	Represent data in a bar graph using appropriate scale in order to represent given information in form of a bar graph	
		Represent data using double bar graph in order to compare and discuss two collection of data at a glance	
Chance and Probability	Chance	Calculate probability in order to find the chance of occurring/non- occurring of the events	Calculates the variability in real life situation in order to appreciate the variation observed in real life situations such as, variations in the height of students in her class and uncertainty in happening of events like throwing a coin

Test items

LG: Collect, record and present data in order to organize experiences and draw inferences from them

Level of difficulty: Medium
Bloom's Level: Understanding

1. The tally chart below displays the heights, in cm, of a group of students.

Height of Students (in cm)	Tally Marks
158	𝍸
161	𝍸 ||
162	𝍸 |||||
165	𝍸 ||||
170	|||
171	||

How many students have height between 160 cm and 166 cm?

Option 1: 34
Option 2: 25
Option 3: 24
Option 4: 29

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. A group of 300 students were divided into small groups based on their year of birth.
   - One-fourth of the students were born in the year 2000
   - The number of students who were born in 1999 is twice the number of students who were born in 2000.
   - The number of students who were born in 2001 is one-third of the number of students who were born in 1999.
   - The number of students who were born in 1998 is half of the number of students who were born in 2001.

   Which pictograph shows the above data?

Option 1:

Year	Number of students
1998	*
1999	******
2000	***
2001	**
*= 25 students	

Option 2:

Year	Number of students
2000	***
1999	******
2001	**
1998	*
*= 25 students	

Option 3:

Year	Number of students
1998	***
1999	**********
2000	********
2001	*****
*= 10 students	

Option 4:

Year	Number of students
1998	*****
1999	***** ***** ***** ***** ***** *****
2000	****** ***** *****
2001	***** *****
*= 5 students	

Correct Answer: Option 1

LG: Organize raw data into tabular form in order to make data easier to interpret

Level of difficulty: Medium
Bloom's Level: Understanding

1. A teacher wants to compare each student's performance on math and science tests conducted last week. Which is the *best* way to organise the data for this purpose?

Option 1:

Marks in Math test	Marks in Science test

Option 2:

Name of the student	Marks in Math test	Marks in Science test

Option 3:

Name of the student	Average of the marks scored in Math and Science test

Option 4:

Average of the marks scored in Math and Science test

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analyzing

2. Ryan, Joana, Alan, Pankaj, Anita, Rupa participated in a quiz. Based on their scores, they were given ranks. The person scoring the highest was given the first rank. The information below describes rank secured by participants.
   - Alan secured rank lower than Joana.
   - Pankaj secured 4thrank, which is one rank lower than that of Joana.
   - Anita didn't secure 6th rank but secured rank lower than Ryan.
   - Alan is not the least.

   Which table correctly represents the data?

Option 1:

Rank	Name
1	Ryan
2	Anita
3	Joana
4	Pankaj
5	Alan
6	Rupa

Option 2:

Rank	Name
1	Alan
2	Ryan
3	Anita

4	Pankaj
5	Joana
6	Rupa

Option 3:

Rank	**Name**
1	Rupa
2	Joana
3	Alan
4	Pankaj
5	Anita
6	Rupa

Option 4:

Rank	**Name**
1	Rupa
2	Anita
3	Ryan
4	Pankaj
5	Joana
6	Alan

Correct Answer: Option 1

LG: Calculate average in order to represent the central tendency of the data

Level of difficulty: Medium
Bloom's Level: Applying

1. As part of class project, Rekha needs to find the average age of her family members. Rekha writes her family member's age as follows
   32, 30, 23, 19, 15
   Which of these is the average age of members in Rekha's family?
   Option 1: 15
   Option 2: 17
   Option 3: 23
   Option 4: 32

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Evaluating

2. In the past 10 days, the average temperature on one of the days was much lower than on the rest of the days. Given the data for the average daily temperature of the past 10 days, which statistic can be used to find the central value of the data?
   Option 1: mean
   Option 2: median
   Option 3: mode
   Option 4: range

Correct Answer: Option 2

LG: Calculate arithmetic mean in order to find its position in the data

Level of difficulty: Medium
Bloom's Level: Applying

1. The data below shows the number of balls a batsman played in the past 6 innings he played.
   18, 36, 6, 12, 18, 30
   What is the mean number of balls the batsman faced in an inning?
   Option 1: 36
   Option 2: 21
   Option 3: 126
   Option 4: 15

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. The data below shows the number of questions a student solved each day in the past 4 days.
   8, 10, 16, 18
   What is the fewest number of questions the student should solve on the fifth day so that the mean number of questions solved each day is at least 14?
   Option 1: 8
   Option 2:18
   Option 3:52
   Option 4: 70

Correct Answer: Option 2

LG: Calculate range of the data in order to know the spread of the data

Level of difficulty: Medium
Bloom's Level: Applying

1. The data below represents the average daily temperature, in °C, of a city in the first week of April.
   29 35 33 40 30 38 32
   What is the range of the average daily temperature of the city in the first week of April?
   Option 1: 11°C
   Option 2: 40°C
   Option 3: 29°C
   Option 4: 33°C

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying

2. Over the period of 7 days, the highest rainfall in a city was on Thursday and the least was on Monday. If the range of the rainfall over this period is 13.6 mm and the rainfall on Thursday was 15.7 mm, what was the rainfall on Monday?
   Option 1: 29.3mm
   Option 2: 14.65mm
   Option 3: 2.1mm
   Option 4: 13.6mm

Correct Answer: Option 3

LG: Calculate mode of the data in order to find the observation that occurs most often in the data set

Level of difficulty: Medium
Bloom's Level: Applying

1. The data below shows the number of wickets, a cricket player got in each of the last 10 matches he played.
   2, 0, 1, 4, 0, 3, 1, 1, 2, 4,1
   Find the mode of the above data.
   Option 1: 4
   Option 2: 1
   Option 3: 2
   Option 4: 0

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analyzing

2. There were 12 tests conducted in a semester. Krishna created a bar graph to represent the rank he secured on each test. The information gathered from the bar graph is given below.
   - Krishna secured the first rank twice.
   - Krishna secured the fifth rank 6 times.

- Krishna secured the third rank 3 times.
- Krishna secured the fourth rank only once.

Which question can be answered using the mode of the data on the bar graph and what is the answer?

Option 1: Question**:** Which rank did Krishna secure the most? Answer: Fifth rank
Option 2: Question**:** How many times did Krishna secure the fifth rank? Answer: 6
Option 3: Question**:** How many times did Krishna secure the fourth rank? Answer: 1
Option 4: Question**:** Which rank did Krishna secure least number times? Answer: fourth rank

Correct Answer: Option 2

LG: Calculate median of the data in order to find the observation that lies in the middle of the data set

Level of difficulty: Medium
Bloom's Level: Applying

1. What is the median of the data below?
   42, 2, 54, 12, 20, 6, 30
   Option 1: 12
   Option 2: 2
   Option 3: 54
   Option 4: 20

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analyzing

2. Consider the data set below consisting of 8 data values.
   10, 9, 5, 18, 12, 13, 5, 20
   Which data value when added to the data set does not change the median of the data set?
   Option 1: 5
   Option 2:10
   Option 3: 11
   Option 4: 12

Correct Answer: Option 3

LG: Represent data in a bar graph using appropriate scale in order to represent given information in form of a bar graph

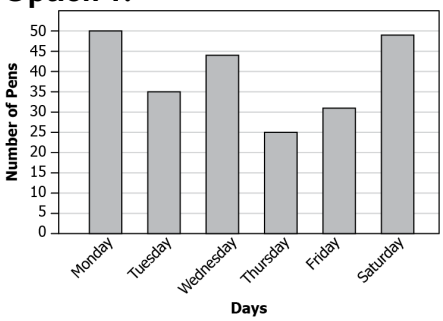
Level of difficulty: Medium
Bloom's Level: Applying

1. The number of pens sold by a shop during a week is given below.

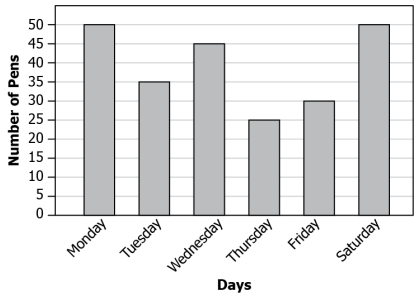
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
50	35	44	25	32	49

Which bar graph correctly displays the data?

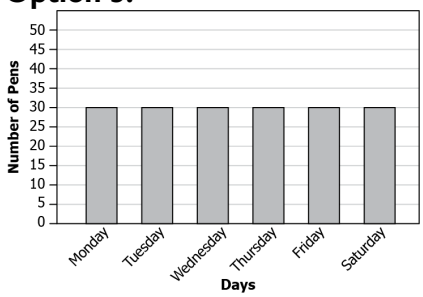
Option 1:



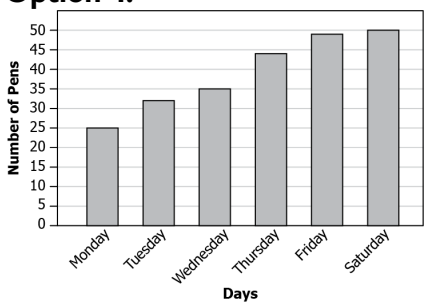
Option 2:



Option 3:



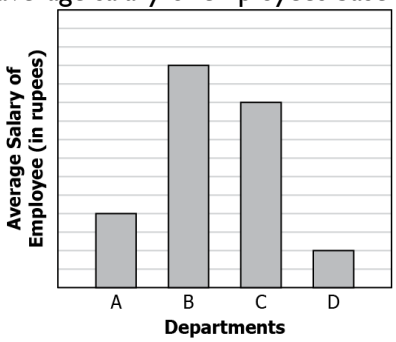
Option 4:



Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analyzing

2. The bar graph below displays the average salary of employees based on their department.



If the difference in the average salary of an employee in Department B and Department D is Rs. 40,000, what must be the scale of the bar graph?

Option 1: 1 unit = Rs 100
Option 2: 1 unit = Rs 400
Option 3: 1 unit = Rs 1000
Option 4: 1 unit = Rs 4000

Correct Answer: Option 4

LG: Represent data using double bar graph in order to compare and discuss two collection of data at a glance

Level of difficulty: Medium
Bloom's Level: Applying

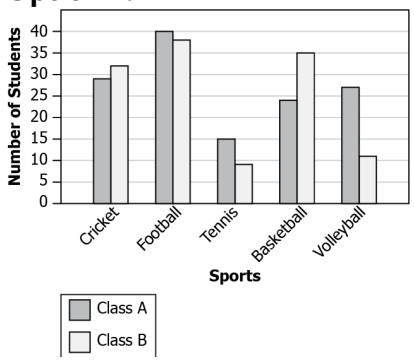
1. A sports teacher tabulated the data she collected from the students of two classes A and B on the kind of sports they are interested in.

Class	Cricket	Football	Tennis	Basketball	Volleyball
A	28	40	15	24	27

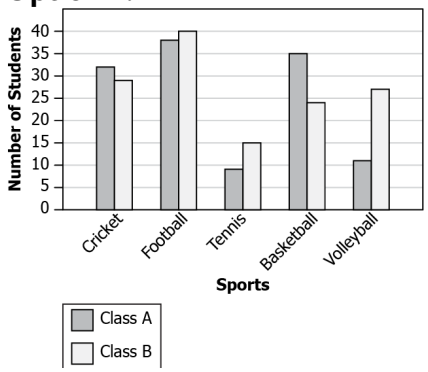
B	32	38	8	35	11

Which bar graph correctly displays the data?

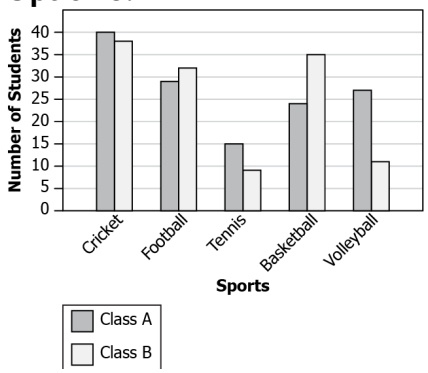
Option 1:



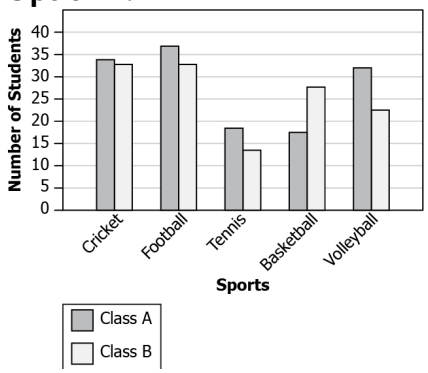
Option 2:



Option 3:



Option 4:



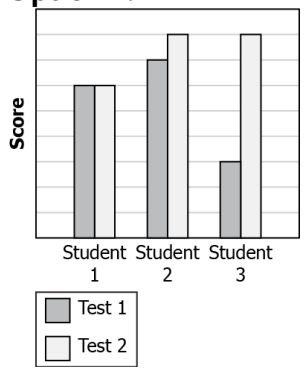
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analyzing

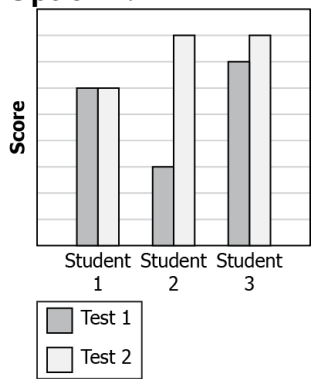
2. To analyze if teaching using new technology affected students' learning, a teacher took the scores of three weakest students on the test conducted before introducing the technology (Test I) and compared with the score on the test conducted after introducing the technology (Test II). The teacher found that:
   - Student 1 showed no improvement.
   - Scores of Student 2 improved the most.
   - Scores of Student 3 also improved.

Which of these could be the possible double graph of the data?

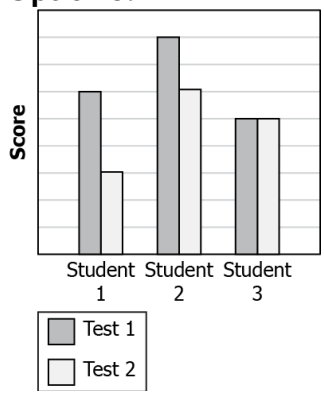
Option 1:



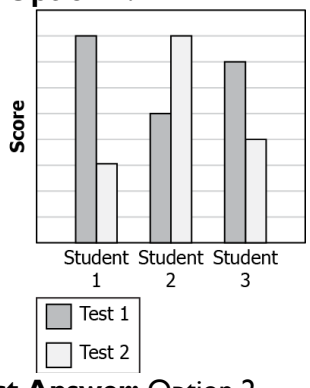
Option 2:



Option 3:



Option 4:



Correct Answer: Option 2

LG: Calculate probability in order to find the chance of occurring/non-occurring of the events

Level of difficulty: Medium
Bloom's Level: Applying

1. A bag contains 6 red, 4, blue and 7 green balls. A ball is drawn randomly from the bag. What is the probability of drawing a green ball?

   Option 1: $\frac{1}{17}$

Option 2: $\frac{7}{17}$

Option 3: $\frac{1}{7}$

Option 4: $\frac{7}{10}$

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. Tina has a jar containing red, green and blue marbles. The probability of drawing any colour marble is the same. She adds 6 blue marbles in the jar and finds that the probability of drawing blue marble changes to ½. What is the probability of drawing a red marble from the jar now?

Option 1: $\frac{1}{2}$

Option 2:$\frac{1}{3}$

Option 3:$\frac{1}{4}$

Option 4: $\frac{1}{9}$

Correct Answer: Option3

Suggested Teacher Resources

1 Lesson Plan

Objective	To calculate the mean, median and mode of the given data
Material required	None
Prerequisite Knowledge	Mean, median, mode
Procedure	The teacher starts with the following story: The residents of Kashmir need your help! Mayor Raj Singh, a scientist, has invented a weather machine. Now he's in control of the weather for the entire region and has subjected the residents of Kashmir to so many different temperatures that they don't know what season it is. One day it's snowing; the next day it's over 100 degrees! The plants are dying, and people are getting sick. Take a look at the temperatures in the past week. **0°, 106°, 50°, 10°, 62°, 90°, 50°** Then, the teacher will explain that the first step to help the residents of Kashmir solve this problem is to sort the temperatures from least to greatest. **0° 10° 50° 50° 62° 90° 106°** Then, the teacher will Ask: • What is the highest temperature this week? (106°) • What is the lowest? (0°) • What is the middle temperature in the set of temperatures ordered from least to greatest? (50°) This is the median. • What is the temperature that occurs most frequently? (50°) This is the mode. • What is the difference between the highest temperature and the lowest temperature? (106° - 0° = 106). This is the range. • Based on the range, would you say the data are clustered together or spread out? Would the range of normal weather patterns be large or small? Explain your reasoning. (The data from Whateverville is spread out; normal weather patterns should have a smaller range.) • What do you think is an average spring temperature in our area? (Answers will vary.) • How can you calculate the average or mean temperature in Kashmir? (The mean can be found by adding all the numbers together and dividing by the number of temperatures.) Then the teacher will ask the students to: Write the simplified definitions for *median, mode, mean,* and *range* on the chalkboard for easy reference. median - middle number • *mode* - most frequent number • *mean* - average • *range* - difference between greatest and least number Next, the teacher asks the students to: • Arrange this data from least to greatest. (*45°, 48°, 51°, 53°, 55°, 57°, 62°, 63°, 69°, 101°*) • What is the median? (*If the data set has two middle numbers, in this case 55° and 57°, then the median is the number halfway between the two-56°.*) • What is the mode? (*There is no mode because no number occurs more than once.*) • What is the range? (*101 - 45 = 56°*) • What is the mean? (*45 + 48 + 51 + 53 + 55 + 57 + 62 + 63 + 69 + 101 = 604. 604 ÷ 10 = 60.4°*) • Which temperature would you eliminate to make all the temperatures fit into spring?

	(*101°*) • How would that affect the mean temperature? (*Eliminating the highest value would lower the mean temperature. 503 ÷ 9 = 55.9°*)
Source	https://www.teachervision.com/probability-statistics/investigating-median-mode-mean

2

Activity

Use your Shoe!

The teacher will start the activity by discussing the following points:

A. Mean is the sum of all values divided by the number of values in the data set. Another term used for mean is average.

B. Median is the middle value in the data set. If there are two middle values, add them and divide by two.

C. Mode is the most frequently occurring value data point of the set.

Next, the teacher will ask the students to record the shoe size of everyone in the class in the following table:

Student	Shoe Size	Gender

Next, the teacher asks the students to find the mean shoe size of the class

Mean (add all shoe sizes / total # of students) = _____

Then, the teacher asks the students to find the median of the shoes sizes of the class:

Median (write all shoe sizes in order from least to greatest, find the middle shoe size. If there are two middle shoe sizes, add them up and divide by 2) = _

Then, find the mode of the data:

Mode (find the shoe size that occurs most frequently) = _____

Then, the teacher asks the students to compare the mean, median, mode of the data with their own shoe size.

4. SIMPLE EQUATIONS

QR Code:

Learning Outcome and Learning Objectives:

Content area/Concepts	Learning Objectives	Learning Outcome
Setting up of an equation	Use number and variable with different operations in order to express a real life situation in the form of a simple linear equation.	Translates a real-life situation in the form of a simple algebraic equation in order to arrive at a generalized problem and solution for the situation
Review of what we know	Convert the given equation in words in order to express it in statement form.	
What is an equation?	Use trial and error method in order to determine the solution of a simple equation.	
More equations	Explain the first step to be taken in order to separate the variable while solving the given equation.	
	Create a strategy in order to solve the given simple equation.	
Solution to equation	Use the given solution in order to construct equations from it.	
Applications of simple equations to practical solutions	Construct simple equations in order to solve them for the given contextual problems/puzzles.	

Test items

LG: Use number and variable with different operations in order to express a real-life situation in the form of a simple linear equation.

Level of difficulty: Medium
Bloom's Level: Applying

1. Swati and Ria made 35 baskets. If Swati made b baskets and Ria made 4 less than twice what Swati made, which of the following equations is true?
   Option 1: $b - 4 = 35$
   Option 2: $2b - 4 = 35$
   Option 3: $3b - 4 = 35$
   Option 4: $3b + 4 = 35$

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. The length of a rectangular field is $\frac{2}{3}$ of its breadth. If the perimeter of the field is 150 m, which of these equations describe the situation?
   Option 1: $\frac{5b}{3} = 150$
   Option 2: $\frac{10b}{3} = 150$
   Option 3: $\frac{6b+2}{3} = 150$
   Option 4: $\frac{12b+4}{3} = 150$

Correct Answer: Option 2

LG: Convert the given equation in words in order to express it in statement form.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which statement describes the equation given below?

   $\frac{2x}{5} - 3 = 12$

   Option 1: Two times of a number is decreased by five is twelve.
   Option 2: Three less than two fifths of a number is twelve.
   Option 3: Three is subtracted from one fifth of a number is twelve.
   Option 4: Three is subtracted from two times of a number is twelve.

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Refer to the statements below about expressing an equation in statement form:
   Statement 1: $x - 6 = 16$ can be expressed as the difference between x and 6 is 16.
   Statement 2: $(2 + 3)t = 35$ can be expressed as 3 times a number plus 2 gives 35.
   Statement 3: $p - 1 = 11$ can be expressed as 1 subtracted from p is 11.
   Which of these statement(s) is/are true?
   Option 1: Only statement 3
   Option 2: Both statements 1 and 3
   Option 3: Both statements 2 and 3
   Option 4: Statements 1, 2 & 3

Correct Answer: Option 2

LG: Use trial and error method in order to determine the solution of a simple equation.
Level of difficulty: Medium

Bloom's Level: Understanding

1. Which of these is a solution for the equation given below?
   $-x - 12 = 20$
   Option 1: $x = 8$
   Option 2: $x = -8$
   Option 3: $x = 32$
   Option 4: $x = -32$

Correct Answer: Option 4

Level of difficulty: Medium
Bloom's Level: Understanding

2. Which of the given option is the solution of the equation $2(t - 1) = 8$?
   Option 1: $t = 4$, as $2 \times t = 2 \times 4 = 8 = \text{RHS}$
   Option 2: $t = 9$, as $(t - 1) = 9 - 1 = 8 = \text{RHS}$
   Option 3: $t = 4.5$, as $2 \times t - 1 = 2 \times 4.5 - 1 = 8 = \text{RHS}$
   Option 4: $t = 5$, as $2 \times (t - 1) = 2 \times (5 - 1) = 8 = \text{RHS}$

Correct Answer: Option 4

LG: Explain the first step to be taken in order to separate the variable while solving the given equation.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which step should a student perform first in order to solve the equation $\frac{5q}{8} = -25$?
   Option 1: Add 25 to both the sides.
   Option 2: Divide both sides by 25.
   Option 3: Multiply both sides by 8.
   Option 4: Subtract 5 from both the sides.

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analysing

2. To solve the equation $2(x - 4) = 16$, two students rewrite it as shown:
   Aman: $x - 4 = 8$
   Ankita: $2x - 8 = 16$
   Which student rewrites the equation correctly to solve it?
   Option 1: Only Aman
   Option 2: Only Ankita
   Option 3: Both Aman and Ankita
   Option 4: Neither Aman nor Ankita

Correct Answer: Option 3

LG: Create a strategy in order to solve the given simple equation.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which option shows to correct way to solve the equation $2k - 5 = 9$?
   Option 1: Add 5 to both the sides and then divide both the sides by 2.
   Option 2: Subtract 5 from both the sides and then divide both the sides by 2.
   Option 3: Add 5 to both the sides and then multiply both the sides by 2.
   Option 4: Subtract 5 from both the sides and then multiply both the sides by 2.

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. The steps followed by Tanya to solve the equation $\frac{2p}{5} - 4 = \frac{8}{5}$ are shown below:

   Step 1: $\frac{2p}{5} - 4 = \frac{8}{5}$

Step 2: $5 \times (\frac{2p}{5} - 4) = 5 \times \left(\frac{8}{5}\right)$
Step 3: $2p - 4 = 8$
Step 4: $2p = 12$
Step 5: $p = 6$
In which step did the she make her first error? What is the correct step?
Option 1: Step 2; $8 \times (\frac{2p}{5} - 4) = 8 \times \left(\frac{8}{5}\right)$
Option 2: Step 3; $2p - 20 = 8$
Option 3: Step 4; $2p = 4$
Option 4: Step 5; $p = 24$
Correct Answer: Option 2

LG: Use the given solution in order to construct equations from it.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following equations can be formed using the solution $t = -3$?
Option 1: $-2t = -6$
Option 2: $t - 4 = -1$
Option 3: $\frac{t}{4} = -0.75$
Option 4: $5 - t = 2$
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying
2. Which of the following equations can be formed using the solution $z = \frac{3}{2}$?
Option 1: $\frac{3z}{2} + 4 = \frac{25}{4}$
Option 2: $-\frac{3z}{2} + 8 = \frac{41}{4}$
Option 3: $6z + 15 = 21$
Option 4: $12z - 5 = 4$
Correct Answer: Option 1

LG: Construct simple equations in order to solve them for the given contextual problems/puzzles.

Level of difficulty: Medium
Bloom's Level: Applying
1. Arpita bought 10 pens from a shop and gave a Rs. 100 note to the shopkeeper. The shopkeeper returned Rs. 40 to her. If the cost of each pen is the same, what is the cost of each pen?
Option 1: Rs. 4
Option 2: Rs. 6
Option 3: Rs. 10
Option 4: Rs. 14
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. Rekha and Sonam took some money and went to a market. Sonam bought a colouring book for Rs. 135 and Rekha spend Rs. 535 to buy a set of story book. After the shopping, both of them have the same amount of money left. If Rekha took twice the amount of money that Sonam took, which option shows the amount of money each one took at the beginning?
Option 1: Rekha: Rs. 200; Sonam: Rs. 400
Option 2: Rekha: Rs. 400; Sonam: Rs. 200
Option 3: Rekha: Rs. 800; Sonam: Rs. 400
Option 4: Rekha: Rs. 400; Sonam: Rs. 800
Correct Answer: Option 3

Suggested Teacher Resources

1 LESSON PLAN

Objective	Use number and variable with different operations in order to express a real-life situation in the form of a simple linear equation.
Material Required	Coloured chalks, Cut-outs
Previous Knowledge	Basic mathematical operations
Procedure	A classroom has triangular tables that can seat one child around each side. The tables in the class are arranged in a row (shown in the picture below.)  How many students can sit at one table? How many around a row 2 tables? Around a row of 3 tables? Write an algebraic expression to show how many students can fit around a row of ***n*** tables? How many tables are needed if there are 26 children in class? Do Now: Students use following table to note down their observations

Number of tables	Number of students that can be seated
1	3
2	4
3	5
.	.
.	.
.	.
.	.
26	___
.	.
.	.
n	___

Teacher will reinforce the definition of

Variable: A variable takes on different numerical values; its value is not fixed. Variables are usually denoted by alphabets, such as x, y, z, m, n, p etc. From variables, expressions are formed.

Teacher will ask students to identify variable in the above Do Now.

Q) If there are 20 students sitting then how many tables are there?

From table we know at every n table, there are n+2 students.

We know there are 20 students.

So, n+2 = 20.

This is known as equation. The equality sign shows that both the values on either side of it are equal.

We know n is number of tables. On solving the equation, the number of tables required for 20 students are 18.

Problems based on real-life:

Q) Ram and Sita had to sell boxes of candy. Ram sold 4 boxes of candy. The sum of total boxes sold were 22.

What do we know?	What do we need to know?	Key words	Equation
Ram sold 4 boxes	How many Sita sold	Sum	S+4=22

Q) Arjun is twice as old as Kavita. Kavita is 15 years old.

What do we know?	What do we need to know?	Key words	Equation
Kavita is 15 years old	How old is Arjun	Twice as old	A = 2K

Source	https://betterlesson.com/lesson/460460/tables-and-equations-they-re-related

2 ACTIVITY

Objective: To help children learn to build equations for a given situation with one operation and find the value for which the equation holds true.

Materials: Bottles or packets of similar kind and 100-gram weights

Setup:

The picture here shows 1 bottle and three 100gm weights on the left-hand side and five 100gm weights on the right-hand side.

Pose the question:

Q) What do you see on the left-hand side?

Q) Do we know the weight of the bottle? How shall we name its weight?

Students will discuss the answer in pairs.

Since the students have already been exposed to the idea of using the letter '*x*' as a variable to represent an unknown quantity, they will have no difficulty in accepting its usage in this situation.

Q) What do we see on the right-hand side?
Q) Is the balance in the level position?
Q) How do we represent all this information as an equation?
Ans: $x + 300 = 500$.

Q) What would be the weight of the bottle?
Students should be able to give the answer to this immediately.
However, the teacher needs to expose them to the procedure of inverse operation as well.

Note: Teacher should discuss and explain 'inverse operations' for all four basic operations at this point.

300 gm can be removed from both sides to maintain the balance in level position.
$x + 300 – 300 = 500 – 300$.
Hence, $x = 200$.

Teacher can do more problems of this kind involving other operations before moving on to the next level.
Setup:

The picture here shows 2 bottles and three 100gm weights on the left-hand side and seven 100gm weights on the right-hand side.

Pose the question:

Q) How do we represent this information as an equation?

Again, talk about the weight of the bottle as the unknown 'x' and help the students to formulate the equation.

$$2x + 300 = 700.$$

Q) What would be the weight of the bottle which is denoted here by *x*?
Students need to internalise that '*x*' stands for some definite quantity in each situation.
Some students may be able to figure out an answer to this through mental calculations.
Help them verify their answer by following the procedure of inversion operations as well.
The visual aid helps students in thinking about what can be removed from both the sides.
$2x + 300 – 300 = 700 – 300$ (inverse of addition is subtraction)
Point out that +300 and –300 cancel each other.
$2x \div 2 = 400 \div 2$ (inverse of multiplication is division)

Hence $x = 200$.
At the introductory stage, students should use inverse operations as part of their working. At a later point they may see the equivalence of writing it only on one side as the other side will inevitably cancel out. That is, instead of writing
$2x + 300 – 300 = 700 – 300$
they will write
$2x = 700 – 300$.
The teacher can do more problems of this kind involving other operations before moving on to the next level.
Note: The teacher can show transposing variables and numbers from one side of the equation to the other after working through a few problems.

5. LINES & ANGLES

QR Code:

R7X4A9

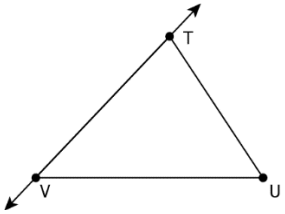
Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction		Recall the concept of line, line segment and angles in order to identify them in the given figure(s).	Classifies pairs of angles based on their properties in order describe linear, supplementary, complementary, adjacent and vertically opposite angles
Related Angles	Complementary Angles	Examine different angles in order to identify complementary angles.	
	Supplementary Angles	Examine different angles in order to identify supplementary angles.	
		Examine different angles in order to determine the measure of their complement and supplement.	
	Adjacent Angles	Describe adjacent angles in order to identify a pair of adjacent angles in the given angles	
	Linear Pair	Examine different angles in order to identify linear pair.	
	Vertically Opposite Angles	Describe vertically opposite angles and their property in order to identify them in the given figure.	
		Identify different types of angles in order to determine the measure of unknown angles in the given figure.	
Pairs of Lines	Intersecting Lines	Compare the given lines in order to distinguish between intersecting and parallel lines.	Applies the properties of linear, supplementary, complementary etc. Angle in order to find the value of one angle when the other one is given.
	Angles made by a Transversal	Discuss the different angles made by a transversal and intersecting lines in order to identify them in the given figure.	Verifies the properties of various pairs of angles formed when a transversal cuts two lines in order demonstrate the properties of angles when two lines are parallel
	Transversal of Parallel Lines	Use the properties of angles made by a transversal of parallel lines in order to determine the measure of unknown angles.	
Checking for Parallel lines		Create a strategy in order to determine whether the given lines are parallel or not.	

Test items

LG: Recall the concept of line, line segment and angles in order to identify them in the given figure(s).

Level of difficulty: Medium
Bloom's Level: Applying
1. Consider the figure shown.



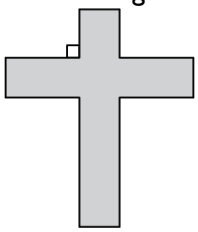
Which of these statements is true?

Option 1: TV is a line; TU and UV are line segments
Option 2: TU and UV are lines; TV is a line segment
Option 3: TV and UV are lines; TU is a line segment
Option 4: TV and TU are lines; UV is a line segment

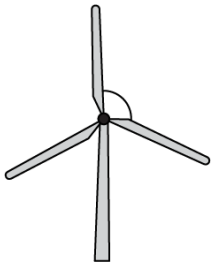
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying
2. Which of these marked angles is an acute angle?

Option 1:

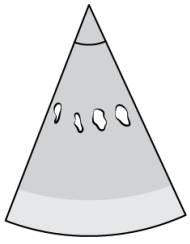


Option 2:



Option 3:

Option 4:



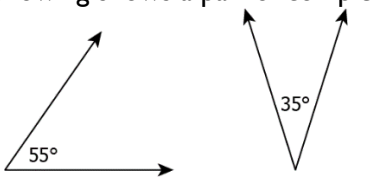
Correct Answer: Option 4

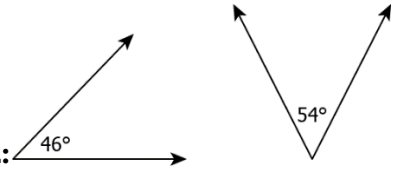
LG: Examine different angles in order to identify complementary angles.

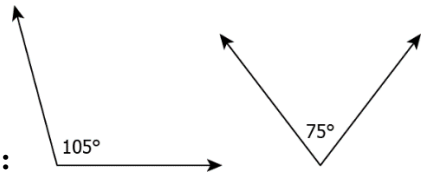
Level of difficulty: Medium

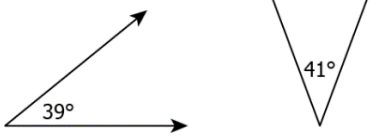
Bloom's Level: Understanding

1. Which of the following shows a pair of complementary angles?

Option 1: 

Option 2: 

Option 3: 

Option 4: 

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Which of the following statements is true?
   Option 1: A pair of complementary angles can have two right angles.
   Option 2: A pair of complementary angles can have two obtuse angles.
   Option 3: A pair of complementary angles can have two acute angles.
   Option 4: A pair of complementary angles can have one acute and one obtuse angle.

Correct answer: 3

LG: Examine different angles in order to identify supplementary angles.

Level of difficulty: Medium
Bloom's Level: Applying

1. Which of the following shows a pair of supplementary angles?
   Option 1: 38° and 52°
   Option 2: 69° and 81°
   Option 3: 84° and 96°
   Option 4: 173° and 187°

Correct Answer: Option 3

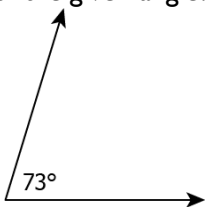
Level of difficulty: Hard
Bloom's Level: Applying

2. Consider two statements shown.
   Statement I: Two right angles can be supplementary.
   Statement II: An obtuse and an acute angle can be supplementary.
   Which of these statement(s) is/are correct?
   Option 1: Only statement I
   Option 2: Only statement II
   Option 3: Both statements I and II
   Option 4: Neither statement I nor statement II

Correct Answer: Option 3

LG: Examine different angles in order to determine the measure of their complement and supplement.

Level of difficulty: Medium
Bloom's Level: Applying
1. What is the measure of the complement of the given angle?

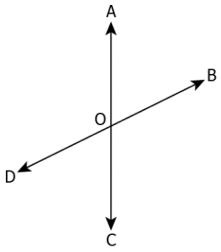


Option 1: 17°
Option 2: 73°
Option 3: 107°
Option 4: 287°
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider the measures of two supplementary angles. $(4a + 3)°$ and $(a - 13)°$. What is the measure of the larger angle?
Option 1: 25°
Option 2: 38°
Option 3: 139°
Option 4: 155°
Correct Answer: Option 4

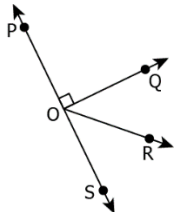
LG: Describe adjacent angles in order to identify a pair of adjacent angles in the given angles

Level of difficulty: Medium
Bloom's Level: Understanding
1. Observe the figure below:



Which of these shows a pair of adjacent angles in the given figure?
Option 1: ∠AOB and ∠COD
Option 2: ∠AOD and ∠BOC
Option 3: ∠AOB and ∠BOC
Option 4: ∠DOB and ∠BOC
Correct answer: 3

Level of difficulty: Hard
Bloom's Level:
2. Observe the figure below:

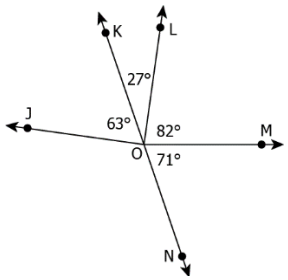


Which of these statements is NOT correct?
Option 1: ∠POQ and ∠QOR are adjacent angles as they have a common vertex O.
Option 2: ∠POQ and ∠ROS are adjacent angles as they have a common vertex O.
Option 3: A pair of complementary angles ∠QOR, ∠ROS are adjacent to each other.
Option 4: A pair of supplementary angles ∠POQ and ∠QOS are adjacent to each other.

Correct answer: 2

LG: Examine different angles in order to identify linear pair.

Level of difficulty: Medium
Bloom's Level: Applying
1. Consider the figure shown.



Which of these is a linear pair?

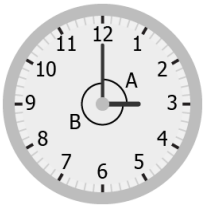
Option 1: ∠JOK and ∠KOL
Option 2: ∠JOL and ∠LOM
Option 3: ∠LOM and ∠MON
Option 4: ∠KOM and ∠MON

Correct Answer: Option 4

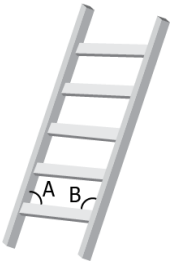
Level of difficulty: Hard
Bloom's Level: Applying
2. In which figure, A and B form a linear pair?

Option 1:

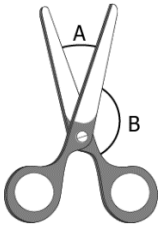
Option 2:



Option 3:



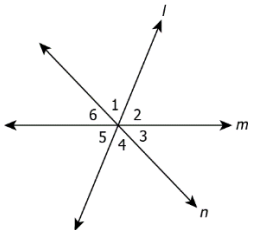
Option 4:



Correct Answer: Option 4

LG: Describe vertically opposite angles and their property in order to identify them in the given figure.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Consider the figure shown.



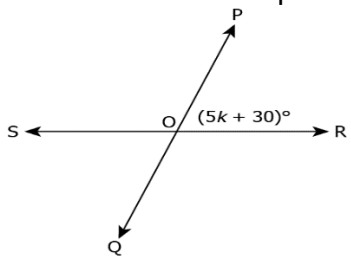
Which of the following shows all the pairs of vertically opposite angles in the figure?

Option 1: ∠1 and ∠2; ∠3 and ∠4; ∠5 and ∠6
Option 2: ∠1 and ∠3; ∠2 and ∠5; ∠4 and ∠6
Option 3: ∠1 and ∠4; ∠2 and ∠5; ∠3 and ∠6
Option 4: ∠1 and ∠5; ∠2 and ∠4; ∠3 and ∠6

Correct answer: 3

Level of difficulty: Hard
Bloom's Level: Analysing

2. In the given figure, lines PQ and RS intersect each other at point O.



What is the measure of ∠POS and ∠QOS?

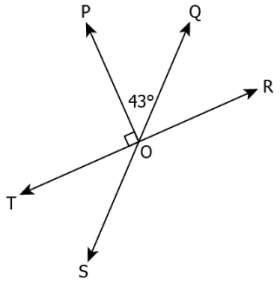
Option 1: $\angle QOS = (60 - 5k)°$ and $\angle POS = (5k + 30)°$
Option 2: $\angle QOS = (150 - 5k)°$ and $\angle POS = (5k + 30)°$
Option 3: $\angle QOS = (5k + 30)°$ and $\angle POS = (60 - 5k)°$
Option 4: $\angle QOS = (5k + 30)°$ and $\angle POS = (150 - 5k)°$

Correct answer: 4

LG: Identify different types of angles in order to determine the measure of unknown angles in the given figure.

Level of difficulty: Medium
Bloom's Level: Applying

1. Consider the figure shown.



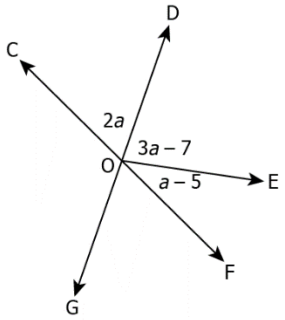
What is the measure of ∠ROS?

Option 1: 43°
Option 2: 133°
Option 3: 137°
Option 4: 313°

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. Consider the figure shown.



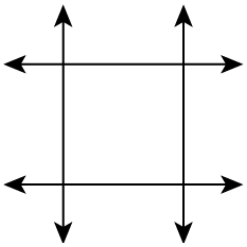
What is the measure of ∠GOE?

Option 1: 59°
Option 2: 79°
Option 3: 91°
Option 4: 96°
Correct Answer: Option 3

LG: Compare the given lines in order to distinguish between intersecting and parallel lines.

Level of difficulty: Medium
Bloom's Level: Applying

1. Consider the figure shown.



How many pair(s) of intersecting lines are in the figure?

Option 1: 1
Option 2: 2
Option 3: 4
Option 4: infinitely many pairs
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

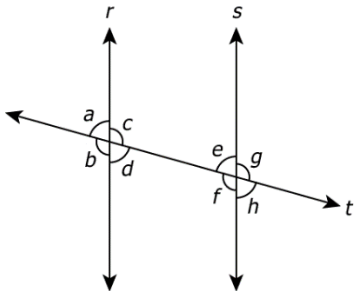
2. Which of these statements is true for a pair of intersecting lines?

Option 1: Two lines always intersect at right angle.
Option 2: Two intersecting lines do not have any common point.
Option 3: Two intersecting lines have exactly one common point.
Option 4: Two intersecting lines can form either a right angle or an acute angle.
Correct Answer: Option 3

LG: Discuss the different angles made by a transversal and intersecting lines in order to identify them in the given figure.

Level of difficulty: Medium
Bloom's Level: Understanding

1. In the given figure, line *r* is parallel to line *s* and line *t* is a transversal as shown:



Which of these options correctly represents the two pairs of corresponding angles and two pairs of interior angle on the same side of the transversal?

Option 1:

Corresponding angles	**Interior angles on the same side of transversal**
$\angle a$ and $\angle e$; $\angle d$ and $\angle h$	$\angle d$ and $\angle f$; $\angle c$ and $\angle e$

Option 2:

Corresponding angles	**Interior angles on the same side of transversal**
$\angle a$ and $\angle d$; $\angle f$ and $\angle g$	$\angle d$ and $\angle f$; $\angle c$ and $\angle e$

Option 3:

Corresponding angles	**Interior angles on the same side of transversal**
$\angle a$ and $\angle e$; $\angle d$ and $\angle h$	$\angle a$ and $\angle b$; $\angle g$ and $\angle h$

Option 4:

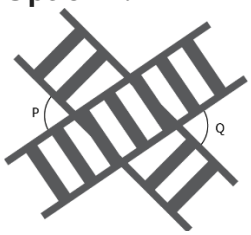
Corresponding angles	**Interior angles on the same side of transversal**
$\angle d$ and $\angle e$; $\angle c$ and $\angle f$	$\angle d$ and $\angle f$; $\angle c$ and $\angle e$

Correct answer: 1

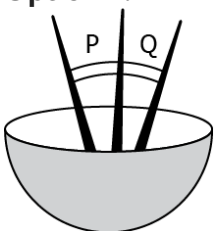
Level of difficulty: Hard
Bloom's Level: Analysing

2. Which of the following shows ∠P and ∠Q as alternate interior angles?

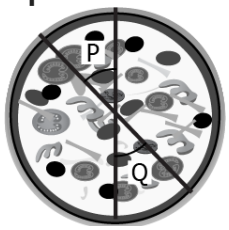
Option 1:



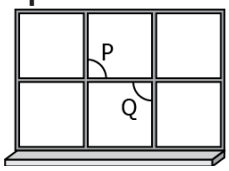
Option 2:



Option 3:



Option 4:

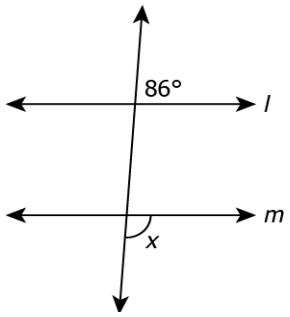


Correct answer: 4

LG: Use the properties of angles made by a transversal of parallel lines in order to determine the measure of unknown angles.

Level of difficulty: Medium
Bloom's Level: Applying

1. In the figure shown, lines *l* and *m* are parallel.



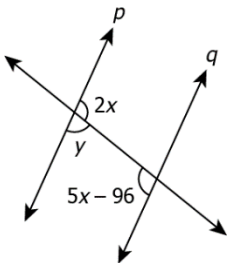
What is the value of *x*?

Option 1: 94°
Option 2: 86°
Option 3: 64°
Option 4: 43°

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying

2. In the figure shown, lines *p* and *q* are parallel.



What is the value of *y*?

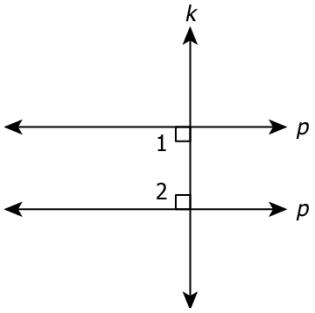
Option 1: 32°
Option 2: 64°
Option 3: 116°
Option 4: 148°

Correct Answer: Option 3

LG: Create a strategy in order to determine whether the given lines are parallel or not.

Level of difficulty: Medium
Bloom's Level: Applying

1. In the figure shown, line *k* cuts line *p* and *q*.



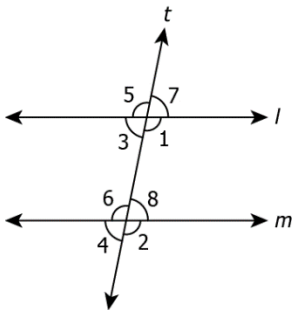
If ∠1 + ∠2 = 180°, which of these statement is true?

Option 1: Lines *p* and *q* are perpendicular.
Option 2: Lines *p* and *q* are parallel.
Option 3: Lines *p* and *k* are parallel.
Option 4: Lines *q* and *k* are parallel.

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. In the figure shown, line *t* cuts lines *l* and *m*.



A student makes two statements about the lines *l* and *m*.
Statement I: If ∠5 and ∠6 are equal, lines *l* and *m* will always be parallel.
Statement II: If ∠4 and ∠8 are equal, lines *l* and *m* will always be parallel.
Which of these statement(s) is/are true?

Option 1: Only statement I
Option 2: Only statement II
Option 3: Both statements I and II
Option 4: Neither statement I nor statement II

Correct Answer: Option 1

Suggested Teacher Resources

1

LESSON PLAN

Objective- Students will be able to correctly name types of angles and state that these angles are congruent depending on whether the lines cut by a transversal are parallel in order to find the missing angles in a given question.

Material Used-: Activity sheet

Procedure-:

1. It is often found that students often have a hard time differentiating between the names we assign to types of angles particularly because, at a quick glance, students often just see pairs of angles without noticing that their location relative to one other and to the lines and transversal matter greatly .
2. Teacher will start the class where teacher wants students to work on the , Crossing the Line, in pairs to create a greater sense of safety and allow more risk taking compared to groups of four. This is important for this lesson since it may hard for students to understand the vocabulary for types of angles. Students often just see pairs of angles without noticing that their location relative to one another, the boundary lines and transversal.

Crossing the Line

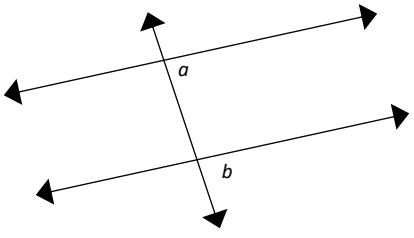
Whenever two lines are cut by a transversal, some very interesting patterns occur. Our goal is to get comfortable with the names of these angles so we can better understand the patterns.

Match the term with the word or description you believe best represents it.

1. Corresponding	a. Opposite
2. Alternate	b. Following each other without interruption
3. Consecutive	c. Located in the same relative position

Given the following diagrams that feature a pair of angles, choose from the following names to best represent the angle relationship you see. Each name can only be used once

☐ Alternate Interior Angles
☐ Alternate Exterior Angles
☐ Corresponding Angles
☐ Consecutive Interior Angles
☐ Consecutive Exterior Angles



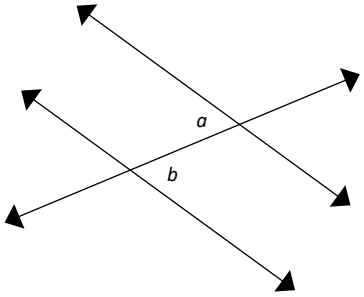
$\angle a$ and $\angle b$ are called

_____

because…

Find another set of angles in the picture that have the

same name. Call them *c* and *d*.

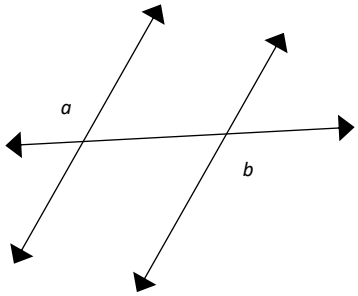


$\angle a$ and $\angle b$ are called

_____

because…

Find another set of angles in the picture that have the same name. Call them *c* and *d*.

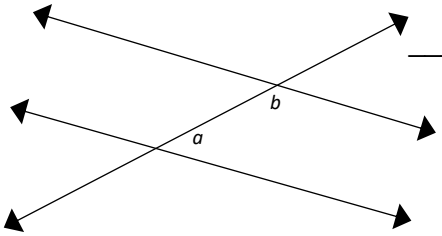


$\angle a$ and $\angle b$ are called

_____

because…

Find another set of angles in the picture that have the same name. Call them *c* and *d*.



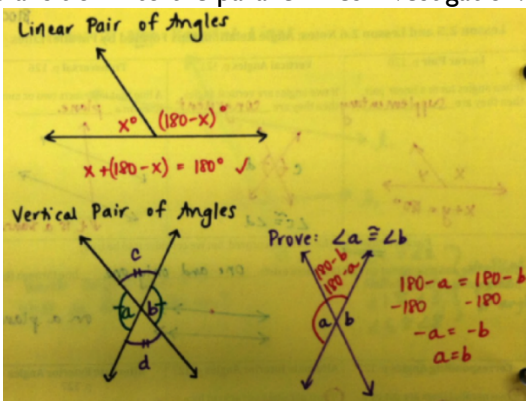
$\angle a$ and $\angle b$ are called

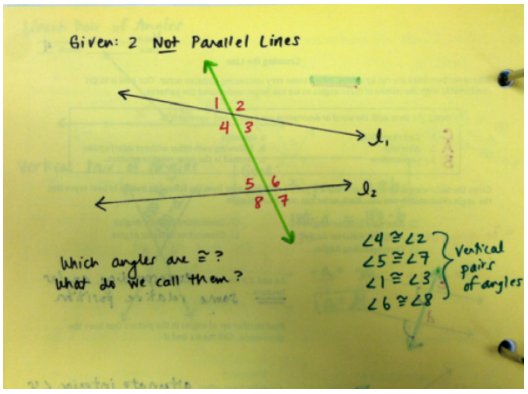
_____

because…

Find another set of angles in the picture that have the same name. Call them *c* and *d*.

- After this activity Teacher will do a whole-class demonstration where Teacher will model for students how to use tracing paper. By this point, several students have conjectured that vertical angles are congruent. At this point, Teacher use the document camera to show that vertical angles are congruent with tracing paper; then prove vertical angles are congruent using linear pairs of angles in a whole-class discussion.
- Teacher goal in this discussion is to begin developing students' understanding for how they can attempt to prove their conjectures true.
- At this point, Teacher ask students to draw two lines that are clearly not parallel and to cut these lines by a transversal since it is important to establish parallel lines as a special condition.
- Teacher ask students to use their tracing paper to identify any pairs of angles that are congruent. We share out our findings as a whole class (only vertical pairs of congruent). Ideally, a student will ask, "But what happens if the lines are parallel? Would there be other pairs of angles that are congruent?" after this do transition into the parallel lines investigation.

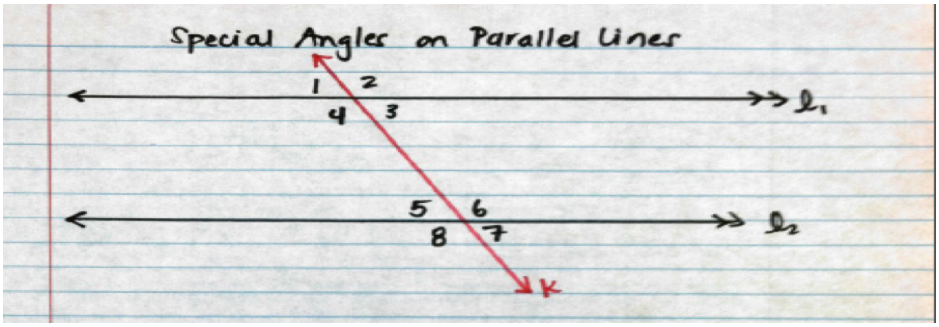




- Teacher then operate under the assumption that the lines on our notebook paper are parallel. Then ask students to use their tracing paper to identify pairs of angles that are congruent and to name these angles by

using their work from Crossing the Line. Ultimately, students write a conjecture for the types of angles that are congruent given parallel lines.

- While students work through this investigation, circulate the room to assist them with using tracing paper and naming pairs of angles. Inevitably, some groups will finish conjecturing about the types of angle pairs that are congruent before other groups; then offer early finishers an extension: identify pairs of angles that are supplementary and prove your conjecture



Conjecture-:
If two parallel lines are cut by a transversal, then...

a. Corresponding angles are_____
b. The alternate interior angles are _____
c. The alternate exterior angles are _____

2 **Activity**

Time- 30 min

- Give the students practice on this skill by letting them work together. Collaborative learning is vital to the success of students. Students learn from each other by justifying their answers and critiquing the reasoning of others.

- For this activity, put the students in pairs. Give each group a Group Activity Sheet on Line Segments, Rays, and Angles. The students must work together draw line segments, rays, and angles**.** They must communicate precisely to others within their groups. They must use clear definitions and terminology as they precisely discuss this problem**.** Upon completion of drawing models, the students must go on a scavenger hunt around the classroom identifying items that have acute, right, obtuse or straight angles. The students explain why they labelled the items as they did by using attributes that clearly separate the groups.

- The students are guided to the conceptual understanding through questioning by their classmates, as well as by teachers. The students communicate with each other and must agree upon the answer to the problem. Because the students must agree upon the answer, this will take discussion, critiquing, and justifying of answers by both students. As the pairs discuss the problem, they must be precise in their communication within their groups using the appropriate math terminology for this skill.

- As they work, monitor and assess their progression of understanding through questioning.
  1. Describe a line segment?
  2. What makes an angle?
  3. What's the difference between a ray and a line?

Group Activity Sheet
Line Segments, Rays, and Angles
Part I: Model

Directions: Using the grid, draw models of line segments, rays, and angles. Label each model.

Part II: Scavenger Hunt

Directions: With your partner, walk around the room to find items that have acute, obtuse, right, or straight angles.

Item	Type of Angle (acute, right, obtuse, straight)

Explain why you classified the items as such.

_____

_____

_____

6. THE TRIANGLE & ITS PROPERTIES

QR Code:

S4A8L5

Learning Outcome and Learning Objectives

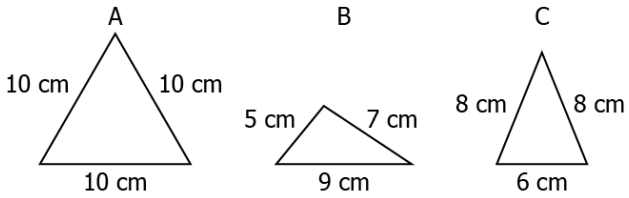
Content area/Concepts	Learning Objectives	Learning Outcome
Introduction	Compare different triangles in order to classify them on the basis of their sides and angles	Applies angle sum property of a triangle to calculate unknown angles of a triangle when its two angles are known
	Recall the parts of a triangle in order to describe it for the given triangle.	
Medians of a triangle	Describe median of a triangle in order to identify it for the given triangle	
Altitude of a triangle	Describe altitude of a triangle in order to identify it for the given triangle	
Exterior angle of a triangle and its property	Apply the exterior angle property of a triangle in order to find the measure of the unknown angle in the given triangle	
Angle sum property of a triangle	Apply the angle sum property of a triangle in order to find the measure of unknown angle.	
	Use appropriate property in order to determine the measure of the unknown angle(s) in the given figure.	
Sum of lengths of 2 sides of a triangle	Apply the property of lengths of sides of a triangle in order to determine whether a triangle is possible for the given side lengths or not.	
	Apply the Pythagoras property in order to verify whether the triangle for the given side lengths will be right angled triangle or not.	
Right angles triangle and Pythagoras property	Apply the Pythagoras property in order to fine the length of the unknown side in a right-angled triangle.	
	Use appropriate properties in order to defend whether the given triangle is possible or not.	

Test items

LG: Compare different triangles in order to classify them on the basis of their sides and angles

Level of difficulty: Medium
Bloom's Level: Understanding

1. Observe the figure below:



Which of the following option correctly classifies the triangles on the basis of their sides?

Option 1:

Figures	Type of triangle
A	Equilateral triangle
B	Isosceles triangle
C	Scalene triangle

Option 2:

Figures	Type of triangle
A	Scalene triangle
B	Isosceles triangle
C	Equilateral triangle

Option 3:

Figures	Type of triangle
A	Equilateral triangle
B	Scalene triangle
C	Isosceles triangle

Option 4:

Figures	Type of triangle
A	Isosceles triangle
B	Equilateral triangle
C	Scalene triangle

Correct Answer: Option 3

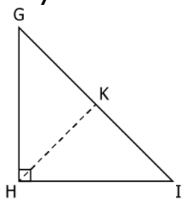
2. In a ΔPQR, ∠P = 55° **and the length of side QR is 18 cm. What could be the measures of remaining parts of the triangle such that** ΔPQR is an obtuse scalene triangle?
   Option 1: ∠Q = 100°, ∠R = 25°, **PQ = 18 cm and PR = 12 cm.**
   Option 2: ∠Q = 110°, ∠R = 15°, **PQ = 6 cm and PR = 20 cm.**
   Option 3: ∠Q = 90°, ∠R = 35°, **PQ = 18 cm and PR = 18 cm.**
   Option 4: ∠Q = 65°, ∠R = 60°, **PQ = 12 cm and PR = 14 cm.**

Correct answer: Option 2

LG: Recall the parts of a triangle in order to describe it for the given triangle.

Level of difficulty: Medium
Bloom's Level: Understanding

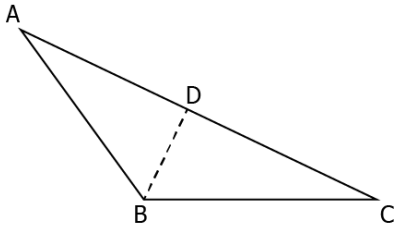
1. Which of the following options represents only the sides of the triangle GHI given below?



Option 1: $\overline{GH}$, $\overline{HI}$, $\overline{GI}$ and $\overline{HK}$

Option 2: $\overline{GH}$, $\overline{HI}$, and $\overline{GI}$
Option 3: $\overline{GH}$, $\overline{HK}$, and $\overline{GK}$
Option 4: $\overline{HK}$, $\overline{HI}$, and $\overline{KI}$
Correct answer:2

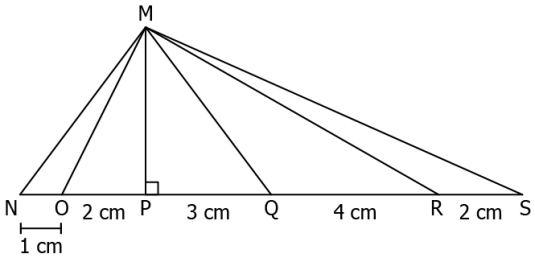
Level of difficulty: Hard
Bloom's Level: Analysing
2. Observe the figure below:



Which of these statements is NOT correct?
Option 1: Angle opposite to side AB in ΔABC is ∠BCA.
Option 2: Vertex opposite to the side DA in ΔABD is A.
Option 3: The side opposite to vertex D in ΔBCD is BC.
Option 4: The side opposite to vertices A and C in ΔABD and ΔBCD is BD.
Correct answer:2

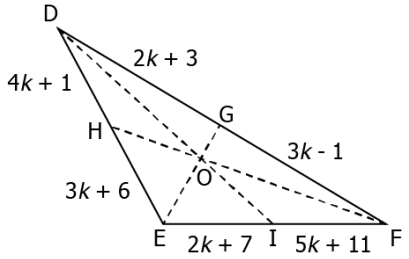
LG: Describe median of a triangle in order to identify it for the given triangle

Level of difficulty: Medium
Bloom's Level: Understanding
1. Observe the figure below:



Which of these line segments is the median of the ΔMNS?
Option 1: $\overline{MP}$
Option 2: $\overline{MO}$
Option 3:$\overline{MR}$
Option 4:$\overline{MQ}$
Correct answer: 4

Level of difficulty: Hard
Bloom's Level: Analysing
2. In the ΔDEF below, DF = 22 cm, EF = 46 cm and DE = 35 cm.



Which of these represents the median(s) of the triangle DEF?
Option 1: EG
Option 2: DI
Option 3: FH and EG
Option 4: FH and DI
Correct answer:1

LG: Describe altitude of a triangle in order to identify it for the given triangle

Level of difficulty: Medium
Bloom's Level: Understanding
1. Two triangles are joined to form a rectangle. How many side(s) in each triangle is/are also the altitude(s)?
   Option 1: no side
   Option 2: 1
   Option 3: 2
   Option 4: 3

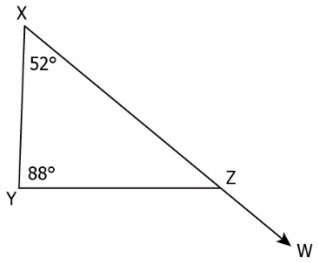
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. The altitude of a triangle lies in the exterior of the triangle. Which of the following can be the measures of two of the angles of the triangle?
   Option 1: 60° and 60°
   Option 2: 56° and 74°
   Option 3: 52° and 38°
   Option 4: 43° and 42°

Correct Answer: Option 4

LG: Apply the exterior angle property of a triangle in order to find the measure of the unknown angle in the given triangle

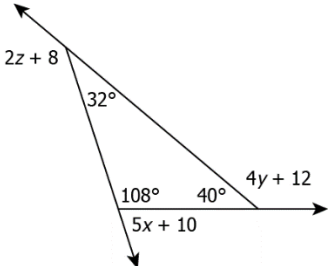
Level of difficulty: Medium
Bloom's Level: Understanding
1. Observe the figure below:



What is the measure of ∠YZW?
   Option 1: 36°
   Option 2: 40°
   Option 3:140°
   Option 4: 144°

Correct answer:3

Level of difficulty: Hard
Bloom's Level: Evaluating
2. Consider the figure given below:

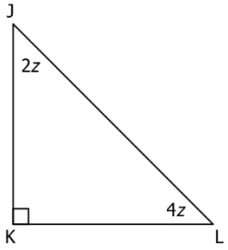


Which of these options represents the value of $x + y + z$?
   Option 1:76.5
   Option 2: 102.4
   Option 3:104.4

Option 4:114.4
Correct answer: 4

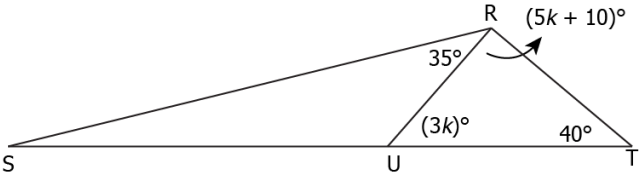
LG: Apply the angle sum property of a triangle in order to find the measure of unknown angle.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Observe the figure below:



What is the measure of ∠KJL?
Option 1: 10°
Option 2:15°
Option 3:30°
Option 4: 60°
Correct answer: 4

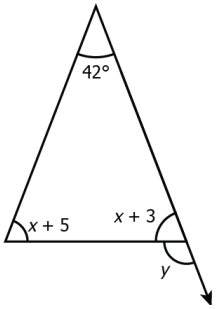
Level of difficulty: Hard
Bloom's Level: Evaluating
2. Consider ΔRST below:



Which of the following shows the measure of ∠RSU?
Option 1: 131.25°
Option 2: 78.75°
Option 3: 16.25°
Option 4: 13.75°
Correct answer: 4

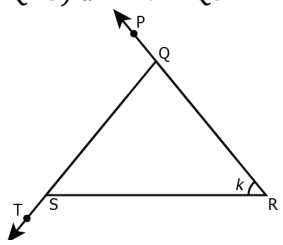
LG: Use appropriate property in order to determine the measure of the unknown angle(s) in the given figure.

Level of difficulty: Medium
Bloom's Level: Applying
1. Consider the triangle shown.



What is the value of*y*?
Option 1: 68°
Option 2: 110°
Option 3: 112°
Option 4: 138°
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analyzing
2. In the triangle shown, $m\angle \mathrm{RST} = 2(m\angle \mathrm{QRS})$ and $m\angle \mathrm{PQS} = 2(m\angle \mathrm{QSR})$.



Which of the following is true about the triangle QRS?
Option 1: It is a scalene triangle
Option 2: It is an isosceles triangle
Option 3: It is an equilateral triangle
Option 4: It is a right-angled triangle
Correct Answer: Option 3

LG: Apply the property of lengths of sides of a triangle in order to determine whether a triangle is possible for the given side lengths or not.

Level of difficulty: Medium
Bloom's Level: Applying
1. For the lengths 8.3 cm, 3.5 cm and 5.6 cm to be the sides of a triangle, which of these conditions should be true?
Option 1: 5.6 + 3.5 < 8.3
Option 2: 8.3 – 3.5 > 5.6
Option 3: 8.3 – 5.6 < 3.5
Option 4: 8.3 + 5.6 > 8.3 + 3.5
Correct Answer: Option 3

LG: Apply the property of lengths of sides of a triangle in order to determine whether a triangle is possible for the given side lengths or not.

Level of difficulty: Hard
Bloom's Level: Applying
2. For the side lengths $a - 3$, $2a$ and $a + 5$ to form a triangle, which of these could be the value of a?
Option 1: 1
Option 2: 2
Option 3: 4
Option 4: 5
Correct Answer: Option 4

LG: Apply the Pythagoras property in order to verify whether the triangle for the given side lengths will be right angled triangle or not.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following side lengths will form a right-angled triangle?
Option 1: 6 cm, 9 cm and 15 cm
Option 2: 5 cm, 12 cm and 17 cm
Option 3: 8 cm, 15 cm and 17 cm
Option 4: 4 cm, 6 cm, 20 cm
Correct answer: 3

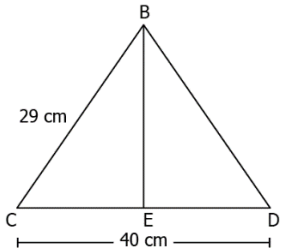
Level of difficulty: Hard
Bloom's Level: Applying
2. The length of legs of a right-angled isosceles triangle are *x* cm. Which of these statements should be true?
Option 1: The square on the hypotenuse is equal to twice the length of the square on one leg.

Option 2: The hypotenuse is equal to the sum of the legs**.**
Option 3: The square on the hypotenuse is equal to the sum of the legs.
Option 4: The hypotenuse is equal to twice the length of the square on one leg.
Correct Answer: Option 1

LG: Apply the Pythagoras property in order to fine the length of the unknown side in a right-angled triangle.

Level of difficulty: Medium
Bloom's Level: Applying
1. What is the perimeter of a triangle having hypotenuse 17 cm and the length of a leg as 8 cm?
Option 1: 34 cm
Option 2: 40 cm
Option 3: 102 cm
Option 4: 120 cm
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. In an isosceles triangle BCD, shown below, BE is the median of the triangle.



For BE to be the altitude of the triangle as well, what should be the length of BE?
Option 1: 21 cm
Option 2: 29 cm
Option 3: 41 cm
Option 4: 58 cm
Correct answer: 1

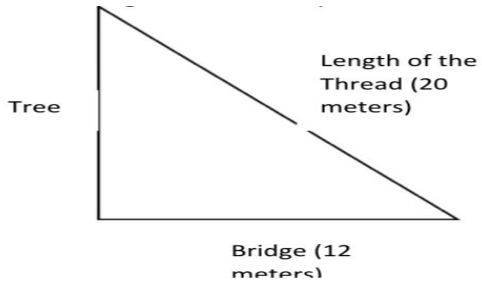
LG: Use appropriate properties in order to defend whether the given triangle is possible or not.

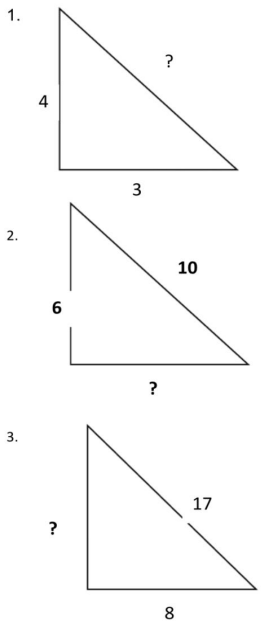
Level of difficulty: Medium
Bloom's Level: Applying
1. For the lengths *a*, *b*, and *c* to be the sides of a right-angled triangle, which of these should be true?
Option 1: The difference of length of any two sides should be greater than the length of the third side.
Option 2: The square of the longest side is equal to the sum of the squares of the other two sides.
Option 3: The sum of length of any two sides should be less than the length of the third side.
Option 4: The length of the longest side is equal to the sum of the other two sides.
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. For the lengths 20 cm and 21 cm to form a triangle, how can the third side length be calculated?
Option 1: 20 + 21
Option 2: $20^2 + 21^2$
Option 3: Lies between (21 – 20) and (21 + 20)
Option 4: Lies between $(20^2 - 21^2)$ and $(20^2 + 21^2)$
Correct Answer: Option 3

Suggested Teacher Resources

1 Lesson Plan

Objective	To apply the Pythagorean property in order to find the length of the unknown side in a right-angled triangle.
Material Required	None
Prerequisite Knowledge	Pythagoras Theorem
Procedure	The teacher will start the class with the following discussion: Can you State Triangle Proportionality Theorem? **Triangle proportionality Theorem** If a line parallel to one side of a triangle intersects the other two sides, then it divides those sides proportionally. **Then, the teacher will start with the following story:** *There was a boy named Raj. Raj and his family were living besides a big tree and a river. His father was a carpenter, and that makes Raj also want to become an Engineer. He shows more interest about mathematics, he always applies mathematics on the things that he usually uses.* *One day while Raj was playing with his kite on the other side of the river, it was accidently stuck at the top of the tree. Luckily, he was able to measure the length of the thread he uses before playing which measures 20 metres.* *Then, since, he has been crossing the bridge for a long time, he already knew the length of the bridge which is 12 meters.* *Until one day, when he was about to cross the bridge going to school, he noticed that the bridge was already destroyed. He doesn't want to be absent on that day because they will have an exam. And suddenly a great idea came to his mind. He needs to cut the tree to replace the bridge. But he was not sure that the length of the tree is longer or equal to the length of the bridge. How could Raj make sure that if he cut the tree it would reach to the other side of the bridge?* *(He is going to find the length of the tree)*  Next, the teacher divides the students in 3 groups and asks them to solve the following questions: Group 1: Ria is admiring a statue in Shastri park from 16 feet away. If the distance between the top of the statue to Ria's head is 20 feet, how much taller is the statue? Group 2: A bird was sitting in 8 feet away from a mango tree and flew 17 feet to reach at the top of the tree. How tall is the tree? Group 3: The foot of a ladder is placed 6 feet from a wall. If the top of the ladder rests 8 feet up on the wall, how long is the ladder?

	 And then the teacher shuffles the questions in groups and discusses the answers with the class.
Source	https://www.researchgate.net/publication/331235436_LESSON_PLAN_for_Pythagorean_Theorem

2 **Activity**

Activity:

Objective: To verify Pythagoras theorem by an alternate method

Material Required: a piece of cardboard,2 sheets of white paper, a pair of scissors, a geometry box, a tube of glue

Procedure:

The teacher will ask the students to carry out the activity by following the given steps:

- Paste a sheet of white paper on the cardboard.
- On this paper, draw a right-angled triangle ABC, right angled at C. Let the lengths of the sides AB, BC and CA be c, a and b units respectively (see Figure 11.1).
- Make an exact replica of this ΔABC on the other paper.
- Construct a square with the side AB as one of its sides. Now, each side of this square is equal to c units.
- Similarly, construct two squares with sides measuring a units and b units along the sides and CA of the ΔABC. Label the diagram as shown in Figure 11.2. Also, shade the squares as shown in Figure 11.2.
- Produce the side DA of the square DEBA to meet the side IH of the square ACHI at M. At point M, draw NM perpendicular to AM, so that N lies on the side CH of the square ACHI.
- Produce the side EB of the square DEBA to meet the side CG of the square BFGC at P.

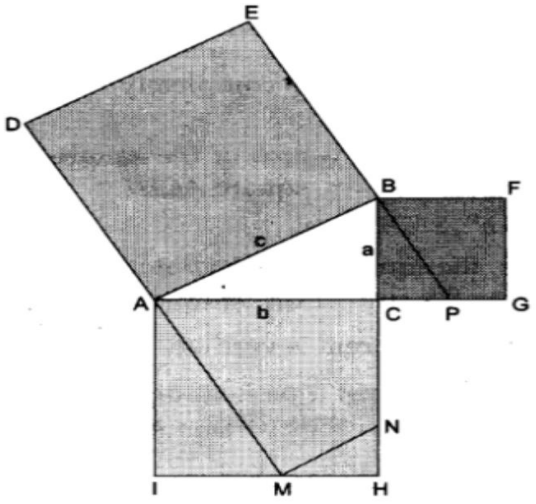


Fig. 11.2

- Cut the squares DEBA, BFGC and ACHI. Also, cut the square BFGC along the line BP and the square ACHI along the lines AM and MN. We thus have a square DEBA, two quadrilaterals—BFGP and ACNM—and three triangles—BCP, AIM and NHM.
- Arrange the two quadrilaterals and the three triangles on the square DEBA as shown in Figure 11.3.

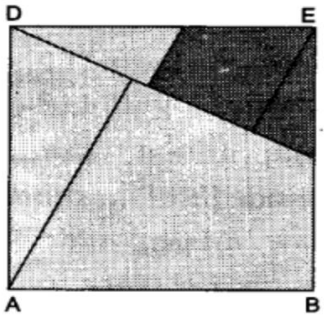


Fig. 11.3

- We observe that all the parts of the squares BFGC and ACHI, i.e., two quadrilaterals and three triangles completely cover the square DEBA. Therefore,
- area of the square DEBA = area of the square BFGC + area of the square ACHI
- i.e., $c^2 = a^2 + b^2$.
- In other words, the square of the hypotenuse of right-angled ΔABC is equal to the sum of the squares of the other two sides

7. CONGRUENCE OF TRIANGLES

QR Code:

C6F4C4

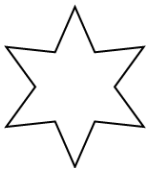
Learning Outcome and Learning Objectives

Content area/Concepts	Learning Objectives	Learning Outcome
Congruence of plane figures	Experiment superposition of different figures in order to verify congruence of two figures	Applies the similarity rules in order to explains the congruency of triangles on the basis of the information given about them like (sss, sas, asa, rhs)
Congruence among line segments	Experiment superposition of different lengths in order to understand congruence of two, line segments and vice versa	
Congruence of angles	Experiment superposition of different angles in order to understand congruence of two angles and vice versa	
Congruence of triangles	Give example(s) in order to discuss the congruence of triangles and its corresponding parts under a given correspondence.	
Criteria for congruence of triangles	Use SSS Congruence criterion in order to examine whether the given triangles are congruent or not.	
	Use SAS Congruence criterion in order to examine whether the given triangles are congruent or not.	
	Use ASA Congruence criterion in order to examine whether the given triangles are congruent or not.	
	Apply RHS congruence criterion in order to check the congruence of given right triangles.	
Congruence among right angles triangle	Use any appropriate criterion of congruency in order to check whether the given triangles are congruent or not.	

Test items

LG: Experiment superposition of different figures in order to verify congruence of two figures

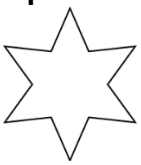
Level of difficulty: Medium
Bloom's Level: Understanding
1. Consider the figure below.



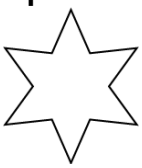
Which of the following is congruent to the above figure?

Option 1:

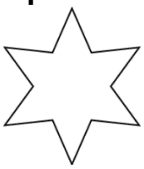
Option 2:



Option 3:



Option 4:



Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analyzing
2. Consider the four figures below.

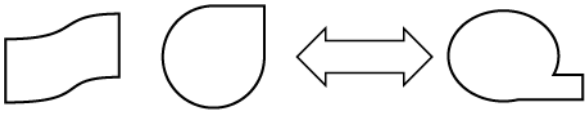


Figure 1 Figure 2 Figure 3 Figure 4

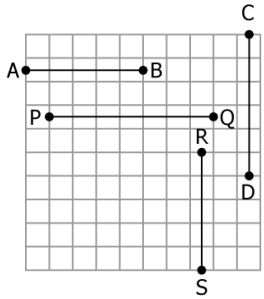
Each figure is cut along a line to get two parts. The two parts generated from three of the figures are congruent.
Which figure result in parts that are not congruent?

Option 1: Figure 1
Option 2: Figure 2
Option 3: Figure 3
Option 4: Figure 4

Correct Answer: Option 4

LG: Experiment superposition of different lengths in order to understand congruence of two line segments and vice versa

Level of difficulty: Medium
Bloom's Level: Analyzing
1. Consider the line segments on the grid.

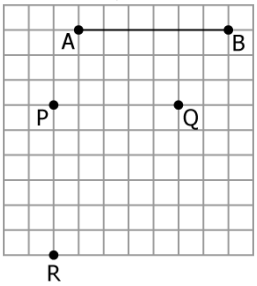


Which of these line segments are congruent?

Option 1: $\overline{AB} \cong \overline{PQ}$
Option 2: $\overline{CD} \cong \overline{PQ}$
Option 3: $\overline{AB} \cong \overline{RS}$
Option 4: $\overline{CD} \cong \overline{RS}$

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analyze and compare
2. Consider the line segment AB and the points P, Q and R on the grid below.



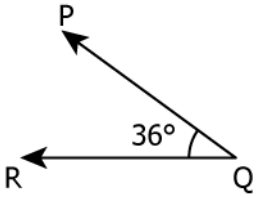
Two students make the following statement.
Student I: Joining points P and Q results in the line segment $\overline{PQ}$congruent to $\overline{AB}$.
Student II: Joining points P and R results in the line segment $\overline{PR}$congruent to $\overline{AB}$.
Who among them makes the correct statement?

Option 1: Student I
Option 2: Student II
Option 3: Both of them
Option 4: Neither of them

Correct Answer: Option 2

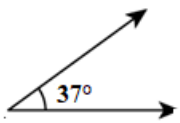
LG: Experiment superposition of different angles in order to understand congruence of two angles and vice versa

Level of difficulty: Medium
Bloom's Level: Understanding
1. Consider the angle shown below.

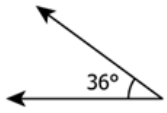


Which of the following angles is congruent to the one shown above?

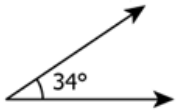
Option 1:



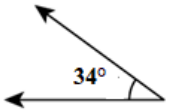
Option 2:



Option 3:



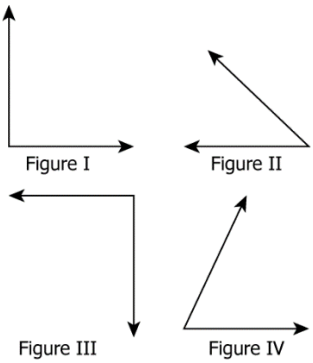
Option 4:



Correct Answer: Option 2

Level of difficulty: Medium
Bloom's Level: Understanding

2. Consider the figures of four angles.



Which angles are congruent?

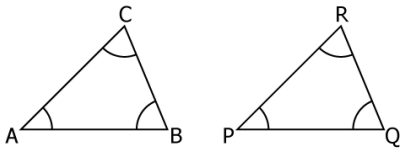
Option 1: Figure I and Figure III
Option 2: Figure I and Figure IV
Option 3: Figure II and Figure III
Option 4: Figure II and Figure IV

Correct Answer: Option 1

LG: Give example(s) in order to discuss the congruence of triangles and its corresponding parts under a given correspondence**.**

Level of difficulty: Medium
Bloom's Level: Understanding

1. Given: $\Delta ABC \cong \Delta PQR$ and $\angle RPQ = 45°$.



Which angle is congruent to $\angle C$?

Option 1: $\angle P$
Option 2: $\angle R$
Option 3: $\angle A$
Option 4: $\angle B$

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Evaluating

2. Consider the statements:

Statement 1: All equilateral triangles are congruent.
Statement 2: All right triangles are congruent.
Which of these is/are true?

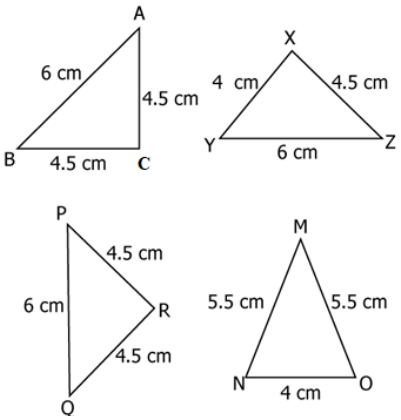
Option 1: Statement I
Option 2: Statement II
Option 3: both the statements
Option 4: neither of the statements

Correct Answer: Option 4

LG: Use SSS Congruence criterion in order to examine whether the given triangles are congruent or not.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the four triangles given below:



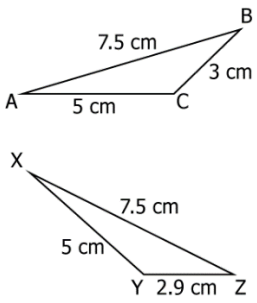
Which triangles are congruent?

Option 1: ΔABC ≅ ΔXYZ
Option 2:ΔMNO ≅ ΔABC
Option 3:ΔXYZ ≅ ΔMNO
Option 4: ΔABC ≅ ΔPQR

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Evaluating

2. Consider the triangles



Are the triangles congruent? Why or why not?

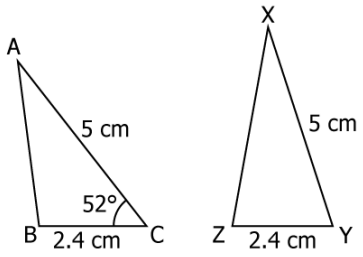
Option 1: Yes, as they both are obtuse angles.
Option 2: No, as one of the angles in both the triangles is an obtuse.
Option 3: Yes, as at least two sides in both the triangles are congruent.
Option 4: No, for the triangles to be congruent BC should be equal to YZ.

Correct Answer: Option 4

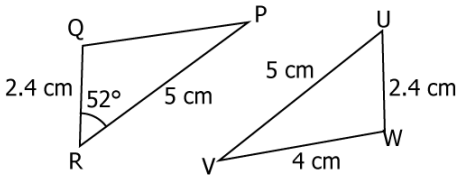
LG: Use SAS Congruence criterion in order to examine whether the given triangles are congruent or not.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Vivek constructed 4 triangles and labelled some parts. He then asked his friend to choose the triangles with the same size.



Triangle I Triangle II



Triangle III Triangle IV

Which triangles have the same size?

Option 1: Triangle I and II
Option 2: Triangle I and III
Option 3: Triangle II and IV
Option 4: All four of them

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Understanding

2. Consider the triangles below.

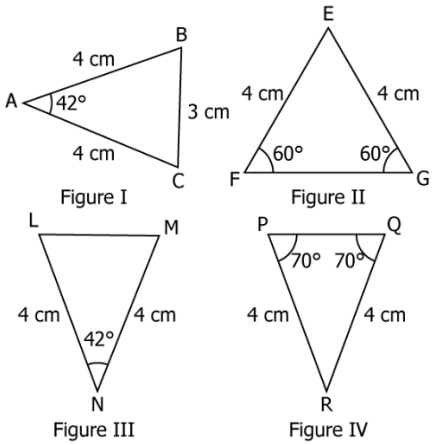


Figure I Figure II

Figure III Figure IV

Which triangles are congruent?

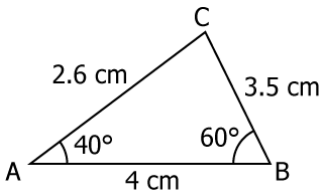
Option 1: $\Delta ABC \cong \Delta FEG$
Option 2: $\Delta BAC \cong \Delta MNL$
Option 3: $\Delta MNL \cong \Delta QRP$
Option 4: All triangles are congruent

Correct Answer: Option 2

LG: Use ASA Congruence criterion in order to examine whether the given triangles are congruent or not.

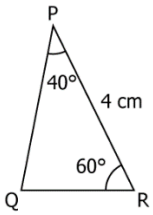
Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the triangle.

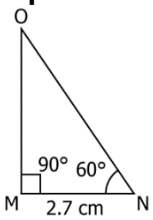


Which among the following is congruent to ΔABC?

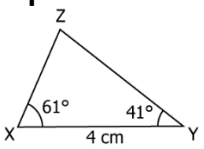
Option 1:



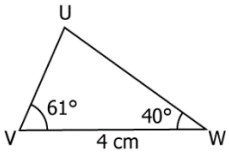
Option 2:



Option 3:



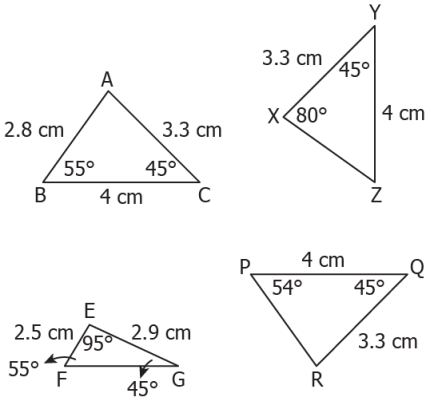
Option 4:



Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understanding

2. Which among the following is not congruent with other triangles?



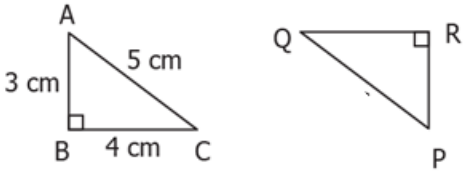
Option 1: ΔEFG
Option 2: ΔXYZ
Option 3: ΔABC
Option 4: ΔPQR

Correct Answer: Option 1

LG: Apply RHS congruence criterion in order to check the congruence of given right triangles.

Level of difficulty: Hard
Bloom's Level: Evaluating

1. Consider the right-angled triangles.



A student made following claims about the triangles.

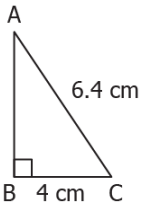
Claim I: Knowing that PQ = 5 cm and PR = 3 cm, it can be concluded that triangles are congruent.
Claim II: Knowing that PQ = 5 cm and QR = 4 cm, it can be concluded that triangles are congruent.
Which claim is correct?

Option 1: only claim I
Option 2: only claim II
Option 3: both the claims
Option 4: neither of the claims

Correct Answer: Option 3

Level of difficulty: Medium
Bloom's Level: Understanding

2. Consider the right-angled triangle ABC.



Which of the following triangles is congruent to ΔABC?

Figure 1

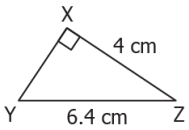


Figure 2

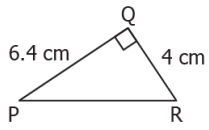


Figure 3

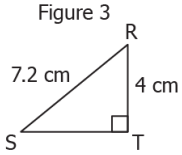
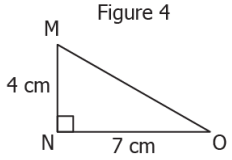


Figure 4



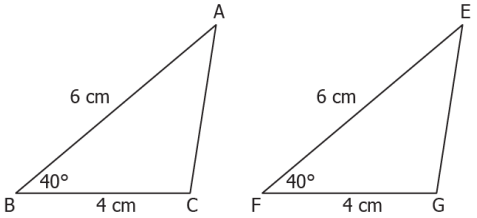
Option 1: Figure I
Option 2: Figure II
Option 3: Figure III
Option 4: Figure IV

Correct Answer: Option 1

LG: Use any appropriate criterion of congruency in order to check whether the given triangles are congruent or not.

Level of difficulty: Medium
Bloom's Level: Evaluating

1. Consider the triangles below.



Are the triangles congruent? Justify.

Option 1: Yes, by SAS criterion.
Option 2: Yes, by SSS criterion.
Option 3: No valid conclusion can be made as the third side in each triangle is not unknown.
Option 4: No valid conclusion can be made as only one of the angles is known for each triangle.

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Evaluating

2. Consider the triangles.

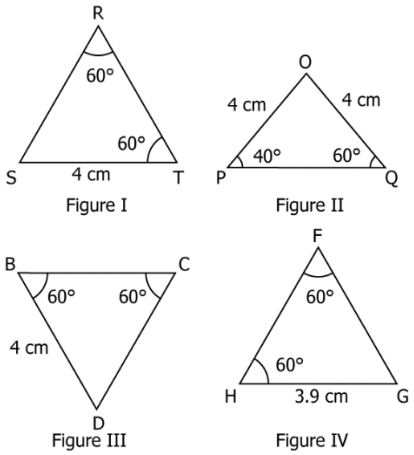


Figure I Figure II Figure III Figure IV

Which of the triangles are congruent?

Option 1: Figure I and III

Option 2: Figure I and IV

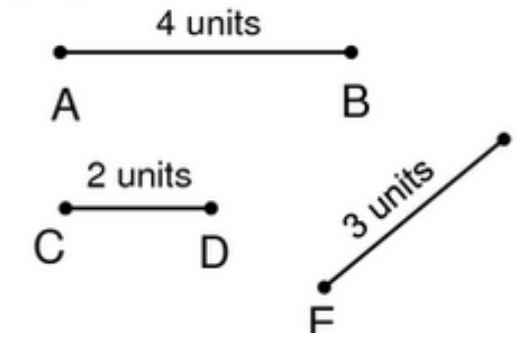
Option 3: Figure II and III

Option 4: Figure III and IV

Correct Answer: Option 1

Suggested Teacher Resources

1 LESSON PLAN

Objective	Give example(s) in order to discuss the congruence of triangles and its corresponding parts under a given correspondence.
Material Required	Straws, geometry set
Previous Knowledge	Congruence of figures, lines and angles
Procedure	Opening: Divide students into groups of 3 and ask them to discuss the following questions: Q) How many different triangles do you think can be constructed using the three-line segments shown? Q) What does this tell you about all triangles with sides of the given lengths?  Student need to reason out their answers. Take few responses and note them down on the board. Big Questions that will be discussed today is Q) What information is required to prove that two triangles are congruent? Activity: Q) What does it mean for triangles to be congruent? Ans: When triangles are congruent, they have three pairs of congruent angles and three pairs of congruent sides. Or Corresponding parts are equal. Q) What would be the converse of this statement? Ans: If two triangles have 3 pairs of congruent sides and 3 pairs of congruent angles then the triangles will be congruent. Since in opening students were able to confirm that only one triangle is possible with 3 sides known. Then it's enough information to guarantee that the triangles are congruent. Hence, triangles are congruent if 3 pair of sides are congruent. This property is known as SSS (side – side - side) rule. Students will divide into groups of 5 and discuss the following question. Students can use sticks/straws to make sides of triangles and protractor to measure angles between sides. Q) What other combinations of sides and angles when congruent leads to triangles being congruent? Students will answer using following table:

	Combination	Sketch the triangle constructed. Are they congruent or not?	Does having combination of congruent parts guarantee that triangles are congruent?

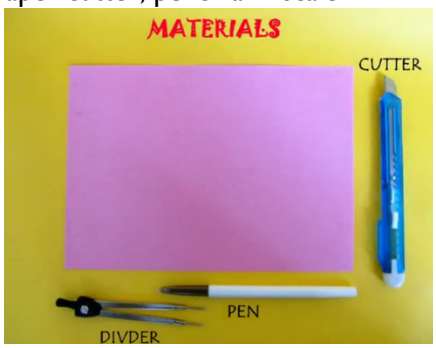
Guiding instructions:

1. Start by thinking of all the different ways two triangles can have three pairs of congruent parts. For example, 'S-S-S' means that the triangles have three pairs of congruent sides. List every combination you can think of.
2. Now go back and look for combinations that are really the same combination counted twice. For example, are 'S-A-A' and 'A-A-S' really different? Keep in mind that triangles are congruent if one can be rotated and reflected to lie on top of the other. Cross out any duplicate combinations. (If you are not sure, just leave both combinations for now. It will become clearer when you use both combinations of elements to build triangles.)
3. Do all combinations of three pairs of congruent elements guarantee that two triangles are congruent? Place a check by every combination you are sure guarantees congruence. Put a question mark by those you doubt. It may help to sketch a few triangles using the space below.

Source	https://betterlesson.com/lesson/resource/1968313/triangleconstructionsite_activity

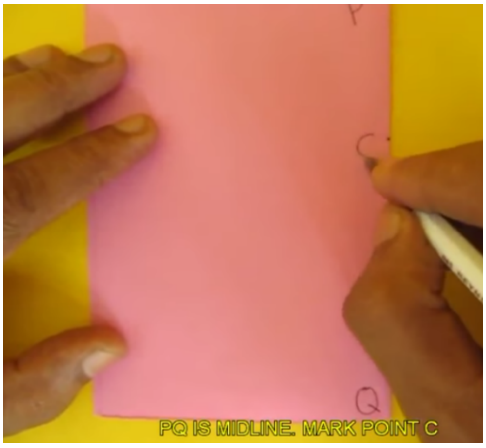
2 ACTIVITY

Objective: Use SSS Congruence criterion in order to examine whether the given triangles are congruent or not.
Materials required: Coloured paper, paper cutter, pencil and scale

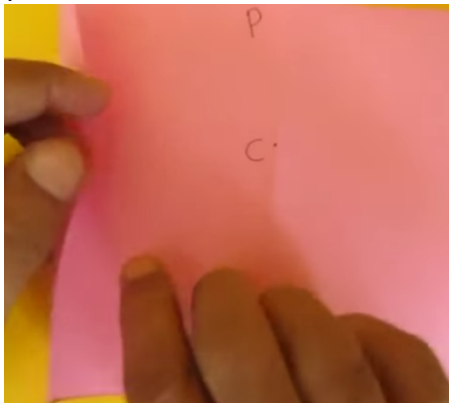


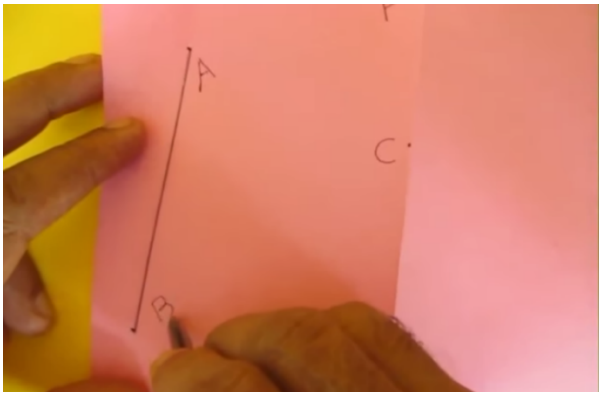
Setup: Coloured sheets to be divided 1 per student. Students need to be careful around sharp objects like cutter and follow the instruction of the teacher properly.
Instructions:
1. Fold the paper in half

2. Mark points P and Q on the edge of the paper. Mark a point C between PQ.

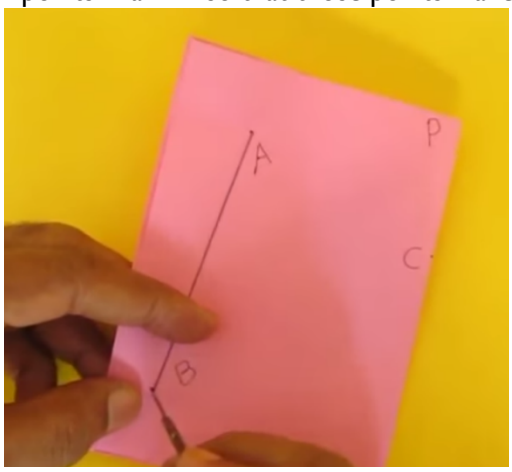


3. Open the paper and fold a crease on the left side of PQ. Make with a line AB as shown.

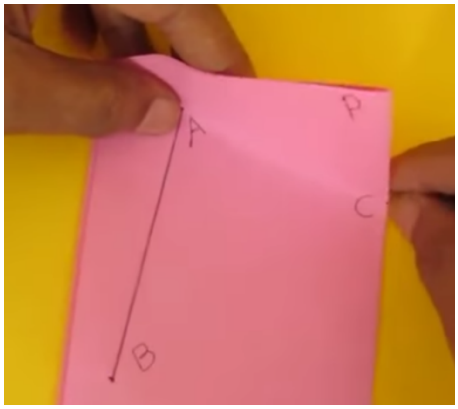


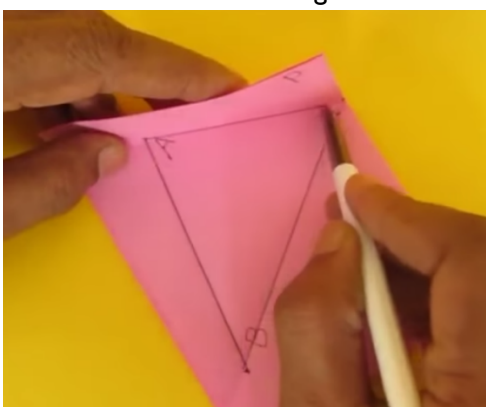


4. Double the paper and poke holes in points A and B so that those points make a mark on the opposite side.

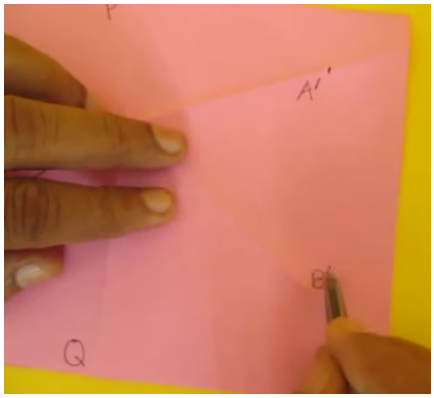


5. Fold from A to C and make a line on the crease. Do the same from B to C. Triangle ABC will be visible.

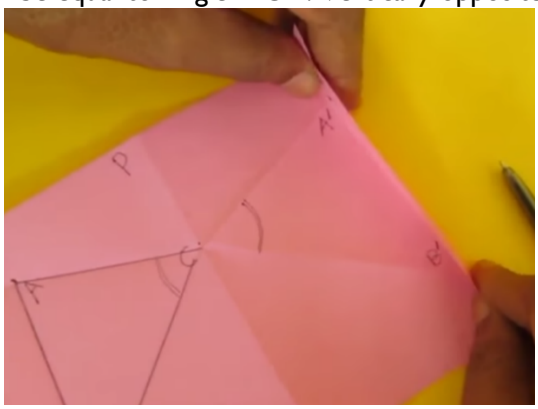




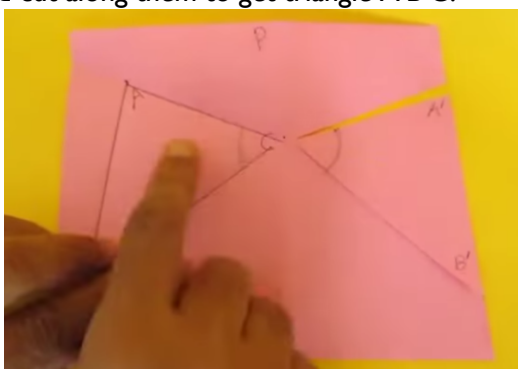
6. Open the paper and mark the poked holes as A' and B'.



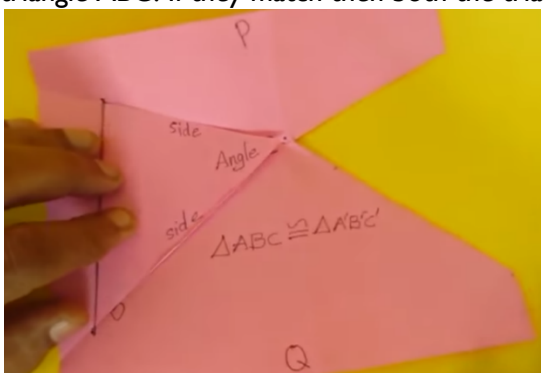
7. Angle ACB will be equal to Angle A'CB'. Vertically opposite angles. Fold along A'B' and cut along the crease.



8. Fold the line from CA' and CB' and cut along them to get triangle A'B'C.



9. Superimpose triangle A'B'C over triangle ABC. If they match then both the triangles are congruent.



Observations:

Sides of triangle ABC were taken at random and were copied to length on triangle A'B'C in steps 3.

In triangle ABC and triangle A'B'C

AB = A'B' (By Construction)

AC = A'C (By symmetry)

BC = B'C (By symmetry)

Hence Triangle ABC is congruent to Triangle A'B'C by SSS rule

8. COMPARING QUANTITIES

QR Code:

A3M1H1

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction		Compare quantities in order to represent them as ratio	Applies algorithm to calculate percentages in order to calculate profits, loss and rate of interest in simple interest calculation
		Compare the units of the quantities in order to represent them in ratio	
Equivalent ratios		Convert ratios into like fractions and compare them in order to identify equivalent ratios	
		Equate ratios in order to represent them in proportion	
		Represent equal ratios in proportion in order to find missing term(s)	
Comparing Quantities using percentage	Meaning of Percentage	Convert denominators of fractions into 100 in order to represent them in percentages	
	Converting Fractional Numbers to Percentage	Convert fractional numbers to percentage in order to make comparing of quantities easier	
	Converting Decimals to Percentage	Convert decimal numbers to percentage in order to make comparing of quantities easier	
	Converting Percentages to Fractions or Decimals	Convert percentages to fractions or decimals in order to solve real life problems	
	Fun with Estimation	Represent shaded part in the form of percentage in order to estimate the part of an area	
Use of Percentages	Interpreting Percentages	Interpret percentage given in a statement in order to infer meaning of the statement	
	Converting Percentages to "How Many"	Convert percentage into number in order to know how many of a given situation	
	Ratios to Percent	Convert ratios to percentages in order to solve problems based on real life	
	Increase or Decrease as Per Cent	Calculate increase or decrease in quantity as percentage in order to examine change in quantity based on real life problems	

Prices related to an item or buying/selling	Profit or Loss as a Percentage	Calculate cost and selling price in order to determine profit/loss percentage	
Charge given on borrowed money or simple interest	Interest for Multiple Years	Understand the concept of simple interest in order to interpret word problems	
		Make use of percentage in order to calculate simple interest for multiple years	

Test items

LG: Compare quantities in order to represent them as ratio

Level of difficulty: Medium
Bloom's Level: Understanding

1. There are 16 red marbles and 24 green marbles in a bag. Which option represents the ratio of red marbles to green marbles?
   Option 1: 2: 3
   Option 2: 3: 2
   Option 3: 2: 5
   Option 4: 3: 5

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Raman has 25 markers in his bag. Of these markers, 8 are red and the remaining markers are black. How many black marker(s) should he pull out from the bag so that the ratio of red to black markers becomes 1:2?
   Option 1: 1
   Option 2: 2
   Option 3: 7
   Option 4: 8

Correct Answer: Option 1

LG: Compare the units of the quantities in order to represent them in ratio

Level of difficulty: Medium
Bloom's Level: Understanding

1. What is the ratio of 5 metres to 200 centimetres?
   Option 1: 5: 2
   Option 2: 2: 5
   Option 3: 1: 40
   Option 4: 40: 1

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. If the ratio of the distances between bus stand and airport to bus stand and railway station is 2 : 3, which of these could be correct?
   Option 1:
   The distance between bus stand and airport = 2 km
   The distance between bus stand and railway station = 300 m
   Option 2:
   The distance between bus stand and airport = 200 m
   The distance between bus stand and railway station = 3 km
   Option 3:
   The distance between bus stand and airport = 4km

The distance between bus stand and railway station = 6,000 m
Option 4:
The distance between bus stand and airport = 400 m
The distance between bus stand and railway station = 6 km
Correct Answer: Option 3

LG: Convert ratios into like fractions and compare them in order to identify equivalent ratios

Level of difficulty: Medium
Bloom's Level: Understanding
1. Consider the statements below.
Statement I: The ratio 2 : 7 is larger than the ratio 4: 5.
Statement II: The ratio of 3 : 8 is larger than the ratio 2 : 9
Which statement(s) is/are correct?
Option 1: Only Statement I
Option 2: Only Statement II
Option 3: Both Statements I and II
Option 4: Neither Statement I nor Statement II

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. The table below shows the results of the football matches played by a team each month in the past four months.

Month	Wins	Losses
September	8	6
October	5	2
November	7	4
December	9	3

If none of the matches was drawn, which option correctly arranges the months according to the winning performance of the team?
Option 1: October > December > November > September
Option 2: December > September > November > October
Option 3: September > December > November > October
Option 4: December > October > November > September

Correct Answer: Option 4

LG: Equate ratios in order to represent them in proportion

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following set of ratios are in proportion?
Option 1: 16: 24 and 26: 39
Option 2: 24: 51 and 16: 51
Option 3: 33: 18 and 44: 15
Option 4: 42: 17 and 28: 34

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing
2. In a solution, two liquids are in the ratio 3 : 5. In another solution, the same two liquids are in the ratio 18 : 30. Are the liquids in both the solutions in proportion?
Option 1: No, because 30 is divisible by 3 but 18 is not divisible by 5.
Option 2: Yes, because 18 is divisible by 3 and 30 is divisible by 5.
Option 3: No, because 18 : 30 is not equivalent to 3 : 5.
Option 4: Yes, because 18 : 30 is equivalent to 3 : 5.

Correct Answer: Option 4

LG: Represent equal ratios in proportion in order to find missing term(s)

Level of difficulty: Medium
Bloom's Level: Understanding
1. If the ratios 21 : 57 and 14 : *z* are in proportion, what is the value of *z*?

Option 1: 57
Option 2: 42
Option 3: 38
Option 4: 36
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying
2. An architect drafts a design of a bridge. The scale he chooses is such that 12 feet of the actual bridge is represented as 4 centimetres. Given that the width of the bridge on the design is 16 centimetres, how wide must be the actual bridge?

Option 1: 196 feet
Option 2: 192 feet
Option 3: 64 feet
Option 4: 48 feet

Correct Answer: Option 4

LG: Convert denominators of fractions into 100 in order to represent them in percentages

Level of difficulty: Medium
Bloom's Level: Applying
1. Ishan has marbles of three different colours in a bag. He creates a table to represent the number of marbles in percentage.

Colour	Number of Marbles	Fraction	Denominator Hundred	In Percentage
Red	25			
Blue	10			
Green	15			

Which option correctly completes the table?

Option 1:

Colour	Number of Marbles	Fraction	Denominator Hundred	In Percentage
Red	25	$\frac{25}{50}$	$\frac{25}{50} \times \frac{100}{100} = \frac{50}{100}$	50%
Blue	10	$\frac{10}{50}$	$\frac{10}{50} \times \frac{100}{100} = \frac{20}{100}$	20%
Green	15	$\frac{15}{50}$	$\frac{15}{50} \times \frac{100}{100} = \frac{30}{100}$	30%

Option 2:

Colour	Number of Marbles	Fraction	Denominator Hundred	In Percentage
Red	25	$\frac{25}{50}$	$\frac{25}{50} \times \frac{10}{10} = \frac{5}{10}$	5%
Blue	10	$\frac{10}{50}$	$\frac{10}{50} \times \frac{10}{10} = \frac{2}{10}$	2%
Green	15	$\frac{15}{50}$	$\frac{15}{50} \times \frac{10}{10} = \frac{3}{10}$	3%

Option 3:

Colour	Number of Marbles	Fraction	Denominator Hundred	In Percentage

Red	25	$\frac{25}{50}$	$\frac{25}{50}\times\frac{10}{10}=\frac{5}{10}$	0.5%
Blue	10	$\frac{10}{50}$	$\frac{10}{50}\times\frac{10}{10}=\frac{2}{10}$	0.2%
Green	15	$\frac{15}{50}$	$\frac{15}{50}\times\frac{10}{10}=\frac{3}{10}$	0.3%

Option 4:

Colour	Number of Marbles	Fraction	Denominator Hundred	In Percentage
Red	25	$\frac{25}{50}$	$\frac{25}{50}\times\frac{100}{100}=\frac{50}{100}$	0.5%
Blue	10	$\frac{10}{50}$	$\frac{10}{50}\times\frac{100}{100}=\frac{20}{100}$	0.2%
Green	15	$\frac{15}{50}$	$\frac{15}{50}\times\frac{100}{100}=\frac{30}{100}$	0.3%

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. To find the percentage equivalent of the fraction $\frac{p}{q}$, Rehan multiplies the numerator and the denominator of the fraction by 20. Rehan then claims that the numerator of the resulting fraction is the percentage equivalent of the fraction $\boldsymbol{\frac{p}{q}}$**.** For Rehan's claim to be correct, which of these must be true?

Option 1: p = 5
Option 2: q = 5
Option 3: p = 100
Option 4: q = 100

Correct Answer: Option 2

LG: Convert fractional numbers to percentage in order to make comparing of quantities easier

Level of difficulty: Medium
Bloom's Level: Understanding

1. Out of 40 bulbs in a carton, 6 bulbs are fused. What percent of the total bulbs are fused?

Option 1: 6%
Option 2: 15%
Option 3: 60%
Option 4: 85%

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Of 50 balls in a bag, 25 balls are red, 5 balls are green and the remaining balls are white. Aarav and Jignesh compare the number of balls based on the information given.
Aarav says that the number of green balls in 30% less than the number of white balls.
Jignesh says that the number of red balls is 10% more than the number of white balls.
Who is/are correct?

Option 1: Only Aarav
Option 2: Only Jignesh
Option 3: Both Aarav and Jignesh
Option 4: Neither Aarav nor Jignesh

Correct Answer: Option 3

LG: Convert decimal numbers to percentage in order to make comparing of quantities easier

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following represents 0.9 as percentage?
   Option 1: 0.09%
   Option 2: 0.9%
   Option 3: 9%
   Option 4: 90%

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. Murli recorded the heights of four different plants as shown.

Plant	Height in inches
Plant A	6.8
Plant B	4.2
Plant C	8.3
Plant D	3.5

Based on the table, three statements are written.
Statement 1: The height of Plant A is 2.6% more than that of Plant B.
Statement 2: The height of Plant C is 48% more than that of Plant D.
Statement 3: The height of Plant B is 20% more than that of Plant D.
How many statements are correct?
   Option 1: None
   Option 2: Only Statement 1
   Option 3: Only Statement 2
   Option 4: Only Statement 3

Correct Answer: Option 4

LG: Convert percentages to fractions or decimals in order to solve real life problems

Level of difficulty: Medium
Bloom's Level: Applying

1. Naman is checking the eggs kept in a tray if they are rotten or not. He finds that 15% of the total eggs are rotten. What fraction of the total eggs in the tray is rotten?
   Option 1: $\frac{20}{3}$
   Option 2: $\frac{3}{2}$
   Option 3: $\frac{3}{20}$
   Option 4: $\frac{2}{3}$

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. Arvind planted tulips in 75% of the total area of his field and left the remaining area to plant different flowers. What fraction of area is available for planting the flowers other than tulips?
   Option 1: $\frac{1}{4}$
   Option 2: $\frac{3}{4}$
   Option 3: $\frac{2}{15}$
   Option 4: $\frac{13}{15}$

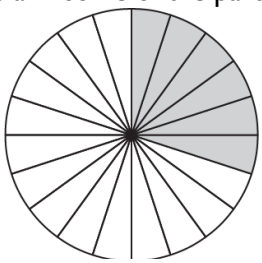
Correct Answer: Option 1

LG: Represent shaded part in the form of percentage in order to estimate the part of an area

Level of difficulty: Medium

Bloom's Level: Understanding

1. A circle is divided into 20 identical parts and some of the parts are shaded as shown.



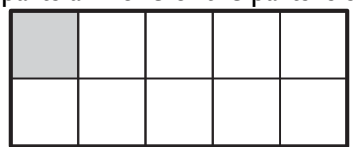
What percent of the circle is shaded?

Option 1: 6%
Option 2: 30%
Option 3: 60%
Option 4: 70%

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. A whole is divided into 10 identical parts and one of the parts is shaded as shown.



How many more parts of the figure must be shaded so that the shaded part becomes exactly 40% of the whole?

Option 1: 1
Option 2: 3
Option 3: 4
Option 4: 6

Correct Answer: Option 2

LG: Interpret percentage given in a statement in order to infer meaning of the statement

Level of difficulty: Medium
Bloom's Level: Understanding

1. A quality analyst checks the quality of the bottles manufactured by his company. He finds that 8% of the bottles were defective. Which of the following option correctly infers the given statement?

Option 1: 2 out of every 10 bottles were defective
Option 2: 8 out of every 10 bottles were defective
Option 3: 2 out of every 100 bottles were defective
Option 4: 8 out of every 100 bottles were defective

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. A company manufactures red pens and blue pens. On each day, the company manufactures 45% red pens and the remaining pens are blue. Which statement correctly interprets the given situation?

Option 1: The company manufactures 10 more blue pens than red pens for every 100 pens.
Option 2: The company manufactures 10 less blue pens than red pens for every 100 pens.
Option 3: The company manufactures 55 more red pens than blue pens for every 100 pens.
Option 4: The company manufactures 55 less red pens than blue pens for every 100 pens.

Correct Answer: Option 1

LG: Convert percentage into number in order to know how many of a given situation

Level of difficulty: Medium
Bloom's Level: Applying

1. A survey of 80 students shows that 35% students own a laptop. How many students own a laptop?

Option 1: 28
Option 2: 35
Option 3: 45
Option 4: 52

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying

2. A total of 400 students appeared on a math competition. Out of these students, 32% got Grade A, 56 % got Grade B and the remaining got Grade C. Based on the information, which statement is correct?
   Option 1: 24 more students got Grade B than Grade A.
   Option 2: 44 fewer students got Grade C than Grade B.
   Option 3: 104 fewer students got Grade A than Grade B.
   Option 4: 80 more students got Grade A than Grade C.

Correct Answer: Option 4

LG: Convert ratios to percentages in order to solve problems based on real life

Level of difficulty: Medium
Bloom's Level: Applying

1. Arun prepares a mixture of milk and water by taking 3 parts of milk and 1 part of water. What would be the percentages of milk and water in such a mixture?
   Option 1: Milk: 3% and Water: 1%
   Option 2: Milk: 7.5% and Water: 2.5%
   Option 3: Milk: 30% and Water: 10%
   Option 4: Milk: 75% and Water: 25%

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying

2. Ritesh spent a total of ₹1,200 on buying different types of books. He spent one part of the money on buying fiction books, four parts on buying puzzle books and five parts on buying autobiographies. Based on the given information, which table represents the correct amount spent on each type of book and percentage of amount spent on each?

Option 1:

Type of Book	Amount Spent on Each Type of Book	Percentage of Amount
Fiction	120	1%
Puzzle	480	4%
Autobiography	600	5%

Option 2:

Type of Book	Amount Spent on Each Type of Book	Percentage of Amount
Fiction	120	10%
Puzzle	480	40%
Autobiography	600	50%

Option 3:

Type of Book	Amount Spent on Each Type of Book	Percentage of Amount
Fiction	12	10%
Puzzle	48	40%
Autobiography	60	50%

Option 4:

Type of Book	Amount Spent on Each Type of Book	Percentage of Amount
Fiction	12	1%
Puzzle	48	4%
Autobiography	60	5%

Correct Answer: Option 2

LG: Calculate increase or decrease in quantity as percentage in order to examine change in quantity based on real life problems

Level of difficulty: Medium
Bloom's Level: Applying

1. The owner of an appliance store decides to decrease the price of a coffee maker from ₹1,450 to ₹1,160. By what percentage will the price of coffee maker decrease?
   Option 1: 2.9%
   Option 2: 20%
   Option 3: 25%
   Option 4: 29%

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. A cloth store sells t-shirts and shirts. The table describes the numbers of shirts and t-shirts that the store sold on Monday and Tuesday.

Day	Number of shirts sold	Number of t-shirts sold
Monday	5	50
Tuesday	10	70

If on selling 1- shirt, the store earns the same amount as on selling 2 t-shirts, by what percent has the store's earning increased from Monday to Tuesday?
   Option 1: 25%
   Option 2: 31.25%
   Option 3: 33.33%
   Option 4: 50%

Correct Answer: Option 4

LG: Calculate cost and selling price in order to determine profit/loss percentage

Level of difficulty: Medium
Bloom's Level: Applying

1. A furniture seller sold a chair for ₹4,200 with a profit of 5%. What was its cost price?
   Option 1: 3,360
   Option 2: 3,990
   Option 3: 4,000
   Option 4: 4,195

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. A shopkeeper buys 300 bowls for ₹6,000. The cost of each bowl is the same. Of these bowls, he sells 100 bowls at a loss of 10%. What must be the selling price of each of the remaining bowl in order to earn an overall profit of 25%?
   Option 1: ₹25
   Option 2: ₹25.13
   Option 3: ₹28.05
   Option 4: ₹28.50

Correct Answer: Option 4

LG: Understand the concept of simple interest in order to interpret word problems

Level of difficulty: Medium
Bloom's Level: Understanding

1. Alisha borrows some amount at rate of interest of 12% per year. Which option correctly interprets the situation?
   Option 1: On every ₹100 borrowed, ₹10 is the interest she has to pay for one year.
   Option 2: On every ₹100 borrowed, ₹12 is the interest she has to pay for one year.
   Option 3: On every ₹1,000 borrowed, ₹10 is the interest she has to pay for one year.
   Option 4: On every ₹1,000 borrowed, ₹12 is the interest she has to pay for one year.

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. Anay takes a loan of ₹54,000 at a rate of interest of 6% per year. How much interest will she pay at the end of one year?
   Option 1:₹3,240
   Option 2: ₹9,000
   Option 3: ₹32,400
   Option 4: ₹57,240

Correct Answer: Option 1

LG: Make use of percentage in order to calculate simple interest for multiple years

Level of difficulty: Medium
Bloom's Level: Applying

1. Anupam borrows ₹1,25,000 from his friend at 10% rate of interest per annum for 3years. How much interest will he pay at the end of 3 years?
   Option 1: ₹12,500
   Option 2: ₹37,500
   Option 3: ₹1,37,500
   Option 4: ₹1,62,500

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. Darshit borrowed a certain amount for 4 years at an interest rate of 8% per annum in the year 2007. He borrowed the same amount for the same time period again in the year 2013 but at 14% interest rate per annum. If he paid ₹1,200 fewer interest at the end of the year 2011 than that paid at the end of the year 2017, what sum did he borrow in 2007?
   Option 1: ₹500
   Option 2: ₹5,000
   Option 3: ₹6,600
   Option 4: ₹7,800

Correct Answer: Option 2

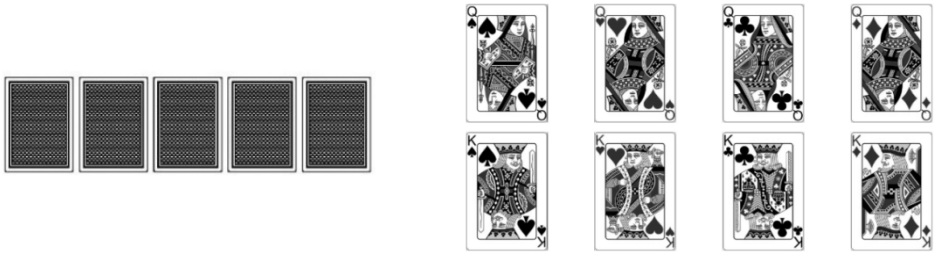
Suggested Teacher Resources

1 LESSON PLAN

Objective-: Students will be able to define, represent and compare a ratio in order to show a relationship between two different quantities.
Material Required-: Activity Sheet.
Procedure-:

- Start the class with do now activity I create do now activity students will review how to create ratios. The Problem pushes students to look at the current ratio of 5:8 and reason what to add to the picture to create a ratio of 3:4 (or 6:8).
- Call students to share out their answers and share whether they agree or disagree with one another. Present a ratio with the numbers switched and ask students if this will work. Students should remember that the order of the values does matter.

Do Now
Here is a set of cards:



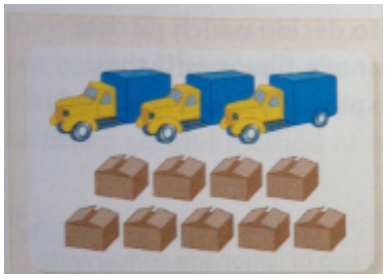
Write each ratio as a fraction:

1. The ratio of face-up cards to the whole set. _____ : _____
2. The ratio of face-down cards to the whole set. _____ to _____
3. The ratio of face-down cards to face-up cards. _____ (Write as fraction)
4. Add a drawing of some face-down cards so that the ratio of face-down to face-up cards is 3:4.

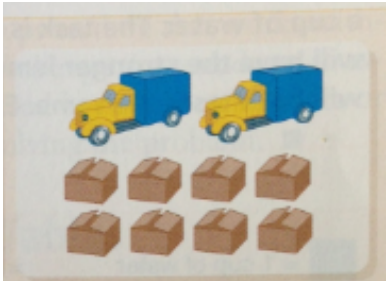
- Now give another activity sheet to the students where they will compare ratios.
- This will give students an opportunity to show what they know about equivalent ratios. Read the prompt and tell students to work for a few minutes on their own.
- After a few minutes, prompt students to participate in a Think Pair Share. Ask students to compare their ratios of trucks to boxes. Call on students to share out their ratios. Ask for one student to share a match he/she found. Ask students if they agree or disagree and why.
- Some students may be confused, or having difficulty finding multiple matches. This is okay. As we want to plant these questions and we will return to them later in the lesson.

Ques1.Write a ratio of trucks to boxes for each picture.
Ques2. Which pictures have the same ratios of trucks to boxes?

Picture A:

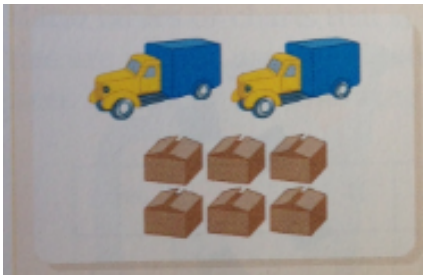


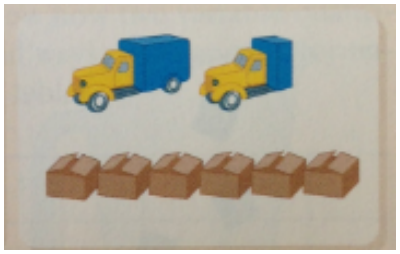
Picture B:



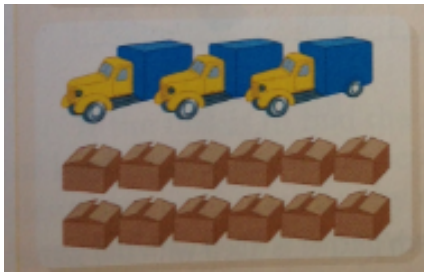
Picture C:

Picture D:

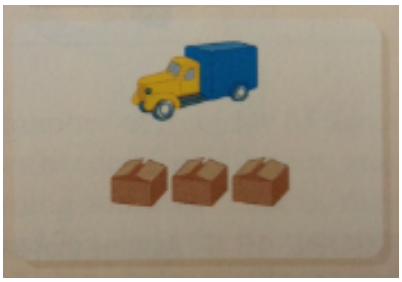




Picture E:



Picture F:



- Present ratio tables as one tool to help students to understand the *relationship* between the two categories. Teacher along with students will work through the bouquet problem together. Students should be able to recognize the pattern and vocalize that the ratio of daisies to tulips is 2:1.

Ratios and Tables:

- Equivalent ratios can be displayed using a table.
- Try to figure out the _____ between the two columns.
- The values in the table do NOT have to go in order.

Problem:

The Student Council is selling bouquets of daisies and tulips. The ratio of the number of daisies to the number of tulips is the same for all of the bouquets. Use the information in the table to figure out the missing values.

Number of bouquets	Number of Daisies	Number of Tulips
1	_____	_____
2	24	12
3	_____	18
_____	60	30

In each bouquet the ratio of daisies to tulips is _____.

2 **Activity**

With 2 die: 1 regular, and in the other replace the 1 by 7 and 2 replaced by 8 (coloured), each with digits and not dots.

• The following initiate the processes for fractions with numerators 1…6 and denominators 3…8.

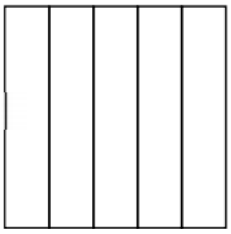
• Any of these processes can be extended to any (proper) fraction with denominator ≤ 10 with the help of the square sheets.

• Then they can be extended further for fractions with any denominators.

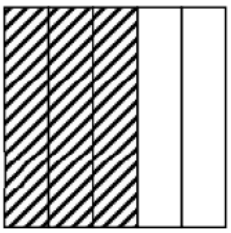
The salient features are mentioned at the end of each. In general:

• The fractions (and whole numbers) get generated at random and thus gives children good opportunity to play with them all.
• Games help children internalize certain math facts and patterns by repeated occurrence where repetition is not boring.
• Care has been taken to focus on (i) only proper or (ii) proper fractions and wholes or (iii) all fractions as is deemed appropriate.
• Paper folding instructions have been included as an integral part whenever necessary and excluded when calculation can or should be done mentally Probabilistically speaking here are the chances of getting.
• An improper fraction: 5/36
• Whole or 1: 4/36 = 1/9
• Whole numbers: 5/36
• Proper fractions: 26/36 = 13/18 Figure 2 3
• Fraction that are reduced: 23/36
• Fractions not reduced: 8/36 = 2/9 (excluding whole numbers)
• Fractions < ½: 15/36 = 5/12

1. Make the fraction:-
a. Role both die – suppose you get numerator = 3 and denominator = 5.
b. Identify in how many parts the whole has to be divided and fold a square paper accordingly (i.e. the number on the coloured dice or denominator q).

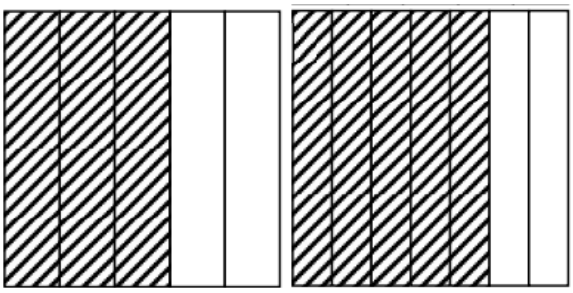


c. Identify how many parts of the above have to be coloured or shaded (i.e. the number on the regular dice or numerator p).



d. Write the fraction as p/q – e.g. 3/5.
Features:
1. Identifying denominator and numerator.
2. Identifying 1 or whole whenever the numbers match i.e. whole 3/3 = … = 6/6.
3. Natural extension to improper fraction as and when it arrives – Initially p > q can be ignored till children master the understanding of proper fractions But afterwards, this opportunity should be grabbed to introduce improper (and mixed) fractions and then the game can be played with 2 regular die or 2 coloured die as well 0.

Bigger and smaller: in groups of 5
Comparing fractions:
a. For any given fraction fold a square and shade it from one end without leaving any gap in between.
b. Fold and shade squares according to the fractions to be compared.
c. Place the squares one below the other with the fold lines vertical and so that the shaded regions start from the left.
d. Compare the shaded regions to order the fractions – bigger the shaded region, bigger the corresponding fraction – e.g. Figure 5 compares 3/5 and 5/7.



Variation 1: a. Each player creates a fraction b. The largest one wins – fraction scale or square sheets can be used to verify c. All fractions can be arranged in order.

Variation 2: After the 1st player gets the 1st fraction

a. The 2nd player throws only the coloured dice and chooses a numerator p, so that the 2nd fraction > the 1st.
b. The 3rd player throws only the regular dice and chooses a denominator q, so that the 3rd fraction > the 1st.
c. The 4th player throws only the coloured dice and chooses a numerator p, so that the 4th fraction < the 1st.
d. The 5th player throws only the regular dice and chooses a denominator q, so that the 5th fraction > the 1st.
e. All fractions are written down and the numbers chosen by players 2-4 circled.
f. The game continues by rotation.
g. One round is complete when each player got a chance to make the 1st fraction.
h. Number of rounds depend on the time available.

Features:

1. Ordering fractions
2. Finding fractions given fractions
3. Open ended and can have multiple solutions
4. Should realize the being 2nd or 5th player is easier than being 3rd or 4th player.

Source-: http://www.teachersofindia.org/en/article/fractions-a4-sheets-and-paper-folding
https://betterlesson.com/lesson/523358/extending-and-comparing-ratios?from=search

9. RATIONAL NUMBERS

QR Code:

Z9T9M8

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
What are rational numbers		Define rational numbers in order to classify a number as a rational number	Applies appropriate mathematical operations on rational numbers in order to solve problems related to daily life situations
		Represent integers in the form of numerator/denominator where denominator is non-zero in order to define rational numbers	
		Multiply numerator and denominator by same non-zero integer in order to find equivalent rational numbers	
Positive and negative rational numbers		Define positive and negative rational numbers in order to classify a number as either of them	
Rational numbers on a number line		Construct a number line in order to represent rational numbers on it	
Rational numbers in standard form		Simplify rational number such that there is no common factor between numerator and denominator in order to represent the number in standard form	
Comparison of rational numbers		Determine the distance of a rational number from 0 in order to compare them	
Rational number between two rational numbers		Calculate and find rational numbers between any 2 rational numbers in order to infer that there are infinite rational numbers between any 2 given rational numbers	
Operations on rational numbers	Addition	Apply the rules of rational numbers operations in order to simplify arithmetic operations	
	Subtraction		
	Multiplication		
	Division		

Test items

LG: Define rational numbers in order to classify a number as a rational number

Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the statements.
   Statement 1: All natural numbers are rational numbers.
   Statement 2: All whole numbers are rational numbers.
   Statement 3: All integers are rational numbers.
   Which of these statements is/are correct?
   Option 1: All three statements
   Option 2: Neither of the statements
   Option 3: Only Statement 1 and Statement 2
   Option 4: Only Statement 2 and Statement 3

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider the set of numbers shown.
   $-2, -3, \frac{1}{2}, \frac{3}{5}, \frac{4}{9}, 4, 5, 7, 9$

How many rational numbers are there in the number set?
Option 1: 2; because only negative integers are rational numbers.
Option 2: 3; because only fractions are rational numbers.
Option 3: 4; because only positive integers are rational numbers.
Option 4: 9; because all integers and fractions are rational numbers.

Correct Answer: Option 4

LG: Represent integers in the form of numerator/denominator where denominator is non-zero in order to define rational numbers

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which option correctly represents an integer 4 as a rational number?
   Option 1: $\frac{4}{1}$
   Option 2: $\frac{4}{0}$
   Option 3: $\frac{4}{4}$
   Option 4: $\frac{1}{4}$

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Rahul writes a rational number as $\frac{4}{m}$. What is the smallest possible value of *m*, if $\frac{4}{m}$ is a positive rational number?
   Option 1: 0
   Option 2: 1
   Option 3: 2
   Option 4: 3

Correct Answer: Option 2

LG: Multiply numerator and denominator by same non-zero integer in order to find equivalent rational numbers

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following rational numbers is equivalent to $\frac{-6}{7}$?

Option 1: $\frac{-4}{9}$
Option 2: $\frac{-8}{5}$
Option 3: $\frac{-12}{7}$
Option 4: $\frac{-12}{14}$
Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing
2. If two rational numbers, $\frac{p}{q}$ and $\frac{a}{b}$, are equivalent such that q is half of b, which relation must hold true?

Option 1: $p = a$
Option 2: $2p = a$
Option 3: $a = \frac{p}{2}$
Option 4: $a = \frac{2}{p}$
Correct Answer: Option 2

LG: Define positive and negative rational numbers in order to classify a number as either of them

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which pair of rational numbers are negative rational numbers?

Option 1: $\frac{4}{7}$ and $\frac{5}{8}$
Option 2: $\frac{-4}{7}$ and $\frac{-5}{8}$
Option 3: $\frac{-4}{-7}$ and $\frac{-5}{-8}$
Option 4: $-(\frac{-4}{7})$ and $\frac{-5}{8}$
Correct Answer: Option 2

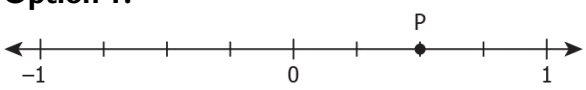
Level of difficulty: Hard
Bloom's Level: Analysing
2. If $\frac{-a}{b}$ is a positive rational number greater than 1, what are the possible values of a and b?

Option 1: $a = 3$, $b = 5$
Option 2: $a = –5$, $b = –3$
Option 3: $a = –5$, $b = 3$
Option 4: $a = –3$, $b = 5$
Correct Answer: Option 3

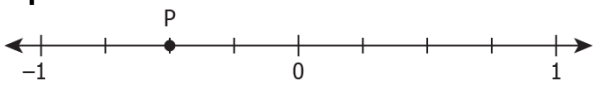
LG: Construct a number line in order to represent rational numbers on it

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which number line shows that alphabet P represents $\frac{3}{4}$?

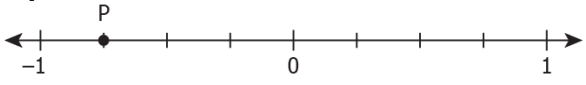
Option 1:



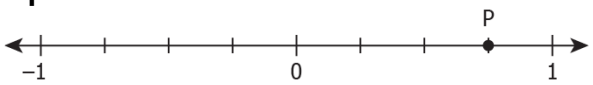
Option 2:



Option 3:



Option 4:



Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. The alphabets on the number line below represent rational numbers.

Based on the number line, which table is correct?

Option 1:

Alphabet	Rational Number
M	$\frac{-3}{2}$
N	$\frac{-1}{2}$
S	$\frac{1}{4}$
T	$\frac{7}{4}$

Option 2:

Alphabet	Rational Number
M	$\frac{3}{2}$
N	$\frac{1}{2}$
S	$\frac{-1}{4}$
T	$\frac{-7}{4}$

Option 3:

Alphabet	Rational Number
M	$\frac{-5}{2}$
N	$\frac{-3}{2}$
S	$\frac{7}{4}$
T	$\frac{9}{4}$

Option 4:

Alphabet	Rational Number
M	$\frac{5}{2}$
N	$\frac{3}{2}$

S	$\frac{-7}{4}$
T	$\frac{-9}{4}$

Correct Answer: Option 1

LG: Simplify rational number such that there is no common factor between numerator and denominator in order to represent the number in standard form

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following is the standard form of $\frac{-42}{56}$?

Option 1: $\frac{-3}{4}$
Option 2: $\frac{3}{4}$
Option 3: $\frac{-6}{8}$
Option 4: $\frac{6}{8}$

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. If $\frac{15}{q}$ represents the greatest possible fraction such that the highest common factor of 15 and q is 5. What is the standard form of $\frac{15}{q}$?

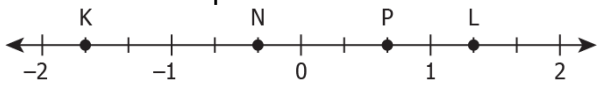
Option 1: $\frac{1}{3}$
Option 2: $\frac{3}{1}$
Option 3: $\frac{1}{5}$
Option 4: $\frac{5}{1}$

Correct Answer: Option 2

LG: Determine the distance of a rational number from 0 in order to compare them

Level of difficulty: Medium
Bloom's Level: Understanding

1. The alphabets on the number line below represent rational numbers.



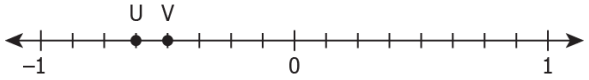
Which option shows the correct comparison of the rational numbers?

Option 1: K > N > P > L
Option 2: L > P > N > K
Option 3: K > L >P>N
Option 4: N>P> L > K

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Alphabets, U and V, represent two rational numbers on the number line shown.



Based on the number line, which option correctly compares U and V?

Option 1: V > U, because both U and V are negative rational numbers and U lies to the left of V.

Option 2: V > U, because both U and V are negative rational numbers and the distance from 0 to U is smaller than the distance from 0 to V.
Option 3: U > V, because both U and V are negative rational numbers and U lies to the left of V.
Option 4: U > V, because the distance from 0 to U is greater than the distance from 0 to V.
Correct Answer: Option 1

LG: Calculate and find rational numbers between any 2 rational numbers in order to infer that there are infinite rational numbers between any 2 given rational numbers

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of these rational numbers lies midway between $\frac{3}{8}$ and $\frac{5}{8}$?
Option 1: $\frac{1}{2}$
Option 2: $\frac{1}{4}$
Option 3: $\frac{3}{4}$
Option 4: $\frac{7}{16}$
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing
2. How many rational numbers lie between two consecutive whole numbers, *a* and *b*?
Option 1: 0; because there does not lie any whole number between two consecutive whole numbers and whole numbers are rational numbers.
Option 2: 1; because the number that lies midway between *a* and *b* is the only rational number between *a* and *b*.
Option 3: Countless because there exist countless fractions between *a* and *b* and all fractions are classified as rational number.
Option 4: Cannot be determined because the exact values of *a* and *b* are not known.
Correct Answer: Option 3

LG: Apply the rules of rational numbers operations in order to simplify arithmetic operations

Level of difficulty: Hard
Bloom's Level: Applying
1. A rational number $\frac{6}{7}$ is subtracted from $\frac{9}{11}$. The result is then added to the additive inverse of $\frac{-5}{8}$. What is the reciprocal of the final sum?
Option 1: $\frac{361}{616}$
Option 2: $\frac{616}{361}$
Option 3: $\frac{409}{616}$
Option 4: $\frac{616}{409}$
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. The numerator and denominator of the rational number $\frac{24}{28}$ are divided by a positive integer *m* to get its standard form as $\frac{a}{b}$. What is the value of the expression $\frac{4}{9} \div m$?
Option 1: $\frac{1}{9}$
Option 2: $\frac{9}{1}$
Option 3: $\frac{9}{16}$
Option 4: $\frac{16}{9}$
Correct Answer: Option 1

Suggested Teacher Resources

1

LESSON PLAN

Objective	To apply the rules of rational numbers operations in order to simplify arithmetic operations on rational numbers
Material Required	Standard deck of Cards
Prerequisite Knowledge	Operations on rational numbers
Procedure	The teacher will arrange students into groups of two or more and will Have students deal out as many cards as possible from a deck of cards, so that each student has an equal number of cards. Then, she will Put aside any extra cards. Next, the teacher will explain to students that every black card in their pile represents a positive number. Every red card represents a negative number. In other words a black seven is worth +7 (seven), a red three is worth 3 (negative 3). At the start of the game, Teacher asks each player to place his or her cards in a stack, face down. Then asks the player to the right of the dealer to turn up one card and say the number on the card. For example, if the player turns up a black eight, he or she says 8. This continues from one player to the next in a clockwise direction. The second player turns up a card, adds it to the first card, and says the sum of the two cards aloud. For example, if the card is a red 9, which has a value of -9, the player says 8 + (-9) = (-1) The next player takes the top card from his or her pile, adds it to the first two cards, and says the sum. For example, if the card is a black 2, which has a value of +2, the player says (-1) + 2 = 1. The game continues until someone shows a card that, when added to the stack, results in a sum of exactly 25. **Extra Challenging Version** To add another dimension to the game, you might have students always use subtraction. Doing that will reinforce the skill of subtracting negative integers. For example, if player #1 plays a red 5 (-5) and player #2 plays a black 8 (+8), the difference is -13: (-5) - (+8) = -13 If the next player plays a red 4, the difference is -9: (-13) - (-4) = -9. [Recall: Minus a minus number is equivalent to adding that number.] Also, the teacher can ask students to note down the numbers and solve the operations in their notebooks.
Source	https://www.educationworld.com/a_tsl/archives/03-1/lesson001.html

2 Activity

Material Required: number lines, metric rulers, pattern blocks, pie shapes, paper strips for fractions, fractional circles or squares, geoboards

Procedure: The teacher will start the activity by asking students to make a fractional strip using the following material:

1. one whole sheet of paper--81/2 x 11--white
2. two half sheets (each half of an 8 1/2 x 11 sheet)-orange
3. three one-third sheets--yellow
4. four one-fourth sheets--pale pink
5. six one-sixth sheets--blue
6. eight one-eighth sheets--green
7. sixteen one-sixteenth sheets--bright pink
8. twelve one-twelfth sheets--beige
9. twenty-four one-twenty-fourth sheets--purple

It would be recommended that each student have a personal kit.

Each of the above coloured sheets of paper can be thought of as a rectangular `pizza' cut into a specific number of parts. Children can be asked to say what one piece of each `pizza' would be called, what 5 pieces would be called, etc. They can then be asked to determine if 5 pieces of any of their `pizzas' is more than one, and, if so, which `pizzas.' They could then be asked to reassemble their `pizzas' into the separate colours and state how many parts of each comprise one-whole, one-half, etc.

Children can take from their kits specific pieces (e. g. 3/8) and be asked to find other kit pieces which show the same amount (e. g. 6/16; 9/24). They can do this by laying their kit pieces on top of or under each other. They are comparing these fractional amounts, but they are also exploring equivalence. You can repeat this same activity for any fraction which has an equivalent.

Continuing this activity. The teacher would ask to have the children select one fraction (e. g. 3/4), place it on their desk, and put under its other fractions which add to give 3/4. For example, one child may place 1/2 and 1/4 under the 3/4; another may place 1/8, 1/8, 1/8, 1/8, 1/16, 1/16, 1/24, 1/24, and 1/24 under the 3/4. Both children would be "correct." These fraction strips may or may not be ordered from the largest amount (1/8) to the smallest amount (1/24). If they are not ordered, the children can then be directed to order them. This activity can be repeated with any beginning fractional amount.

1/6	1/6
1/6	1/6

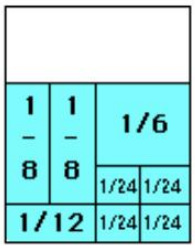
1/6 + 1/6 + 1/6 + 1/6 = 2/3

4/6 = 2/3

2.

2/6 + 4/12 = ⅔

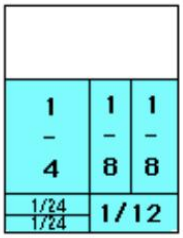
3.



2/8 + 1/6 + 1/12 + 4/24 = 2/3

2/8 + 2/6 + 1/12 = ⅔

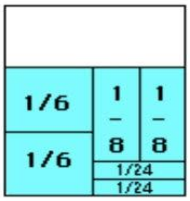
4.



1/4 + 1/8 + 1/8 + 1/12 + 1/24 + 1/24 = 2/3

1/4 + 2/8 + 3/24 = ⅔

5.



1/6 + 1/6 + 1/8 + 1/8 + 1/24 + 1/24 = 2/3

2/6 + 2/8 + 2/24 = 2/3

2/6 + 1/4 + 1/12 = 2/3

6.

1/6 + 1/6 + 1/24 + 1/24 + 1/24 + 1/24 + 1/24 + 1/24 + 1/24 1/24 = 2/3

10. PRACTICAL GEOMETRY

QR Code:

Learning Outcome and Learning Objectives

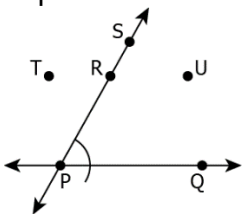
Content area/Concepts	Learning Objectives	Learning Outcome
Construction of line parallel to given line, though a point not on the line	Use a ruler and compass in order to construct a line parallel to another line through a point not on the line	Uses ruler and a pair of compasses in order to construct a line parallel to a given line from a point outside the line and the triangles
Constructing a triangle when length of 3 sides are known (SSS criterion)	List and execute steps in order to construct a triangle given the measures of its three sides.	
Constructing a triangle when the lengths of two sides and measure of angle between them are known (SAS)	List and execute steps in order to construct a triangle when any of its two lengths and an angle between them is given.	
Construct triangle when measure of 2 angles and one side are known (ASA)	List and execute steps in order to construct a triangle when any of its two angles and the side included between them is given.	
Construct a right-angled triangle when length of one leg and hypotenuse are known (RHS)	List and execute steps in order to construct a right-angled triangle when the length of one leg and its hypotenuse are given.	
	Examine the given information in order to determine if construction of a triangle from it is possible or not.	

Test items

LG: Use a ruler and compass in order to construct a line parallel to another line through a point not on the line

Level of difficulty: Medium
Bloom's Level: Understanding

1. A teacher asks his students to write the step-in order to draw a line parallel to PQ, passing through R.



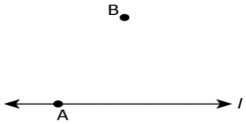
The responses of two of students are as follows.
Statement 1: Draw a line RU such that ∠PRT + ∠RPQ = 180°
Statement 2: Draw a line RU such that ∠PRU + ∠RPQ = 180°
Who among them is/are correct?

Option 1: Only Student 1
Option 2: Only Student 2
Option 3: Both Student 1 and Student 2
Option 4: Neither Student nor Student 2

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider the figure shown.



Bhavin wrote the following steps in order to construct a line parallel to line *l*, passing through point B.
Step 1: Join A to B.
Step 2: With A as the centre and a convenient radius, draw an arc cutting *l* at C and AB at D.
Step 3: With B as the centre and the radius greater than that of used in Step 2, draw an arc EF cutting AB at G.
Step 4: Place the pointed tip of the compasses at C and adjust the opening so that the pencil tip is at D.
Step 5: With the same opening as in Step 4 and with G as the centre, draw an arc cutting the arc EF at H.
Step 6: Join BH to draw a line *m*. *m* ∥ *l*.
Bhavin did not write the correct steps. In which step did he make the first error and what should be the correct step?

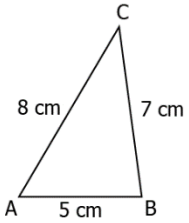
Option 1:
Step 3: With B as the centre and the same radius as in Step 2, draw an arc EF cutting AB at G.
Option 2:
Step 3: With B as the centre and the radius smaller than that of used in Step 2, draw an arc EF cutting AB at G.
Option 3:
Step 4: Place the pointed tip of the compasses at C and adjust the opening so that the pencil tip is at B.
Option 4:
Step 4: Place the pointed tip of the compasses at B and adjust the opening so that the pencil tip is at D.

Correct Answer: Option 1

LG: List and execute steps in order to construct a triangle given the measures of its three sides.

Level of difficulty: Medium
Bloom's Level: Understanding

1. A teacher asks his students to write the possible steps in order to construct triangle ABC as shown below.



The responses of two of the students are as shown.

Student 1	Student 2
Step 1: Draw AB = 5 cm	**Step 1:** Draw AB = 5 cm
Step 2: With A as the centre and radius 8 cm, draw an arc.	**Step 2:** With B as the centre and radius 7 cm, draw an arc.
Step 3: With B as the centre and radius 7 cm, draw an arc intersecting the arc drawn in Step 2 at a point, say C.	**Step 3:** With A as the centre and radius 8 cm, draw an arc intersecting the arc drawn in Step 2 at a point, say C.
Step 4: Join AC and BC to get triangle ABC.	**Step 4:** Join AC and BC to get triangle ABC.

Who among them has/have written the correct steps?

Option 1: Only Student 1
Option 2: Only Student 2
Option 3: Both Student 1 and Student 2
Option 4: Neither Student 1 nor Student 2

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analysing

2. Divit has to construct a triangle PQR where PQ = 12 cm, QR = 10 cm and PR = 7 cm. He writes the following steps in order to construct the required triangle.

Step 1: Draw PR = 7 cm
Step 2: Draw QR = 10 cm
Step 3: With P as the centre and radius 12 cm, draw an arc intersecting QR at Q.
Step 4: Join PQ to get triangle PQR.

Is it possible to construct the triangle PQR by following the steps written by Divit?

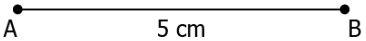
Option 1: Yes, because the steps suggest that the sides will be drawn in increasing order of their lengths.
Option 2: No, because the sides must be drawn in decreasing order of their lengths.
Option 3: Yes, because vertices P, Q and R are not collinear.
Option 4: No, because vertex Q does not lie on the intersection point of the arcs PQ and QR.

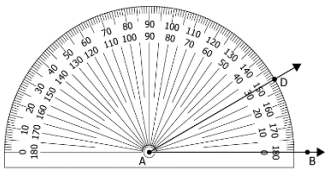
Correct Answer: Option 4

LG: List and execute steps in order to construct a triangle when any of its two lengths and an angle between them is given.

Level of difficulty: Medium
Bloom's Level: Understanding

1. The first two steps to construct a triangle whose two sides are 5 cm and 8 cm long and the included angle measures 30° are as shown.

Step 1: 

Step 2: 

What should be the next step in order to complete the construction?

Option 1: Step 3: Taking B as the centre, mark a point C at a distance of 8 cm lying on AD and join B to C.

Option 2: Step 3: Taking A as the centre, mark a point C at a distance of 8 cm lying on AD and join B to C.
Option 3: Step 3: Taking D as the centre, mark a point C at a distance of 8 cm lying on AB and join D to C.
Option 4: Step 3: Taking D as the centre, mark a point C at a distance of 8 cm lying on AD and join B to C.
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. Amira follows the below written steps in order to construct a triangle.
Step 1: Draw RS = 9 cm
Step 2: With S as the centre, draw an angle RSU of measure 60°.
Step 3: With S as the centre, draw an arc of radius 13 cm, intersecting SU at T.
Step 4: Join RT.
Which of these triangles is drawn by Amira?
Option 1: Triangle RST where RS = 9 cm, RT = 13 cm and ∠RST = 60°.
Option 2: Triangle RSU where RS = 9 cm, RU = 13 cm and ∠RSU = 60°.
Option 3: Triangle RST where RS = 9 cm, ST = 13 cm and ∠RST = 60°.
Option 4: Triangle RSU where RS = 9 cm, SU = 13 cm and ∠RSU = 60°.
Correct Answer: Option 3

LG: List and execute steps in order to construct a triangle when any of its two angles and the side included between them is given.

Level of difficulty: Medium
Bloom's Level: Understanding
1. The table below shows the steps written by Kiara and Lavanya in order to construct a triangle ABC where AB = 6 cm, ∠CAB = 30° and ∠CBA = 45°.

Steps Written by Kiara	Steps Written by Lavanya
Step 1: Draw AB = 6 cm.	**Step 1:** Draw ∠DAE = 30°.
Step 2: With A as the centre, draw ∠BAD = 30°.	**Step 2:** Label any point B on AD.
Step 3: With B as the centre, draw ∠ABE = 45° meeting AD at C.	**Step 3:** Draw ∠ABF = 45° meeting AE at C.

Who among them has/have written the correct steps of construction of the required triangle ABC?
Option 1: Only Kiara
Option 2: Only Lavanya
Option 3: Both Kiara and Lavanya
Option 4: Neither Kiara nor Lavanya
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Analysing
2. Sumer wrote the following steps in order to construct a triangle KLM where KL = 8 cm, ∠MKL = 45° and ∠MLK = 60°.
Step 1: Draw a line *l* and mark a point K on it.
Step 2: With K as the centre, draw ∠AKB = 45°.
Step 3: With K as the centre and radius 8 cm, draw an arc intersecting KA at M.
Step 4: With M as the centre, draw ∠KML = 60°meeting KB at C.
Sumer did not write the correct steps. In which step did he make the first error and what should be the correct step?
Option 1: Step 1: Draw KL = 8 cm
Option 2: Step 1: Draw a line *l* and mark a point L on it.
Option 3: Step 3: With K as the centre and radius 8 cm, draw an arc intersecting KB at M.
Option 4: Step 3: With K as the centre and radius 8 cm, draw an arc intersecting KA at L.
Correct Answer: Option 4

LG: List and execute steps in order to construct a right-angled triangle when the length of one leg and its hypotenuse are given.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following options shows the correct order of steps for constructing a right triangle ABC where ∠ABC = 90°, AB = 3 cm and AC = 5 cm?
   Option 1: Step 1: Draw AB = 5 cm.
   Step 2: With A as the centre, draw an angle, ∠BAD = 90°.
   Step 3: With B as the centre and radius 3 cm, draw an arc intersecting AD at C. Join BC to get triangle ABC.
   Option 2: Step 1: Draw AB = 3 cm.
   Step 2: With A as the centre, draw an angle, ∠BAD = 90°.
   Step 3: With B as the centre and radius 5 cm, draw an arc intersecting AD at C. Join BC to get triangle ABC.
   Option 3: Step 1: Draw AB = 5 cm.
   Step 2: With B as the centre, draw an angle, ∠ABD = 90°.
   Step 3: With A as the centre and radius 3 cm, draw an arc intersecting BD at C. Join AC to get triangle ABC.
   Option 4: Step 1: Draw AB = 3 cm.
   Step 2: With B as the centre, draw an angle, ∠ABD = 90°.
   Step 3: With A as the centre and radius 5 cm, draw an arc intersecting BD at C. Join AC to get triangle ABC.

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying

2. Yakshit writes the following steps in order to response a question given in his book.

Step 1: Draw a line *l* and mark a point P on it.
Step 2: With P as the centre, draw ∠APB = 90°.
Step 3: With P as the centre and radius 8 cm, draw an arc intersecting AP at a point, say M.
Step 4: With M as the centre and radius 10 cm, draw an arc intersecting PB at T.
Step 5: Join MT.
What of these is the possible question, he is solving?

Option 1: Construct a right triangle APT where AP = 8 cm and AT = 10 cm.
Option 2: Construct a right triangle APB where AP = 8 cm and AB = 10 cm.
Option 3: Construct a right triangle MPT where MP = 8 cm and MT = 10 cm.
Option 4: Construct a right triangle MPB where MP = 8 cm and MB = 10 cm.

Correct Answer: Option 3

LG: Examine the given information in order to determine if construction of a triangle from it is possible or not.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of these triangles can NOT be constructed?
   Option 1: ΔABC where m∠B = 60°, m∠C = 120° and BC = 9 cm
   Option 2: ΔABC where m∠A = 45°, m∠B = 75° and AB = 5 cm
   Option 3: ΔABC where AB = 12 cm, BC = 8 cm and AC = 11 cm
   Option 4: ΔABC where AB = 5 cm, BC = 6 cm and AC = 7 cm

Correct Answer: Option 1

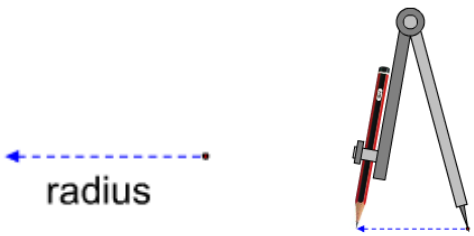
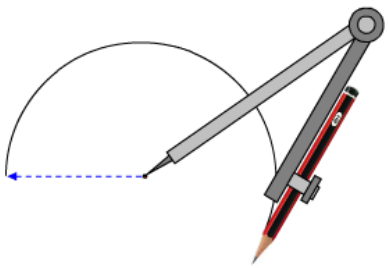
Level of difficulty: Hard
Bloom's Level: Analysing

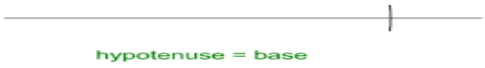
2. Is it possible to construct ΔPQR where PQ = PR = 12 cm and QR = 24 cm?
   Option 1: Yes, because three measurements are known.
   Option 2: No, because the measurement of at least one of the angles must be known.
   Option 3: Yes, because the length of side QR is not greater than the sum of the lengths of sides, PQ and PR.
   Option 4: No, because the length of side QR must be smaller than the sum of the lengths of sides, PQ and PR.

Correct Answer: Option 4

Suggested Teacher Resources

1 Lesson Plan

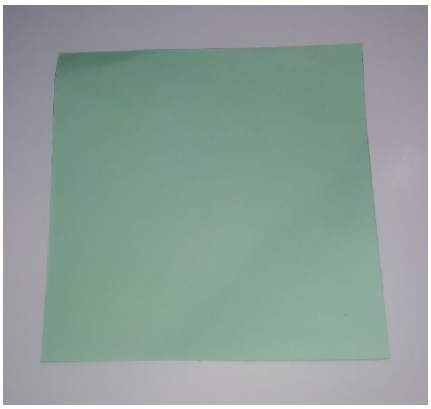
Objective	List and execute steps in order to construct a triangle given the measures of its three sides.
Material Required	Compass, ruler, Scale, pencil
Previous Knowledge	Using compass
Procedure	Teacher will start with a quick recall of how to make an arc: 1. Using their compass students will mark a point on their copies as centre. • center 2. Students will measure appropriate distance to use as radius on their compass as shown.  3. Keeping the metal point fixed students will use the pencil side of the compass to draw an arc as shown.  Teacher will let students know how drawing arc is useful in making construction of a triangle with all sides known to us. Divide students into pairs and ask them to find a way to make a triangle using arc. Teacher will start explaining steps of construction: 1. Draw a line which is known as base. The length of the base is equal to one side of the triangle.

	 2. Measure the length of second side using compass. Draw an arc with either of the end point of the base as centre.  3. Measure the length of third side using compass. Draw an arc with the other end of the base as centre.  4. Join the end points of the base with the intersection of the arc.  Students will get the required triangle. Q) Construct a triangle with side 11 cm, 6 cm, 8 cm. Teacher will ask students is it possible to construct a triangle with side 7cm, 7 cm, 15 cm. If no then what is the underlying logic to make a triangle when 3 sides are known. Ans: Sum of two side must be greater than the third side.
Source	http://teachersofindia.org/en/presentation/constructing-specific-triangles

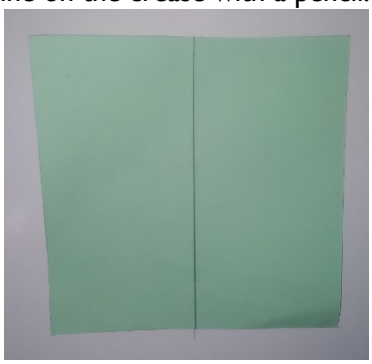
2

Activity

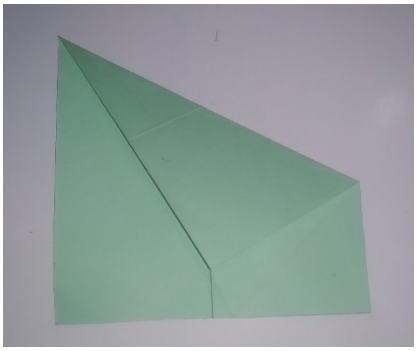
Objective: Students would be able to make 15, 30, 45, 60, 75 and 90-degree angles without using a protractor.
Materials Required: Coloured paper, Scale, pencil
Setup: Every student has a square coloured paper, pencil and a scale. They will follow the teacher's instructions step by step.
Instructions:
1. Take a square piece of coloured paper.



2. Fold it exactly in the middle and draw a line on the crease with a pencil.

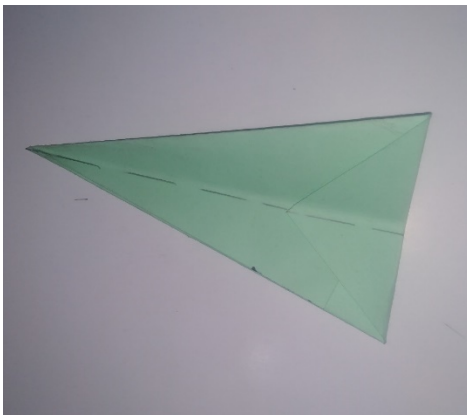


3. Take one corner of the and fold it on the line drawn before as shown in the following picture.

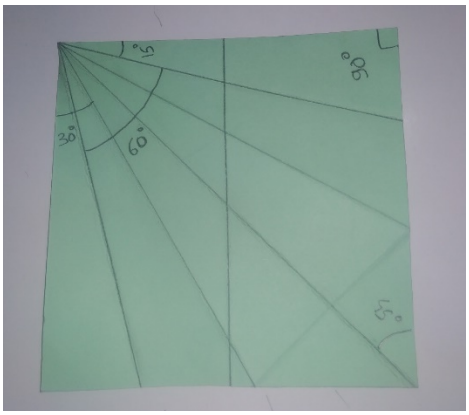


4. Take the opposite corner and fold it over the previous fold as shown. Fold in the tail piece that is left and students will have a piece of folded paper that looks like following image.

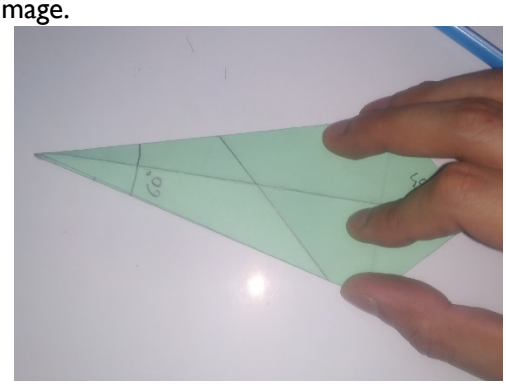
5. Fold the paper exactly in the middle.



6. Unfold all the paper and draw lines over the markings. Students will get something like the image.
Ask students to work in pairs and identify all the angles they can find in their respective piece of paper. Teacher will model out 15 degree.



For measuring students can just fold the paper over the degree they want to measure. For measuring 60 degree paper can be folded as shown in the image.



Source: http://teachersofindia.org/en/video/fly-rocket

11. PERIMETER & AREA

QR Code:

R3H3G9

Learning Outcome and Learning Objectives

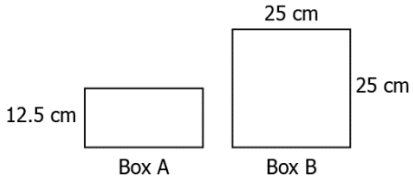
Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction		Describe the area and perimeter of plane figures in order to find the same for square and rectangle	Uses unit square grid/graph sheet in order to approximate the area of a closed shape
		Give example(s) in order to explain/discuss that increase in perimeter of a plane figure does not always mean that area will also increase	
		Use unit square grid sheets in order to determine the perimeter and area square and rectangles	
Squares and rectangles	Triangles as Parts of Rectangles	Develop and apply a formula in order to determine the area of triangle as half of the area of a rectangle.	
	Generalising for other Congruent Parts of Rectangle	Recall the concept of congruent figures in order to generalise the area of congruent parts of rectangles.	
Area of a parallelogram		Use unit square grid sheets in order to find the perimeter and estimate the area of parallelogram.	
		Develop and apply a formula in order to determine the area of a parallelogram.	
Area of triangle		Compare the area of a triangle and its corresponding parallelogram in order to discuss their relation.	
Circles	Circumference of a Circle	Use direct or indirect measurements in order to describe the relationships among radius, diameter, and circumference of circles	
		Investigate different circumference of circles and compare them with their respective diameter in order to relate circumference to Pi.	
		Use direct or indirect methods to find the circumference of circle, semicircle.	
	Area of Circle	Develop and apply the formula in order to find the area of a circle and semicircle.	
Conversion of units		Convert units in order to measure area or perimeter in other units.	
Applications		Examine area and perimeter of different figures in order to find solution for real life problems.	Applies properties of simple shape in order to calculate the areas of the regions enclosed in a rectangle and a square

Test items

LG: Describe the area and perimeter of plane figures in order to find the same for square and rectangle

Level of difficulty: Medium
Bloom's Level: Understanding

1. Observe the two boxes below:



If the total length of lace required to cover the edges of both the boxes is the same, which of these expressions represents the length of the box A?

Option 1: $\frac{25\times25}{12.5}$ cm

Option 2: $\frac{2\times25}{12.5}$ cm

Option 3: $(4 \times 25) - 12.5$ cm

Option 4: $(2 \times 25) - 12.5$ cm

Correct answer: 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. The perimeter of a rectangle is 20 cm. If the rectangle has whole number side lengths, what is the greatest area that the rectangle can have?
   Option 1: 24 cm^2
   Option 2: 25 cm^2
   Option 3: 70 cm^2
   Option 4: 95 cm^2

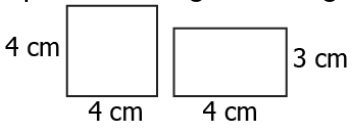
Correct answer: 1

LG: Give example(s) in order to explain/discuss that increase in perimeter of a plane figure does not always mean that area will also increase

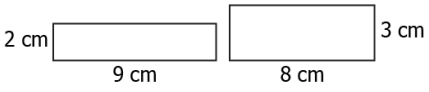
Level of difficulty: Medium
Bloom's Level: Applying

1. Which of these option shows figures having the same area and a change in perimeter?

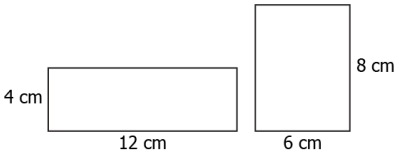
Option 1:

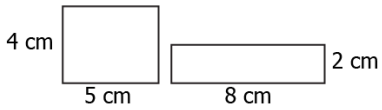


Option 2:



Option 3:



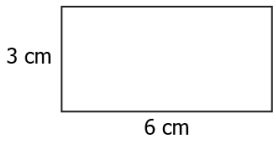


Option 4:

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. Consider the figure shown.



If the length increases by 3 cm and breadth decreases by 1 cm, which of these statement is correct?

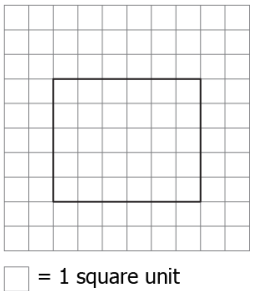
Option 1: The perimeter increases by 4 cm and the area remains the same.
Option 2: The perimeter remains the same and the area increases by 4 cm.
Option 3: The perimeter and the area both increase by 4 cm.
Option 4: The perimeter and the area remains the same.

Correct Answer: Option 1

LG: Use unit square grid sheets in order to determine the perimeter and area square and rectangles

Level of difficulty: Medium
Bloom's Level: Understanding

1. Observe the figure below:



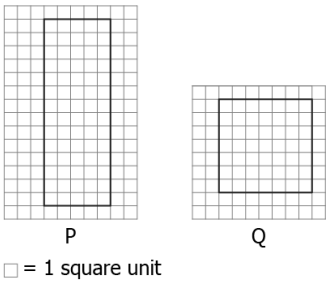
What is the perimeter of the given figure?

Option 1: 11 units.
Option 2: 22 units.
Option 3: 30 units.
Option 4: 60 units.

Correct answer: 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider the figure below:



Which of these statements is correct?

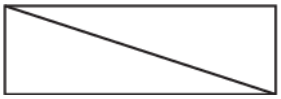
Option 1: The area of figure P is 21 square units more than the area of figure Q.
Option 2: The area of figure Q is 30 square units more than the area of figure P.
Option 3: The area of figure P is 10 square units more than the area of figure Q.
Option 4: The area of figure Q is 14 square units more than the area of figure P.

Correct answer: 1

LG: Develop and apply a formula in order to determine the area of triangle as half of the area of a rectangle.

Level of difficulty: Medium
Bloom's Level: Applying

1. Consider a rectangle shown, divided into two congruent triangles. The length of the rectangle is twice its breadth.

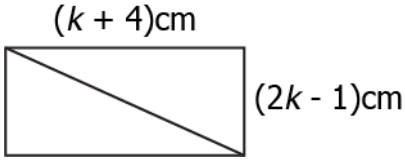


If the length is 14 cm, what is the area of each triangle?

Option 1: 21 cm^2
Option 2: 49 cm^2
Option 3: 98 cm^2
Option 4: 196 cm^2
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying

2. Consider a rectangle shown.



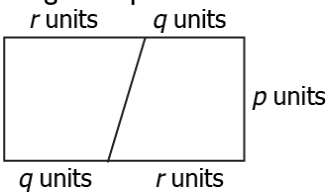
If the perimeter of the rectangle is 30 cm, what is the area of each triangle?

Option 1: 15 cm^2
Option 2: 28 cm^2
Option 3: 30 cm^2
Option 4: 56 cm^2
Correct Answer: Option 2

LG: Recall the concept of congruent figures in order to generalise the area of congruent parts of rectangles.

Level of difficulty: Medium
Bloom's Level: Understanding

1. A rectangle is decomposed into two congruent parts as shown below:

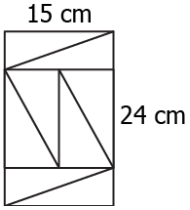


Which of these expressions represents the area of each congruent part of the rectangle?

Option 1: $\frac{1}{2} \times (q + r) \times p$
Option 2: $2 \times (q + r) \times p$
Option 3: $2 \times (q + r + p)$
Option 4: $(q + r) \times p$
Correct answer: 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Observe the figure below:



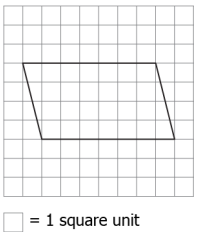
Which of these options represents the area of each small rectangle ?

Option 1: 45 cm^2
Option 2: 60 cm^2
Option 3: 180 cm^2
Option 4: 360 cm^2

Correct answer: 1

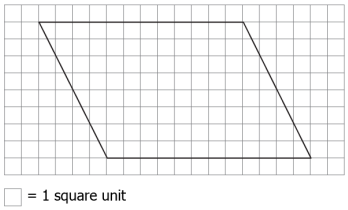
LG: Use unit square grid sheets in order to find the perimeter and estimate the area of parallelogram.

Level of difficulty: Medium
Bloom's Level: Applying
1. Consider a parallelogram shown.



What is the area of the parallelogram?
Option 1: 11 cm^2
Option 2: 14 cm^2
Option 3: 22 cm^2
Option 4: 28 cm^2
Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider a parallelogram shown.

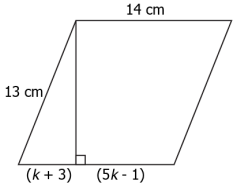


What is the perimeter of the parallelogram?
Option 1: 20 cm
Option 2: 40 cm
Option 3: 48 cm
Option 4: 96 cm
Correct Answer: Option 2

LG: Develop and apply a formula in order to determine the area of a parallelogram.

Level of difficulty: Medium
Bloom's Level: Applying
1. The height of a parallelogram is 5 cm more than its base. If the length of the base is 6 cm, what is the area of the parallelogram?
Option 1: 30 cm^2
Option 2: 33 cm^2
Option 3: 34 cm^2
Option 4: 66 cm^2
Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider a parallelogram shown.

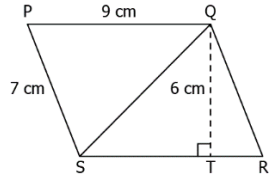


What is the area of the parallelogram?
Option 1: 84 cm^2

Option 2: 91 cm²
Option 3: 168 cm²
Option 4: 182 cm²
Correct Answer: Option 3

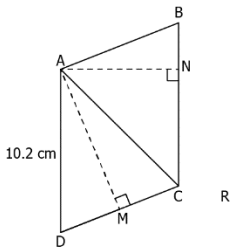
LG: Compare the area of a triangle and its corresponding parallelogram in order to discuss their relation.

Level of difficulty: Medium
Bloom's Level: Applying
1. Consider a parallelogram shown.



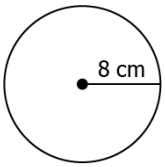
Which of these shows the area of the triangle PQS?
Option 1: $\frac{1}{2}(9 \times 7)$ cm²
Option 2: $\frac{1}{2}(9 \times 6)$ cm²
Option 3: $\frac{1}{2}(6 \times 7)$ cm²
Option 4: (9×6) cm²
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider a parallelogram shown.



If AM = 9 cm and AN = 7.5 cm, which of these shows the area of the triangle ACD?
Option 1: $\frac{1}{2}(8.5 \times 9)$ cm²
Option 2: $\frac{1}{2}(10.2 \times 9)$ cm²
Option 3: (10.2×9) cm²
Option 4: (9×8.5) cm²
Correct Answer: Option 1

LG: Use direct or indirect measurements in order to describe the relationships among radius, diameter, and circumference of circles
Level of difficulty: Medium
Bloom's Level: Applying
1. Consider a circle shown.



Which of these shows the diameter of the circle?
Option 1: 2×8
Option 2: $\frac{1}{2} \times 8$
Option 3: $8 + 2$
Option 4: $8 - 2$
Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying

2. The radius of a circle is *r* cm. If the radius becomes thrice, how will the circumference of the circle change?
   Option 1: The circumference will become thrice.
   Option 2: The circumference will become six times.
   Option 3: The circumference will become one-third.
   Option 4: The circumference will become one-sixth.

Correct Answer: Option 1

LG: Investigate different circumference of circles and compare them with their respective diameter in order to relate circumference to Pi.

Level of difficulty: Medium
Bloom's Level: Applying

1. The radius of a circle is 5.25 cm and its circumference are 33 cm. Which of these relations is true?
   Option 1: $\frac{33}{10.5} = 3.14$
   Option 2: $\frac{33}{5.25} = 3.14$
   Option 3: $\frac{33}{7.25} = 3.14$
   Option 4: $\frac{33}{2.625} = 3.14$

Correct Answer: Option 1

Level of difficulty: Medium
Bloom's Level: Applying

2. Which of these statements is correct?
   Option 1: The circumference of a circle is always twice its diameter.
   Option 2: The circumference of a circle is always three times its diameter.
   Option 3: The circumference of a circle is always more than twice its diameter.
   Option 4: The circumference of a circle is always more than three times its diameter.

Correct Answer: Option 4

LG: Use direct or indirect methods to find the circumference of circle, semicircle.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Devika wants to decorate 2 semi-circular cardboards, each of radius 28 cm, by putting coloured ribbon along its boundary. How much ribbon is required to decorate the cardboards?
   Option 1: 144 cm
   Option 2: 176 cm
   Option 3: 288 cm
   Option 4: 352 cm

Correct answer:3

Level of difficulty: Hard
Bloom's Level: Evaluating

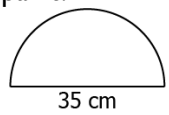
2. A circular tyre of radius 10.5 inches takes 350 revolution to cover a certain distance. How many revolutions will a tyre of radius 7 inches take to cover the same distance?
   Option 1: 44
   Option 2: 328
   Option 3: 525
   Option 4: 788

Correct answer: 3

LG: Develop and apply the formula in order to find the area of a circle and semicircle.

Level of difficulty: Medium
Bloom's Level: Understanding

1. For an arts project, Aditi wants to paint a semi-circular disc as shown below. If the diameter of the disc is 35 cm, how much area does she need to paint?



Option 1: 110 cm^2
Option 2: 481.25 cm^2
Option 3: 962.50 cm^2
Option 4: 1925 cm^2
Correct answer: 2

LG: Convert units in order to measure area or perimeter in other units.

Level of difficulty: Medium
Bloom's Level: Applying
1. The area of a rectangle is 60 mm^2. What is the area of the rectangle in cm^2?
Option 1: 0.06 cm^2
Option 2: 0.6 cm^2
Option 3: 6 cm^2
Option 4: 6000 cm^2
Correct Answer: Option 2

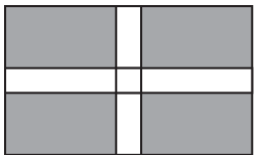
Level of difficulty: Hard
Bloom's Level: Applying
2. The area of a square is 0.04 ha. What is the area of the square in cm^2?
Option 1: 4 cm^2
Option 2: 400 cm^2
Option 3: 40,000 cm^2
Option 4: 40,00,000 cm^2
Correct Answer: Option 4

LG: Examine area and perimeter of different figures in order to find solution for real life problems.

Level of difficulty: Medium
Bloom's Level: Understanding
1. A pathway 8 m wide is built outside and around a square park of side length 45 m. Which of these options represents the area of the pathway?
Option 1: 784 m^2
Option 2: 1769 m^2
Option 3: 2745 m^2
Option 4: 4834 m^2
Correct answer: 1

LG: Examine area and perimeter of different figures in order to find solution for real life problems.

Level of difficulty: Hard
Bloom's Level: Analysing
2. Aditi was decorating a cardboard of length 1 m 45 cm and breadth 80 cm by using fancy border of width 20 cm. She placed the borders, such that it cuts at rights angles, by overlapping through the centre of the board and parallel to its sides, as shown below. She painted the remaining area of the board. How much area did she paint?



Option 1: 6700 cm^2
Option 2: 7100 cm^2
Option 3: 7500 cm^2

Option 4: 15,700 cm^2
Correct answer: 2

Suggested Teacher Resources

1 Lesson Plan

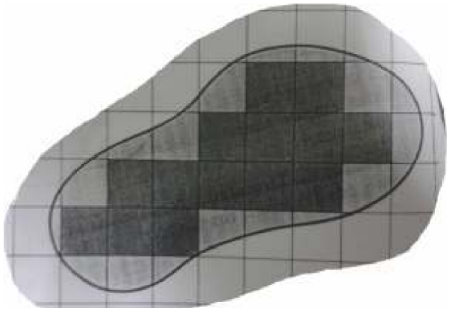
Objective: - To compare sizes through usage of cm Square in order to understand the area.
Material Required- Graph, scale, leaf.
Procedure-

- Tell them that the area of a shape refers to the space that it encloses or covers.
- Pose the question: "How does one measure the space occupied (area) by a book? By a leaf? By a circle?" It is not necessary to use the word regular shape and irregular shape.
- Children may suggest usage of small objects. They could do that. However by this stage they are already familiar with centimetre as a measure for lengths.
- They also use square ruled notebooks which have cm squares. They can stick some of these papers onto thick card sheets and cut cm squares to use as a measure for covering these shapes.
- Tell the children that a square that measures one centimetre by one centimetre is a square centimetre.

- Pose the question: "Who has the biggest hand in the class?" Let children draw an outline of their hands and check the area by filling them in with cm squares. They could also measure the area of their foot. They could draw the outlines of these on square grid paper. It may also be interesting to find out how much variation can be there if the same hand is traced in different positions on the square grid paper.

My hand is ____ cm square in size (area).

- As an extension they can do a craft activity of mosaic work with coloured cm squares and create beautiful motifs and write about them.



- At some point it is good to pause and ask: "Does everything have an area?" A discussion about this can reveal students' understanding and misconceptions about area. It can lead to questions about 3-D objects, curved spaces. Through discussion, difference between closed shape and open shape, area and capacity (volume) can be clearly brought out.

- Now do another activity. A transparent grid can be prepared using hard transparent plastic sheet as shown in Figure to create a cm square grid. A thread frame can also be prepared using a thick cardboard frame with threads running across in a grid form. Objects can be placed underneath the grid and squares can be counted.

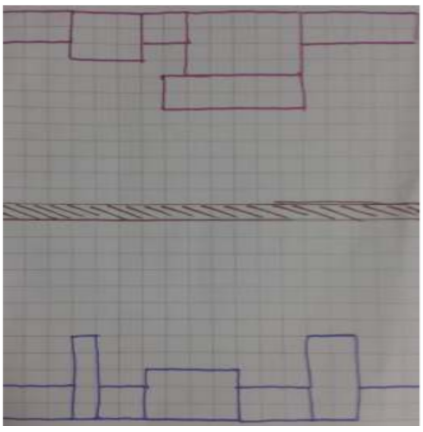
2 Activity

Objective: To determine areas of larger spaces.

- Discuss with children the need for a larger unit to measure areas of bigger spaces.
- By this stage they may be already familiar with a foot as a measure. Tell the children that a square that measures one foot on each side is a square foot. They can measure the areas of larger spaces and record them as square feet or square metres etc. At this point it would be good to have a discussion on length unit getting converted to square length unit, e.g. cm → sq. cm, matchstick → sq. matchstick, inch → sq. inch etc.

Materials: Square grid paper of A4 size, two dice

- Each child starts from one end of the sheet as shown in Figure.



- A line is drawn separating the sheet into two equal parts.

- Each child throws the two dice and draws a rectangle or square with the numbers that appear.
- They continue to take turns in throwing dice and building more and more rectangles attached to the previously drawn ones.
- Each child continues to throw the dice and build rectangles as long as there is space on their side even if the other has stopped.
- At the end they sum the areas of the gaps that arise. The one with the smallest gap area is the winner.

Source-:http://www.teachersofindia.org/en/ebook/teaching-area-and-perimeter

12. ALGEBRAIC EXPRESSIONS

QR Code:

K8B9P3

Learning Outcome and Learning Objectives

Content area/Concepts	Learning Objectives	Learning Outcome
Introduction	Describe algebraic expressions in order to distinguish them from arithmetic expressions.	Translates a real-life situation in the form of a simple algebraic equation in order to arrive at a generalized problem and solution for the situation
Formation of expressions	Combine variables and constants in order to form an algebraic expression for the given statement.	
Terms of an expression	Examine the given algebraic expression in order to determine its terms and their factors.	
	Examine the given algebraic expressions in order to distinguish between the terms which are constants and those which are not.	
	Examine the given algebraic expression in order to determine the numerical coefficient of the given variable.	
Like and unlike terms	Examine the algebraic factors of the given terms in order to distinguish between like and unlike terms.	
Monomials, binomials, trinomials and polynomials	Examine the given algebraic expressions in order to classify them as monomial, binomial, trinomial, polynomial.	
Add and subtract algebraic expressions	Combine like terms in order to simplify the given algebraic expression.	Applies algebraic properties in order to add/subtract two algebraic expressions
	Add algebraic expressions in order to determine their sum.	
	Subtract the given algebraic expressions in order to determine their difference.	
Finding value of an expression	Use the given value of variable(s) in order to evaluate the algebraic expression.	
Using algebraic formulas and rules	Use the given algebraic expression in order to complete the table of number patterns or find its nth term.	
	Examine the pattern in order to verify whether the given algebraic expression satisfies the shown pattern or not.	

Test items

LG: Describe algebraic expressions in order to distinguish them from arithmetic expressions.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Ankita wrote an algebraic expression. Which of these expressions could she have written?
   Option 1: $(18 \div 3) + 10$
   Option 2: $(8 \times x \times y) + 3$
   Option 3: $(11 \times 2) + 10$
   Option 4: $(20 - 7) + 12$

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. Consider an expression shown: $(21 \div 2) + 10 - 3$
   Which of these changes if made would make this expression an algebraic expression?
   Option 1: By replacing division operation by multiplication operation.
   Option 2: By multiplying the division of 21 and 2 by the number 2.
   Option 3: By multiplying the division of 21 and 2 by the variable *p*.
   Option 4: By replacing subtraction operation by division operation.

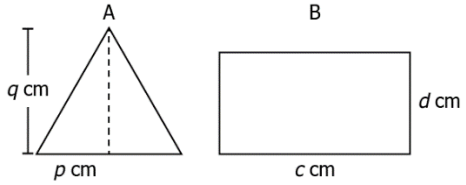
Correct Answer: Option 3

LG: Combine variables and constants in order to form an algebraic expression for the given statement.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of these expressions can be formed from the given statement? "Three times the cube of z is subtracted from two times z"
   Option 1: $2 + z - 3 - z^3$
   Option 2: $2z - 3z^3$
   Option 3: $3z^3 + 2z$
   Option 4: $3z^3 - 2z$

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. Deepika paints two cardboards, A and B, as shown below:



If the cost of painting is Rs. 2 per cm^2, which of these expressions, in rupees, represents the total cost required to paint the two cardboards?
   Option 1: $\frac{pq}{2} + cd + 4$
   Option 2: $\frac{pq}{2} + cd$
   Option 3: $pq + 2cd$
   Option 4: $2(pq + cd)$

Correct Answer: Option 3

LG: Examine the given algebraic expression in order to determine its terms and their factors.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following options represents the terms of the expression $4mn + 5m - 3n - 2$?
   Option 1: -2
   Option 2: $5m, -3n$ and -2
   Option 3: $4mn, 5m$ and $-3n$
   Option 4: $4mn, 5m, -3n$ and -2

Correct answer: 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider an expression shown. "5 subtracted from the sum of 5 times $u$squared and 5 times the product of $u$and -1". Which of these statements is correct?
   Option 1: All terms of the expression are: $5u^2$, $-5u$ and –5.
   Option 2: All terms of the expression are: $5u^2$and $-5u$.
   Option 3: All factors of the term$-5u$ are: 5 and u.
   Option 4: All factors of the term $5u^2$ are: 5 and u.

Correct answer: 1

LG: Examine the given algebraic expressions in order to distinguish between the terms which are constants and those which are not.

Level of difficulty: Medium
Bloom's Level: Applying

1. Consider an algebraic expression shown. $7c^2 - 3cd + 5$. Which table correctly shows constants and the terms which are not constants?
   Option 1:

Constants	**Terms which are not constants**
7, 5, –3	c^2, cd

   Option 2:

Constants	**Terms which are not constants**
c^2, cd	7, 5, –3

   Option 3:

Constants	**Terms which are not constants**
5	$7c^2$, $-3cd$

   Option 4:

Constants	**Terms which are not constants**
$7c^2$, $-3cd$	5

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. Consider an algebraic expression shown. The difference between the area of a square of side length 5 cm and the area of a rectangle of side lengths $4$and $3x$. Which term is not a constant in the expression?
   Option 1: 25
   Option 2: –12
   Option 3: $-x$
   Option 4: $-12x$

Correct Answer: Option 4

LG: Examine the given algebraic expression in order to determine the numerical coefficient of the given variable.

Level of difficulty: Medium
Bloom's Level: Understanding

1. What is the numerical coefficient of the term containing q^2 in the expression$3p^2 - 6pq^2 + 5pq$?
   Option 1: 6
   Option 2: 5
   Option 3: 3
   Option 4: -6

Correct answer: 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. What is sum of the numerical coefficients of the variables *m* and *n* in the expression given by the statement below? "Circumference of the circle of radius *m* subtracted from the circumference of the circle of radius $\frac{n}{2}$ "
   Option 1: $-\pi$
   Option 2: -1
   Option 3: 3
   Option 4: π

Correct answer: 1

LG: Examine the algebraic factors of the given terms in order to distinguish between like and unlike terms.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of the following is a not a pair of like terms?
   Option 1: 12, 78
   Option 2: $\frac{3}{2}z, \frac{3}{2}z^2$
   Option 3: $-8xy^2, 6y^2x$
   Option 4: $2m^2n^2, 7n^2m^2$

Correct answer: 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Seema has 3 packets of pens and 4 packets of crayons.

- Each packet of pens has 2*x* pens.
- Each packet of crayons has 3*y* crayons.

Out of the total, Seema gave *x* pens and *y* crayons to her friend. Which of the following statements is true about the expression representing the total number of pens and crayons left with her?
   Option 1: The expression has no pair of like terms as the terms are 6*x*, -*x*, 12*y* and –*y*.
   Option 2: The expression has one pair of like terms and that pair consists of the terms, 6*x* and -*x*.
   Option 3: The expression has one pair of like terms and that pair consists of the terms, 12*y* and –*y*.
   Option 4: The expression has two pairs of like terms, and that pairs are **(**6*x*, -*x*) and (12*y*, –*y*).

Correct answer:4

LG: Examine the given algebraic expressions in order to classify them as monomial, binomial, trinomial, polynomial.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Consider the expressions below.
   A**:** $3r^2 - 2s^2 - 12rs + 1$
   B: $4r^2s^2 - 12r$
   Which of these statements is correct?
   Option 1: Expression A is a trinomial and expression B is a binomial.
   Option 2: Expression A is a polynomial and expression B is a binomial.
   Option 3: Expression A is a trinomial and expression B is a monomial.
   Option 4: Expression A is a polynomial and expression B is a trinomial.

Correct answer: 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider two expressions shown. Expression P: The product of $\frac{3}{2}$ and *b*. Expression Q: The sum of 5 times *b* cubed and *b* squared. Which of these statements is NOT correct?
   Option 1: Expression P formed is both a monomial and a polynomial.
   Option 2: Expression Q formed is both a binomial and a polynomial.

Option 3: The sum of expression P and Q is a trinomial.
Option 4: The difference of expression P and Q are not a polynomial.
Correct answer: 4

LG: Combine like terms in order to simplify the given algebraic expression.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following is the simplified form of the given expression? $9d^2 + 12de - 17de - 2d^2 + 8ed + 5 - 13$
Option 1: $7d^2 - 5de + 8ed + 8$
Option 2: $7d^2 - 3de - 8$
Option 3: $7d^2 + 13de + 8$
Option 4: $7d^2 + 3de - 8$
Correct answer: 4

Level of difficulty: Hard
Bloom's Level: Evaluating
2. Which of the following statement is true about the expression given below?
$$-14m^2l - 17m^2 + 4n^2 - 15lm^2 - (-6m^2 - 10n^2 + 18l^2m^2) - 12m^2l^2$$
Option 1: The simplified form is a trinomial $-59m^2l - 11m^2 + 14n^2$.
Option 2: The simplified form is a trinomial $-35m^2l - 23m^2 + 6n^2$.
Option 3: The simplified form is a polynomial$-29m^2l - 23m^2 - 6n^2 + 6l^2m^2$.
Option 4: The simplified form is a polynomial $-29m^2l - 11m^2 + 14n^2 - 30l^2m^2$.
Correct answer:4

LG: Add algebraic expressions in order to determine their sum.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Consider the expressions given below:
P: $-11a^2b - 12ab + 9a - 6b$
Q: $18ba - 7b + 8ba^2 - 12a$
Which of these represents the sum of the expressions P and Q?
Option 1:$3a^2b - 3a - 13b$
Option 2:$3a^2b + 6ab + 3a - 13b$
Option 3:$-3a^2b + 6ab - 3a - 13b$
Option 4:$3a - 13b - 11a^2b - 12ab + 18ba + 8ba^2$
Correct answer:3

Level of difficulty: Hard
Bloom's Level: Evaluating
2. Which of these expressions should be added to the sum of the expressions $6b^2 - 11a^3b^2 + 17a^2 - 15b^3a^2$and $4b^3a^2 - 9a^2 - 13b^2 + 8b^2a^3$, such that it becomes a binomial?
Option 1:$5b^3a^2 - 7b^2a^3 + 10b^2a^3 + 6b^3a^2 - 8a^2$
Option 2:$-5b^3a^2 + 7b^2a^3 - 10b^2a^3 - 6b^3a^2$
Option 3:$5b^3a^2 - 7b^2a^3 + 10b^2a^3 + 6b^3a^2$
Option 4:$5b^3a^2 + 7b^2a^3 - 10b^2a^3 + 6b^3a^2$
Correct answer: 3

LG: Subtract the given algebraic expressions in order to determine their difference.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following options represents the subtraction of $-15w^2 + 9v^2 - 21wv + 13w^2v$ from $-3v^2 + 16wv + 13w^2 - 19w^2v$?
Option 1:$-12v^2 + 28w^2 + 37wv - 32w^2v$
Option 2:$-28w^2 + 12v^2 - 37wv + 32w^2v$

Option 3: $12v^2 + 28w^2 + 37wv + 32w^2v$
Option 4: $-2w^2 + 6v^2 - 5wv - 6w^2v$
Correct answer: 1

Level of difficulty: Hard
Bloom's Level: Evaluating

2. An algebraic expression P is subtracted from $-7j^3 + 12jk^3 + 11k^3 - 8j^2k^2$ to get $-15k^3j - 4k^3 + 12k^2j^2 - 5j^3$. What do we get if the expression P is subtracted from $15jk^3 + 15k^3 - 7j^3 + 10j^2k^2$?
Option 1: $-42k^3j - 30k^3 + 9j^3 + 10k^2j^2$
Option 2: $42k^3j + 30k^3 - 9j^3 - 10k^2j^2$
Option 3: $-12k^3j - 5j^3 + 30k^2j^2$
Option 4: $12k^3j + 5j^3 - 30k^2j^2$
Correct answer: 3

LG: Use the given value of variable(s) in order to evaluate the algebraic expression.

Level of difficulty: Medium
Bloom's Level: Applying

1. What is the value of the expression, $3p^2 - q + 4pq$, if $p = 2$ and $q = -5$?
Option 1: 47
Option 2: 33
Option 3: –33
Option 4: –23
Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Applying

2. The value of the expression, $2(3n - m^2) + 2mx - n^2$, is 13. If $m = -2$ & $n = 3$, what is the value of *x*?
Option 1: –8
Option 2: –3
Option 3: 1
Option 4: 3
Correct Answer: Option 2

LG: Use the given algebraic expression in order to complete the table of number patterns or find its nth term.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Observe the table below:

Expression	Terms				
	First	Second	Third	Fourth	Fifth
$2n^2 - 1$					

Which of the following options shows the complete table?

Option 1:

Expression	Terms				
	First	Second	Third	Fourth	Fifth
$2n^2 - 1$	1	7	17	31	49

Option 2:

Expression	Terms				
	First	Second	Third	Fourth	Fifth
$2n^2 - 1$	2	8	18	32	50

Option 3:

Expression	Terms				
	First	Second	Third	Fourth	Fifth
$2n^2 - 1$	3	7	11	15	19

Option 4:

Expression	Terms

	First	Second	Third	Fourth	Fifth
$2n^2 - 1$	-1	1	7	17	31

Correct answer: 1

Level of difficulty: Hard
Bloom's Level: Analysing

2. Observe the table below:

Expression	Terms				
	First	Second	Third	Fourth	Fifth
$8n^2 - 5n$	3	22	57	50 + *a*	*a* + *b*

What are the values of *a* and *b*?

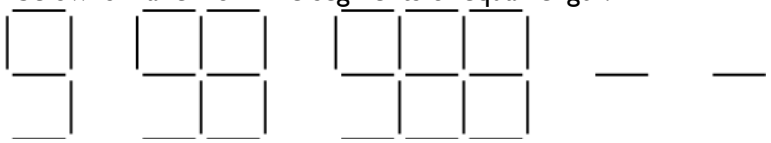
Option 1: *a* = 58 and *b* = 117
Option 2: *a* = 108 and *b* = 175
Option 3: *a* = 58 and *b* = 167
Option 4: *a* = 73 and *b* = 122

Correct answer:1

LG: Examine the pattern in order to verify whether the given algebraic expression satisfies the shown pattern or not.

Level of difficulty: Medium
Bloom's Level: Applying

1. The pattern shown below is made from line segments of equal length.



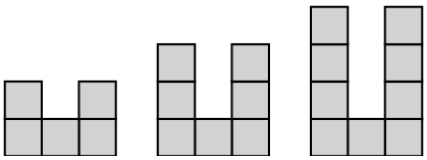
Which of these algebraic expression satisfies the given pattern?

Option 1: $7n - 1$
Option 2: $4n + 2$
Option 3: $5n + 1$
Option 4: $9n - 3$

Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider a pattern made of boxes shown below.



Which of these will satisfy the given pattern?

Option 1: $(5n - 1) - (3n - 4)$
Option 2: $(3n + 2) - (n + 5)$
Option 3: $(2n + 1) - (4n + 2)$
Option 4: $(4n + 5) - (6n + 8)$

Correct Answer: Option 1

Suggested Teacher Resources

1 LESSON PLAN

Objective- To use the given value of variable(s) in order to evaluate the algebraic expression.
Material Required- Balance with two pans; Different weights: 50gm, 100gm, 500gm.
Procedure -

- The teacher will start the class by introducing the balance and would ask students:

Introduction: Understanding Equilibrium

- The teacher let students place some weights to bring the balance to a level position. Ask them what would happen if a 100gm weight is removed from the left side pan. How would the balance look? (Which side will go down?) What should one do to the right side pan to bring the balance to a level position? Now try adding a 500gm weight to the right side pan. How does the balance look now? What should be done to the left side pan to bring the balance to a level position? Now halve the weight on the left side pan of the balance. What needs to be done to the right side of the pan to bring the balance to a level position? Similarly, try to place three times the weight on one side and see what needs to be done on the other side.
- Next, the teacher demonstrates the following on the balance and asks students to:

The picture here shows 1 bottle and three 100gm weights on the left-hand side and five 100gm weights on the right-hand side.

- Then, the teacher poses the question: What do you see on the left-hand side? Do we know the weight of the bottle? How shall we name its weight?
- Since the students have already been exposed to the idea of using the letter 'x' as a variable to represent an unknown quantity, they will have no difficulty in accepting its usage in this situation. What do we see on the right hand side? Is the balance in the level position? How do we represent all this information as an equation?
  $x + 300 = 500$.
  What would be the weight of the bottle? Students should be able to give the answer to this immediately.
  $x + 300 – 300 = 500 – 300$.
  Hence, $x = 200$.
  Next, the teacher will demonstrate the following:

The picture here shows 2 bottles and three 100gm weights on the left-hand side and seven 100gm weights on the right-hand side.
How do we represent this information as an equation?
Again, talk about the weight of the bottle as the unknown 'x' and help the students to formulate the equation.

2x + 300 = 700.
What would be the weight of the bottle which is denoted here by x? Students need to internalise that 'x' stands for some definite quantity in each situation.

- Some students may be able to figure out an answer to this through mental calculations.

Help them verify their answer by following the procedure of inversion operations as well. The visual aid helps students in thinking about what can be removed from both the sides

2x + 300 – 300 = 700 – 300 (inverse of addition is subtraction)

Point out that +300 and –300 cancel each other
2x ÷ 2 = 400 ÷ 2 (inverse of multiplication is division)
Hence x = 200

- At the introductory stage, students should use inverse operations as part of their working. At a later point they may see the equivalence of writing it only on one side as the other side will inevitably cancel out.

That is, instead of writing 2x + 300 – 300 = 700 – 300 they will write 2x = 700 – 300.
The teacher can do more problems of this kind involving other operations before moving on to the next level.

2 ACTIVITY

Objective: To show the identity $(a + b)^2$ and $(a-b)^2$

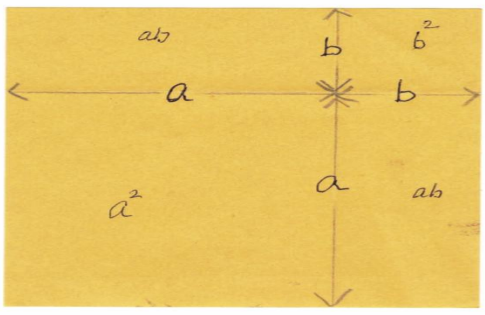


Figure 3

Ask students to take a square paper and fold them along the two indicated lines. The two different lengths can be labelled as a and b as shown in Figure 3.

- What is the side of the original square? a + b
- What is the area of the original square? $(a + b)^2$
- What is the area of the big square? a^2
- What is the area of the small square? B^2

What is the area of each rectangle? ab, ab

- What do they all sum up to? $a^2 + 2ab + b^2$ Hence $(a + b)^2 = a^2 + 2ab + b^2$

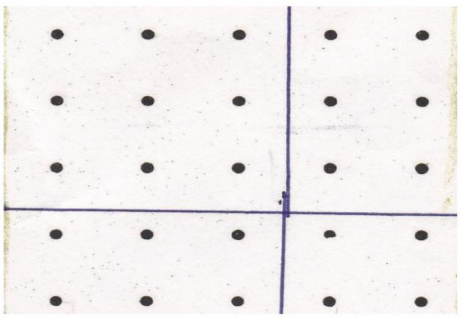


Figure 4

The teacher can also show this on a square dot paper as shown in Figure 4. $(3 + 2)(3 + 2) = 3 \times 3 + 3 \times 2 + 3 \times 2 + 2 \times 2$ which is $(3 + 2)^2 = 3^2 + 2 \times 3 \times 2 + 2^2$ Again if a = 3 and b = 2 then $(a + b)^2 = a^2 + 2ab + b^2$

Next, For $(a-b)^2$:

This method works for positive numbers a and b, with b < a. Ask students to take a square paper and fold them along the two indicated lines. The two different lengths can be labelled as a and b as shown in Figure 5

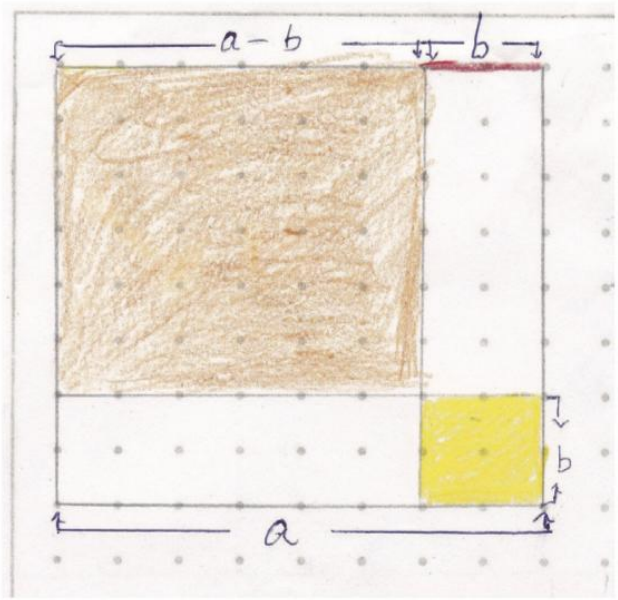


Figure 5

• What is the side of the original square? A
• What is the area of the original square? A^2
• What is the length of the portion which is being cut?
B
• What is the length of the remaining part of the line? a – b
• What is the area of the square brown portion?
Each of its sides is a – b. Area of the brown square is $(a – b)^2$

• What is the area of the small yellow square? b^2
• What is the area of each outlined rectangle? ab
• Is it possible to remove both these two rectangles (of size ab)?
Removal of two such rectangles will mean that b^2 will end up being removed twice.

In order to compensate for that we need to put back one b^2

Hence $(a – b)^2 = a^2 – 2ab + b^2$

13. EXPONENTS AND POWERS

QR Code:

C1Z3I4

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Exponents		Describe exponential form of numbers in order to express numbers in exponential notation.	Applies properties of exponential numbers in order to simplify problems involving multiplication and division of large numbers
		Examine the exponential form of the given number in order to identify its base and exponent.	
		Examine the numbers given in exponential form in order to compare and represent them in an order.	
		Find prime factors of numbers in order to express them as the product of powers of prime factors	
Laws of Exponents	Multiplying Powers with the Same Base	Apply laws of exponents in order to simplify a given expression	
	Dividing Powers with the Same Base		
	Taking Power of a Power		
	Multiplying Powers with the Same Exponents		
	Dividing Powers with the Same Exponents		
Miscellaneous examples of laws of exponents			
		Write numbers using powers of 10 in order to express them in standard form	
Decimal Number system		Expand the given number using powers of 10 in order to express it in the exponent form.	
Expressing large numbers in standard form		Represent large numbers in exponential form in order to read, understand and compare them easily.	

Test items

LG: Describe exponential form of numbers in order to express numbers in exponential notation.

Level of difficulty: Medium

Bloom's Level: Understanding

1. The exponential form of $p \times q \times p \times q \times p \times p \times p \times q \times q$ is _.

   Option 1: $p^5 \times q^4$
   Option 2: $p^4 \times q^5$
   Option 3: $p^5 \times q^5$
   Option 4: $p^6 \times q^4$

Correct Answer: Option 1

LG: Describe exponential form of numbers in order to express numbers in exponential notation.

Level of difficulty: Hard
Bloom's Level: Understanding

2. The exponential form of a number $6 \times 6 \times 6 \times 6 = 6^m$ and a number $5 \times 5 \times 5 = 5^n$. What is the exponential form of a number $(\underbrace{2 \times 2 \times \ldots}_{(m+1)\text{times}}) \times (\underbrace{7 \times 7 \times \ldots}_{(n-1)\text{times}})$?

   Option 1: $2^5 \times 7^3$
   Option 2: $2^4 \times 7^3$
   Option 3: $2^3 \times 7^4$
   Option 4: $2^5 \times 7^2$

Correct Answer: Option 4

LG: Examine the exponential form of the given number in order to identify its base and exponent.

Level of difficulty: Medium
Bloom's Level: Understanding

1. In the statement below, there are 3 blanks, numbered as (1), (2) and (3). The exponential form of $m \times m \times m \times m \times m \times m$ is ___ (1) _ such that the base is ___ (2) _ and the exponent is ___ (3) _. Which option correctly identifies (1), (2) and (3)?

   Option 1: (1) m^6; (2) 6; (3) m
   Option 2: (1) m^6;(2) m; (3) 6
   Option 3: (1) 6^m; (2) m; (3) 6
   Option 4: (1) 6^m; (2) 6; (3) m

Correct Answer: Option 2

Level of difficulty: Easy
Bloom's Level: Understanding

2. If exponential form of a number is m^{k+1}, which of these is true?

   Option 1: Exponent = m; base = k
   Option 2: Exponent = m; base = $k + 1$
   Option 3: Exponent = $k + 1$; base = m
   Option 4: Exponent = k; base = m

Correct Answer: Option 3

LG: Examine the numbers given in exponential form in order to compare and represent them in an order.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Which of these numbers are arranged in the correct order?

   Option 1: $2^7 < 15^2 < 3^5 < 4^4$
   Option 2: $2^7 < 3^5 < 4^4 < 15^2$
   Option 3: $15^2 < 4^4 < 3^5 < 2^7$
   Option 4: $2^7 < 3^5 < 15^2 < 4^4$

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understanding

2. Consider the numbers

$$(-5)^m < 7^2 < (-3)^n$$

Which of these could be the value of m and n?

Option 1: m is any even number greater than 2 and n is an even number
Option 2: m is any even number and n is any odd number
Option 3: m is any odd number and n is any even number
Option 4: m is any odd number and n is an even number greater than 2
Correct Answer: Option 4

LG: Find prime factors of numbers in order to express them as the product of powers of prime factors.

Level of difficulty: Medium
Bloom's Level: Understanding
1. The prime factors of 12800 can be expressed as _.
Option 1: $2^7 \times 5^2$
Option 2: $2^9 \times 5^2$
Option 3: $2^7 \times 3 \times 5^2$
Option 4: $2^{10} \times 5^2$
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Applying
2. If $12500 = 5^a \times 2^b$, which of these can be expressed in the powers of prime factors as $5^{a-1} \times 2^{2b}$?
Option 1: 500
Option 2: 2500
Option 3: 10000
Option 4: 62500
Correct Answer: Option 3

LG: Apply laws of exponents in order to simplify a given expression.

Level of difficulty: Hard
Bloom's Level: Evaluating
1. If $(\frac{t^m}{t^n})^3 \times \frac{(t^2)^n}{t^m} = (\frac{t^m}{t^n})^p \times (t^p)^n \times (t^{-m})^p$, what is the relation between$m$ and n?
Option 1: $m = n$
Option 2: $2m = n$
Option 3: $m = 2n$
Option 4: $2m = np$
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Understanding
2. If $(\frac{14}{6})^{-m} \times (\frac{3}{7})^{12} = (\frac{27}{343})^6$, what is the value of m?
Option 1: –1.5
Option 2: – 6
Option 3: 30
Option 4: 6
Correct Answer: Option 4

LG: Write numbers using powers of 10 in order to express them in standard form

Level of difficulty: Medium
Bloom's Level: Understanding
1. What is twice of the number 14500000 in standard form?
Option 1: 1.45×10^5
Option 2: 2.9×10^5
Option 3: 2.9×10^7
Option 4: 1.45×10^7
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying

2. The standard form of a 5-digit number is $a \times 10^m$ and a 4-digit number is $m \times 10^n$. What is the standard form of the number $(m \times n) \times 10^{m+n}$?

Option 1: 1.2×10^8
Option 2: 1.2×10^7
Option 3: 2×10^{10}
Option 4: 2×10^9

Correct Answer: Option 1

LG: Expand the given number using powers of 10 in order to express it in the exponent form.

Level of difficulty: Medium
Bloom's Level: Understanding

1. Using exponents, the number 105796 can be expressed in exponential form as _.

Option 1: $1 \times 10^6 + 0 \times 10^4 + 5 \times 10^3 + 7 \times 10^2 + 9 \times 10 + 6 \times 10^0$
Option 2: $1 \times 10^5 + 0 \times 10^4 + 5 \times 10^3 + 7 \times 10^2 + 9 \times 10 + 6 \times 10^0$
Option 3: $1 \times 10^5 + 0 \times 10^4 + 5 \times 10^4 + 7 \times 10^2 + 9 \times 10 + 6 \times 10$
Option 4: $1 \times 10^5 + 0 \times 10^4 + 5 \times 10^3 + 7 \times 10^2 + 9 \times 10 + 6 \times 10$

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Evaluating

2. The expanded form of a 5-digit whole number can be expressed as

$$a \times 10^n + b \times 10^{n-1} + c \times 10^{m+1} + d \times 10^{m-n-1} + e \times 10^{n+1}$$

where $m - n = 1$ and a, b, c, d and e are non-zero digits of the number. What is the number?

Option 1: $eabcd$
Option 2: $ceabd$
Option 3: $ceab0$
Option 4: $cebad$

Correct Answer: Option 2

LG: Represent large numbers in exponential form in order to read, understand and compare them easily.

Level of difficulty: Medium
Bloom's Level: Understanding

1. In 2012, population of Delhi was about 18980000 and Mumbai was about 18410000. Which of these can be concluded about their population?

Option 1: As $18.98 \times 10^6 > 18.41 \times 10^6$, Delhi is more populated than Mumbai
Option 2: As $18.98 \times 10^6 > 18.41 \times 10^6$, Mumbai is more populated than Delhi
Option 3: As $18.98 \times 10^6 < 18.41 \times 10^6$, Delhi is more populated than Mumbai
Option 4: As $18.98 \times 10^6 < 18.41 \times 10^6$, Mumbai is more populated than Delhi

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Understanding

2. The standard form of two numbers, X and Y are $p \times 10^q$ and $m \times 10^n$ respectively. Consider the following relations.
Relation I: $q > n$ Relation II: $p > m$
Which of the given relations verify that $X > Y$?

Option 1: Both relations together are sufficient, but neither relation alone is sufficient
Option 2: Relation 2 alone is sufficient, but Relation 1 alone is not sufficient
Option 3: Relation 1 alone is sufficient, but Relation 2 alone is not sufficient
Option 4: Each relation alone is sufficient

Correct Answer: Option 3

Suggested Teacher Resources

1 **Lesson Plan**

Objective	Find prime factors of numbers in order to express them as the product of powers of prime factors
Material Required	Coloured chalks
Previous Knowledge	Multiplication
Procedure	**Opening: Story** In a faraway village a group of children decided to explore their neighbourhood forest. As they wandered around the forest, they found a box hidden in a hole in a huge tamarind tree. They took the box out and found that it contained some rare coins. They quickly counted the coins and found that there were 45 of them, which they divided among themselves equally. Now ask students to guess how many children there were in the group. Of course, you will get different answers, as there are several possibilities. (i) There could have been 3 children and each child could have got 15 coins. (ii) There could have been 5 children and each child could have got 9 coins. (iii) There could have been 9 children and each child could have got 5 coins. (iv) There could have been 15 children and each child could have got 3 coins. (v) Or there could have been 45 children and each child could have got 1 coin. Teacher will note down all the possibilities on the board. Ask them if there are any more possibilities. There are none, right, so point this out. Also tell them the reason why this is so: it is because the numbers 1, 3, 5, 9, 15, and 45 are the only numbers that divide 45. These are called the divisors or the factors of 45. **Factorizing numbers** Draw attention to the number 45 again. Highlight the first possibility, 45=3 x15. Point out that 15 itself can be broken into factors and written down as 3x5. 45=3x3x5 In other words, the only factors of 3 are 1 and 3 and similarly for 5, its only factors are 1 and 5. Natural numbers that have exactly two divisors, namely 1 and itself, are called prime numbers and natural numbers that are the product of at least two prime numbers are called composite numbers. Point out that in the above example 45 is written as a product of prime numbers. This is called factorizing 45 into a product of prime numbers. This can be done for any number. For example, 100 = 2 x 50 = 2 x 2 x 25 = 2 x 2 x 5 x 5 60 = 2 x 30 = 2 x 2 x 15 = 2 x 2 x 3 x 5 81 = 9 x 9 = 3 x 3 x 3 x 3 210 = 2 x 105 = 2 x 3 x 35 = 2 x 3 x 5 x 7 **Factors and multiples** Factorizing is one thing, but one can also do the reverse: one can build up new numbers by multiplying prime numbers. Provide examples to the students: 2 x 3 = 6

$2 \times 2 \times 3 \times 5 = 60$
$3 \times 3 \times 5 \times 7 = 315$

Let them have some fun computing such combinations on their own. This is where you can also help students understand the difference (and the relationship) between factors and multiples. From the
above examples, take the number 60 and ask the children for its factors, putting them down in a column
on the board (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 20, and 60). Now, in a second column put down the numbers
that are obtained by multiplying 60 with another number. So you get 120 (60x2), 180 (60x3), 240, 300,
and so on —explain that these numbers are multiples of 60. Let them try this with smaller numbers. E.g.:
24 (factors 1, 2, 3, 4, 6, 8, 12, and 24; multiples 24, 48, 72, 96, 120, and so on).

Factors to exponents
Now that they know how to build new numbers, get them to do this using the same factors each time, but in varying numbers.

Ask students to use the prime numbers 2, 3, 5, and 7. What if they used each of these only once? They would get the number 210.
Now ask them if they can guess (or calculate) what
2 x2x3x3x3x5x5x5x5x5x7x7x7x7x7x7x7 will be.

The answer is a big number having 11 digits: 11117830500. The prime numbers that are the factors of 11117830500 are 2, 3, 5, and 7—the same
numbers that are the prime factors of 210!
The difference lies in how many times 2, 3, 5, and 7 appear in the factorization of these two numbers.
In 210, each of them appears only once, whereas in 11117830500, the prime number 2 appears twice, 3 appears three times, and so on.

Put up the equation on the board and get the students to look carefully at the factorization:
11117830500=2x2x3x3x3x5x5x5x5x5x7x7x7x7x7x7x7

Discuss:
It takes up a lot of space, doesn't it? More importantly, to find out how many times each prime number appears in the factorization, its necessary to count them.
Introduce new notation as follows:
$11117830500=2^2x3^3x5^5x7^7$
where the small number at the top right showed us how many times a number appears. It's a neat way of keeping track of the number of times a prime number appears and saving space too?
Tell students that 2^2, 3^3, etc., is read as 2 to the power of 2, 3 to the power of 3 and so on.
11 to the power of 3 will be $11^3=11x11x11$.

Ask students to rewrite the factorization of some numbers:
$45= 3^2x5$
$100=2^2x5^2$
$60=2^2x3x5$
$81=3^4$

Teacher's Notes: Using the above examples, teachers can get students to understand that prime numbers are the building blocks from which other numbers are made using repeated multiplication. Therefore, they are very important in mathematics. The fact that almost every number can be factored as a product of prime numbers as we have done here was known to the Greeks even before 300 BC, i.e., 300 years before the birth of Jesus Christ, more than 2300

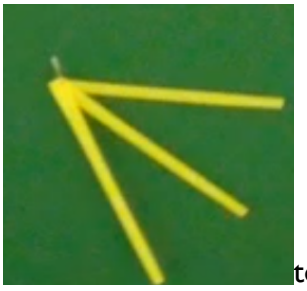
	years ago! Even ancient Greek mathematicians like Pythagoras and Euclid were fascinated by prime numbers and the factorization of a composite number into its prime factors.
Source	http://teachersofindia.org/en/lesson-plan/factors-exponents

2 Activity

Objective: Branching model to understand exponents with positive integer powers consisting modules of 2, 3 or 5 (i.e. prime number) branches with a common origin – modules can be linked to form a tree.

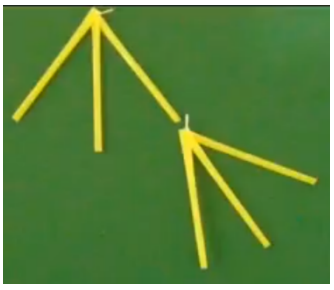
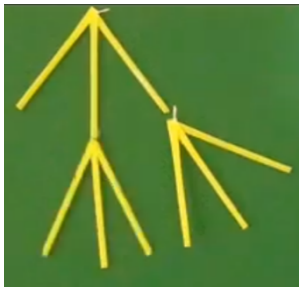
Use: introducing exponents and rules of exponents – (i) $p^m \times p^n = p^{m+n}$ (ii) $(p^m)^n = p^{m \times n}$ and (iii) $(pq)^n = p^n \times q^n$ for natural numbers p, q, m, n

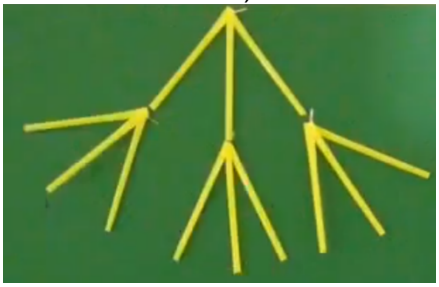
Material required:
Straws, stapler pins


to represent 3^m

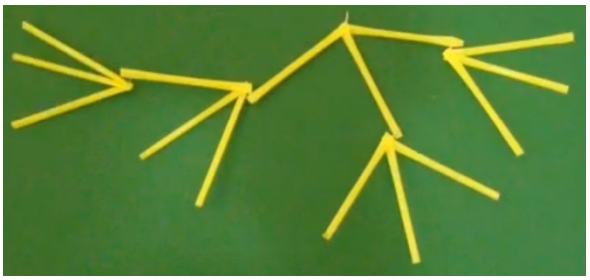

to represent 5^m

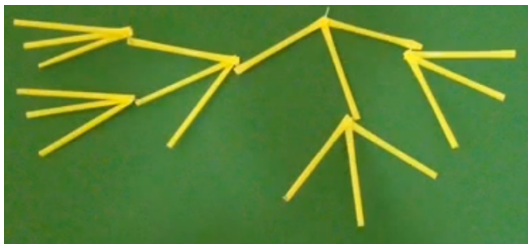
Steps:
1. Take representation of 3^m representation through straws.
2. Attach another 3^m to each end of previous straws as shown.

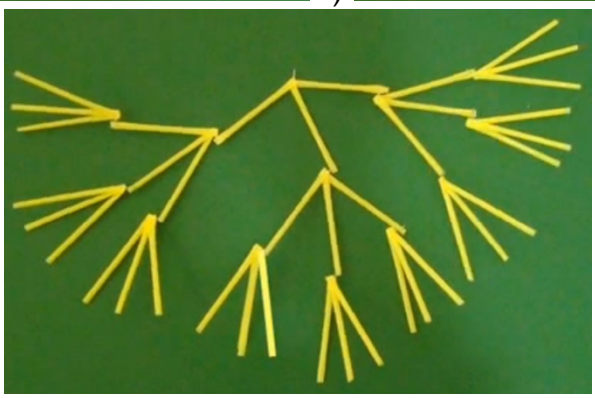
a)  b) 

c) 

3. Count the number of straw ends to find 3^2 which will turn out to be 9.
4. Repeating these steps again will give students the value of 3^3 which will be 27

d) 

e) 

f) 

Reference:

http://www.teachersofindia.org/en/video/straw-powers-3
http://www.teachersofindia.org/en/video/straw-powers-5
http://www.teachersofindia.org/en/video/powers-2-3-and-5
http://www.teachersofindia.org/en/video/exponential-identi

14. SYMMETRY

QR Code:

X2K5Y5

Learning Outcome and Learning Objectives

Content area/Concepts	Learning Objectives	Learning Outcomes
Introduction	Give examples and non-examples in order to describe symmetrical figures.	-
Lines of symmetry for regular polygons	Determine lines of symmetry for the given figures in order to classify them on the basis of no. Of lines of symmetry.	
	Examine regular polygons in order to determine their lines of symmetry.	
	Complete the mirror reflection of the given figure(s) along the mirror line (i.e., the line of symmetry) in order to identify the figure	
Rotational symmetry	Give example(s) for rotational symmetry in order to describe their centre of rotation and the direction of rotation.	
	Examine the given figure in order to determine its angle of rotation.	
	Examine the given figure in order to determine its order of rotation.	
Line symmetry and rotational symmetry	Examine the given figures in order to identify figures which have both line symmetry as well as rotational symmetry.	

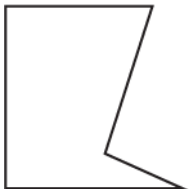
Test items

LG: Give examples and non-examples in order to describe symmetrical figures.

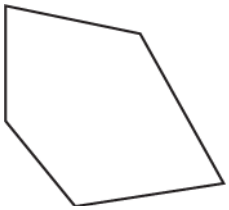
Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of these figures is symmetrical about a line?

Option 1:

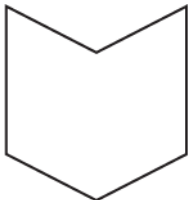
Option 2:



Option 3:



Option 4:



Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Understanding
2. Consider the figures shown.

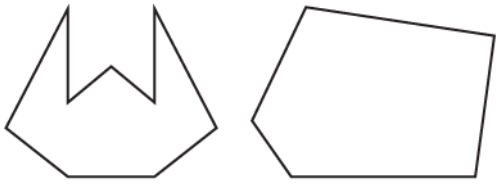


Figure 1 Figure 2

A student made the following conclusions after observing the figures.
Conclusion I: Figure 1 is line symmetric as there is a line about which it can be folded so that the two parts coincide.
Conclusion II: Figure 2 is not line symmetric as there is no line about which it can be folded so that the two parts coincide.
Which of the above conclusion(s) is/are correct?

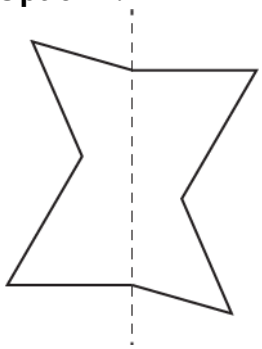
Option 1: Only Conclusion I
Option 2: Only Conclusion II

Option 3: Both Conclusion I and Conclusion II
Option 4: Neither Conclusion I nor Conclusion II
Correct Answer: Option 3

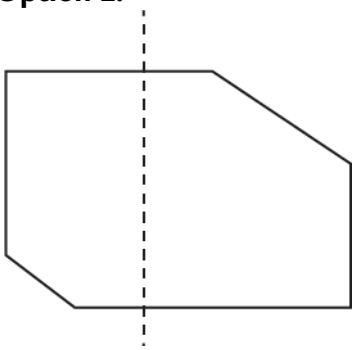
LG: Determine lines of symmetry for the given figures in order to classify them on the basis of no. Of lines of symmetry.

Level of difficulty: Medium
Bloom's Level: Understanding
1. In which of these figures, the dotted line shows the line of symmetry?

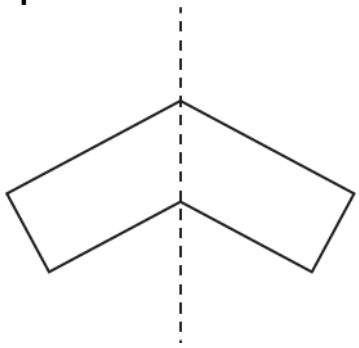
Option 1:



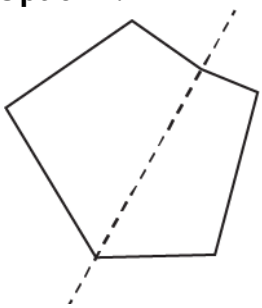
Option 2:



Option 3:



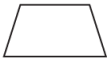
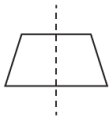
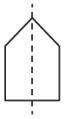
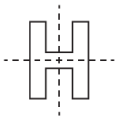
Option 4:



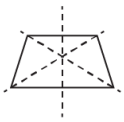
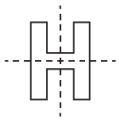
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analysing
2. Identify the table which correctly shows the lines of symmetry of the given figures.

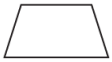
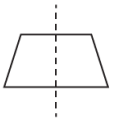
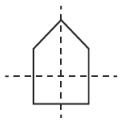
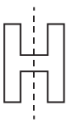
Option 1:

Figures	Lines of Symmetry
 (i)	
 (ii)	
 (iii)	

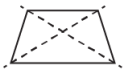
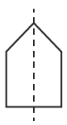
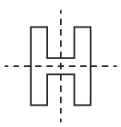
Option 2:

Figures	Lines of Symmetry
 (i)	
 (ii)	
 (iii)	

Option 3:

Figures	Lines of Symmetry
 (i)	
 (ii)	
 (iii)	

Option 4:

Figures	Lines of Symmetry
 (i)	
 (ii)	
 (iii)	

Correct Answer: Option 1

LG: Examine regular polygons in order to determine their lines of symmetry.

Level of difficulty: Easy
Bloom's Level: Understanding

1. How many lines of symmetry a regular hexagon has?
   Option 1: 4
   Option 2: 6
   Option 3: 7
   Option 4: 3

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Understanding

2. Consider a polygon having four sides and opposite sides equal. Which of the condition(s) below is/are required to prove that the polygon has 4 lines of symmetry?
   Condition I: Adjacent sides are equal
   Condition II: Each angle is a right angle
   Option 1: Only Condition I is sufficient
   Option 2: Only Condition II is sufficient
   Option 3: Both Condition I and Condition II
   Option 4: Neither Condition I nor Condition II

Correct Answer: Option 3

LG: Complete the mirror reflection of the given figure(s) along the mirror line (i.e., the line of symmetry) in order to identify the figure

Level of difficulty: Medium
Bloom's Level: Understanding

1. If dotted line represents the mirror line, which of the following figures is the other part of the given figure?

Option 1:

Option 2:

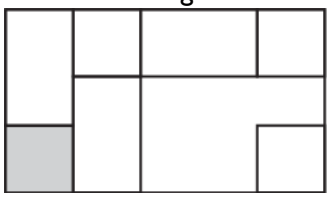
Option 3:

Option 4:

Correct Answer: Option 2

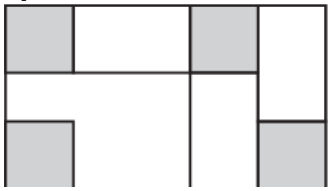
Level of difficulty: Hard
Bloom's Level: Analysing

2. Consider the figure shown.

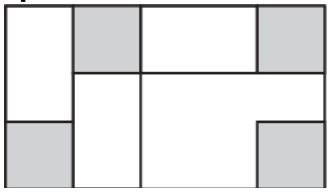


If all squares in the given figure are shaded, which of these will be the mirror image of the given figure?

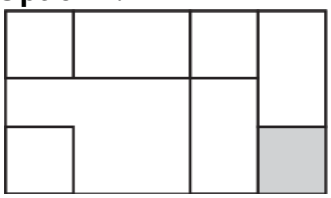
Option 1:



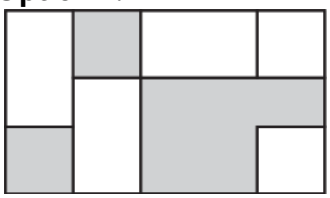
Option 3:



Option 2:



Option 4:



Correct Answer: Option 1

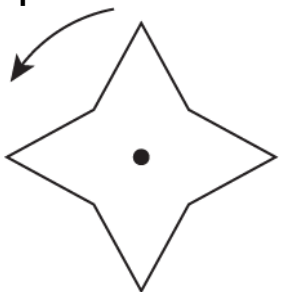
LG: Give example(s) for rotational symmetry in order to describe their centre of rotation and the direction of rotation.

Level of difficulty: Medium
Bloom's Level: Understanding

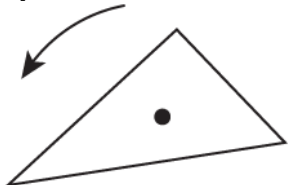
1. Which of these is an example of rotational symmetry about their centre of order more than 1?

Option 1:

Option 2:



Option 3:



Option 4:

Correct Answer: Option 2

Level of difficulty: Medium
Bloom's Level: Understanding

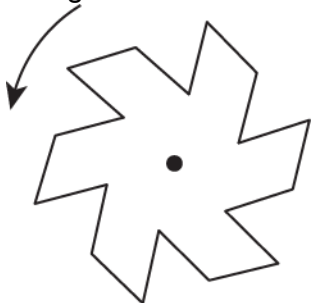
2. Which of these letters does not have rotational symmetry about its centre?
   Option 1: H
   Option 2: O
   Option 3: N
   Option 4: E

Correct Answer: Option 4

LG: Examine the given figure in order to determine its angle of rotation.

Level of difficulty: Medium
Bloom's Level: Understanding

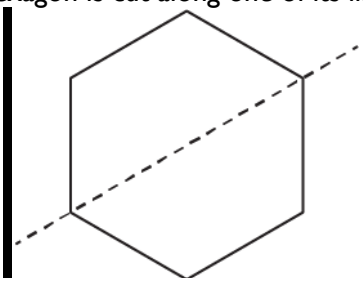
1. What is the angle of rotation of the given figure?



Option 1: 60°
Option 2: 30°

Option 3: 45°
Option 4: 72°
Correct Answer: Option 1

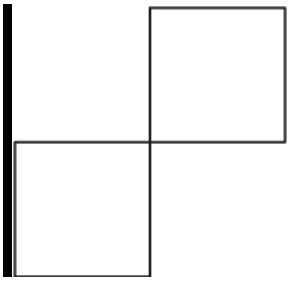
Level of difficulty: Hard
Bloom's Level: Analysing
2. A regular hexagon is cut along one of its line of symmetry as shown.



Is it true that the angle of rotation of the new figure is half of the previous figure? If not, at what angle it should be turned to get back to the original position?
Option 1: No, the angle of rotation should be 120°
Option 2: No, the angle of rotation should be 360°
Option 3: Yes
Option 4: No, the angle of rotation should be 60°
Correct Answer: Option 2

LG: Examine the given figure in order to determine its order of rotation.

Level of difficulty: Medium
Bloom's Level: Understanding
1. What is the order of rotation of the given figure?



Option 1: 3
Option 2: 4
Option 3: 2
Option 4: 6
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Understanding
2. Observing the figures below, a student made the following conclusions:
Conclusion I: Figure 1 has a rotational symmetry of order 4.
Conclusion II: Figure 2 has rotational symmetry of order 5.

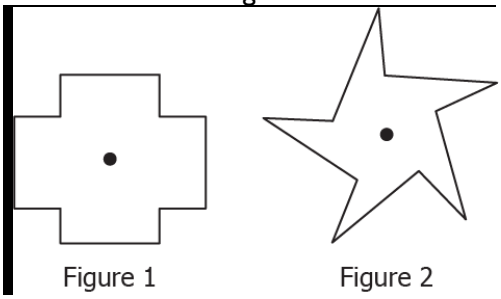


Figure 1 Figure 2

Which of the above conclusion(s) is/are correct?
Option 1: Only Conclusion I
Option 2: Only Conclusion II

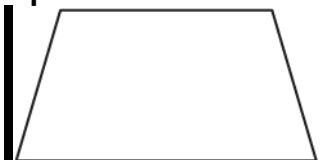
Option 3: Both Conclusion I and Conclusion II
Option 4: Neither Conclusion I nor Conclusion II
Correct Answer: Option 3

LG: Examine the given figures in order to identify figures which have both line symmetry as well as rotational symmetry.

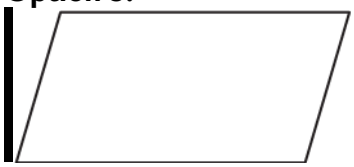
Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of these figures has line as well as rotational symmetry?

Option 1:

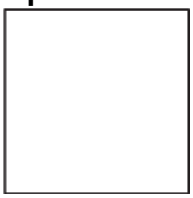
Option 2:



Option 3:



Option 4:



Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing
2. Which of the condition(s) below is/are required to prove that the polygon having 5 sides has line as well as rotational symmetry?
   Condition I: All sides are equal
   Condition II: All angles are equal
   Option 1: Either of the conditions is sufficient
   Option 2: Both the conditions are required
   Option 3: Condition II is required not condition I
   Option 4: Condition I is required not condition II

Correct Answer: Option 2

Suggested Teacher Resources

1

Lesson Plan

Objective-SWBAT Identify objects with reflectional and rotational symmetry in order to find its line and order of symmetry.

Material required-Activity sheet.
Procedure-

- Start with Do Now, students identify the various line symmetries of letters in the alphabet. Use this simple activity to activate student's prior knowledge of symmetry. They don't have any problem identifying letters with line symmetry, but they sometimes have difficulty identifying letters with rotational (point) symmetry when we get to them. After about 3 or 4 minutes, we go over the Do Now as a group. Call on various students to state their letters. Then ask other students to decide if all of the letters.

Do Now: Group the letters of the alphabet based on their symmetries. Describe the type of symmetry the letters in each group have. Some letters may fit in more than one category. The use of the boxes below is optional. If more space is needed, write on the back of the paper.

A B C D E F G H I J K L M

N O P Q R S T U V W X Y Z

Letters: Description:	Letters: Description:
Letters: Description:	Letters: Description:

Question-:
1. Which letters have vertical line symmetry only?
2. Which letters have horizontal line symmetry only?
3. Which letters have both horizontal and vertical line symmetry?
4. Which letters are asymmetrical?

- Now begin discussion on line symmetry. Tell students, "Another name for line symmetry is reflectional symmetry. Why do you think it's called that?" Although students can answer this question, they have difficulty verbalizing exactly what they are trying to say. Through further questioning, elicit that an object has reflectional symmetry if there is a straight line passing through the object and dividing it in half where one side of the shape is the same as the other except it is inverted.
- Next, move on to point symmetry. Ask the students, "Are the letters S, N, and Z symmetrical?" In the Do Now, it was concluded that these letters do not have line symmetry; however, these letters are symmetrical. Instruct students to turn their Do Now slip upside down. Students can see that the letters S, N, and Z look the same upside down as they do right side up. These letters have rotational or point symmetry. They can be rotated 180° around a point in the center of the letter and look the same. Ask, "Which other letters have point symmetry?" Students identify H, I, O, and X correctly, but often include some incorrect letters. Because M becomes W and vice versa when they are rotated 180° about a point in the middle of the letter, students often think they have point symmetry. Additionally, students also identify C and E as having point symmetry. To address this misconception, Remind students that the letters must have the exact same orientation when they are rotated in order to have point symmetry.
- We then go into rotational symmetry more in depth by discussing order and angle of rotation. Students sometimes have difficulty identifying an object's order at first, but with practice, they catch on quickly.
- Now show students the cross from the Greek flag. We discuss the reflectional and rotational symmetry of the cross. The worksheet has similar types of practice examples.

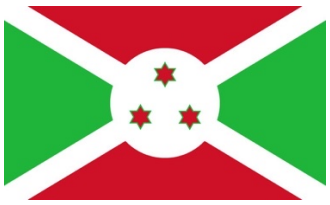
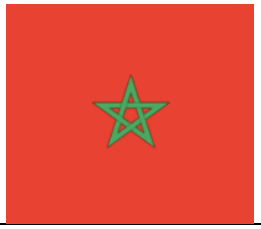
Questions-:
1.How many lines of symmetry does it have?
2.What is order and angle of rotation?

- Give students worksheet of the international flags. This helps to give students some context when looking at the flags.
- As the students are working, Ask guiding questions, such as, "If you fold the paper along the lines of symmetry you have drawn, do the halves match up?" and "What happens when you turn the paper upside down?" Some of the examples are a bit tricky. Instruct the students to look carefully.
- After about 15 minutes of working, Stop the students and we go over their responses. Call on students to come to the board and draw lines of symmetry. We can also see rotational symmetry by actually rotating the objects.

Reflectional and Rotational Symmetry in International Flags

Below are pictures based on flags from various countries. For each picture:

- Draw all lines of symmetry, if the object has reflectional symmetry.
- Write the order and degree of rotation. Remember, an object without rotational symmetry has an order of 1.

Burundi 	Uruguay 	Israel 
United States 	Morocco 	Hong Kong 
South Korea 	Isle of Man (UK) 	United Kingdom 

2 Activity

Objective- The students will be able to define symmetry and identify and list examples of symmetrical objects, both manmade and in nature.

Material Required- Drawing paper, pencils/colored pencils or markers, stapler to use.

Modeling

- Explain to students that many manmade and natural objects are symmetrical.
- Use a couple of symmetrical objects as an example for students.
- Tell students they will be searching for other symmetrical objects throughout the room/school and outdoors.

Guided Practice

- Place students in pairs.
- Distribute drawing paper with coloured pencils, etc. The students will also need something to write on when moving outside the room.
- Tell students they are to find as many symmetrical objects as possible, make a sketch of each item, and draw the line of symmetry on each.
- Allow students time inside the classroom, through the school or other indoor location, and outdoors.
- Once completed, the students will organize their drawings in a booklet, stapling the pages together, and creating a cover page with a title.
- Finally, allow each pair of students to show some of their drawings to the class and to tell why they are symmetrical. If an object is not symmetrical, allow other students to explain why it is not.
- Display completed booklets in an area for other students and/or visitors to review.

Independent Practice- Give students practice in identifying symmetrical shapes using teacher-created, commercial worksheets, or Internet resources. Students make drawings of objects at home that are symmetrical, share with the class the next day.

Source-: https://betterlesson.com/lesson/resource/1960366/reflectional-and-rotational-symmetry-activity
https://www.teacher.org/lesson-plan/symmetry-search/

15. VISUALIZING SOLID SHAPES

QR Code:

V1V5H8

Learning Outcome and Learning Objectives

Content area/Concepts	Sub-concept	Learning Objectives	Learning Outcome
Introduction: Plane figures and solid shapes		Discuss and give examples in order to differentiate between plane figures and solid shapes	-
Faces, edges and vertices		Examine different solid shapes in order to identify and count their number of faces, edges and vertices	
Nets for building 3D shapes		Build nets of 3D shapes in order to understand their properties	
Drawing solids on a flat surface	Oblique Sketches	Examine oblique sketches in order to visualise all the faces of a solid shape	
	Isometric Sketches	Use isometric dot sheet in order to draw isometric sketches of a 3D shape.	
	Visualising Solid Objects	Draw 3D objects in 2D in order to visualize solid objects from different perspectives.	
Viewing different sections of a solid	Cutting or Slicing	Examine cross sections of different solid shapes in order to interpret and visualise different planes.	
	Shadow Play	Examine the different figures formed by changing the angle of shadows formed in order to visualise solid figures	
	Looking at it from Certain Angles to Get Different Views	Examine solid figures from different angles in order to view different sections of solids.	

Test items

LG: Discuss and give examples in order to differentiate between plane figures and solid shapes.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of these is not an example of a solid shape?
   Option 1: A bucket
   Option 2: A cube
   Option 3: A circle
   Option 4: A wooden log

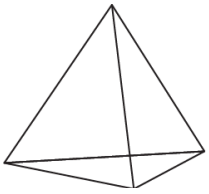
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Analysing
2. Which of the following claim(s) is/are correct?
   Claim 1: A shoe box is an example of a solid shape because it has some length, breadth and height.
   Claim 2: A rectangle is an example of a plane figure because it has some length and breadth but no height.

Option 1: Only Claim 1
Option 2: Only Claim 2
Option 3: Both Claim 1 and Claim 2
Option 4: Neither Claim 1 nor Claim 2
Correct Answer: Option 3

LG: Examine different solid shapes in order to identify and count their number of faces, edges and vertices.

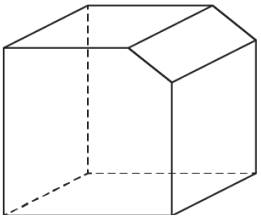
Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following is true about the solid shown below?



   Option 1: It has equal number of faces and vertices.
   Option 2: It has equal number of faces and edges.
   Option 3: It has equal number of vertices and edges.
   Option 4: It has equal number of faces, edges and vertices.

Correct Answer: Option 1

Level of difficulty: Hard
Bloom's Level: Applying
2. How many faces, edges and vertices does the solid shown below have?



   Option 1: Faces: 6; Edges: 12; Vertices: 8
   Option 2: Faces: 7; Edges: 15; Vertices: 10
   Option 3: Faces: 7; Edges: 15; Vertices: 12
   Option 4: Faces: 8; Edges: 16; Vertices: 12

Correct Answer: Option 2

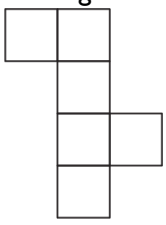
LG: Build nets of 3D shapes in order to understand their properties.

Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following is true about the net of a cylinder?
   Option 1: The net is made up of a rectangle and a circle.
   Option 2: The net is made up of a rectangle and two circles that are identical.
   Option 3: The net is made up of a circle and two rectangles that are identical.
   Option 4: The net is made up of a rectangle and two circles that need not to be identical.

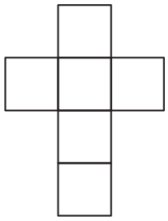
Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing
2. Which of the following nets can NOT make a cube?

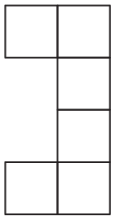
Option 1:



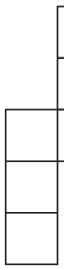
Option 2:



Option 3:



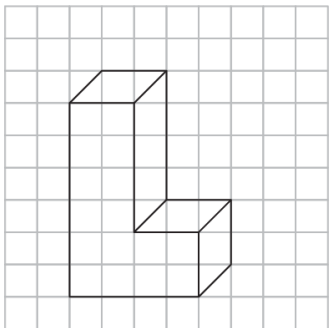
Option 4:



Correct Answer: Option 3

LG: Examine oblique sketches in order to visualise all the faces of a solid shape.

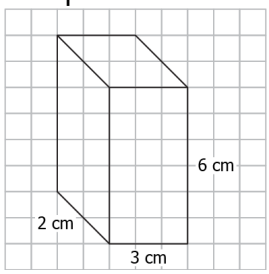
Level of difficulty: Medium
Bloom's Level: Analysing
1. How many faces does the oblique sketch shown have?



Option 1: 4

Option 2: 6
Option 3: 7
Option 4: 8
Correct Answer: Option 4

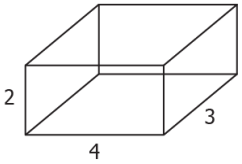
Level of difficulty: Hard
Bloom's Level: Analysing
2. Consider the two statements about the oblique sketch shown:



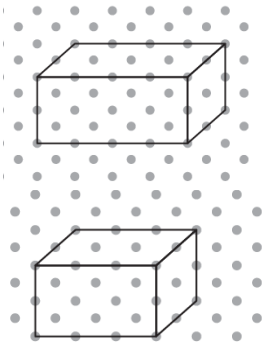
Statement 1: The sketch shown is a cuboid
Statement 2: The dimensions of the top surface are 2 cm by 3 cm.
Which of the two statement(s) is/are correct?
Option 1: Only Statement 1
Option 2: Only Statement 2
Option 3: Both Statement 1 and Statement 2
Option 4: Neither Statement 1 nor Statement 2
Correct Answer: Option 3

LG: Use isometric dot sheet in order to draw isometric sketches of a 3D shape.

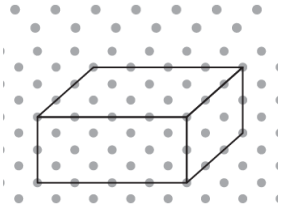
Level of difficulty: Medium
Bloom's Level: Understanding
1. Which of the following option shows the isometric sketch of the cuboid shown below?



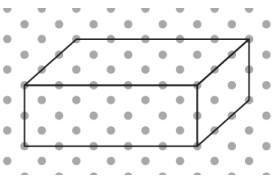
Option 1:



Option 2:



Option 3:



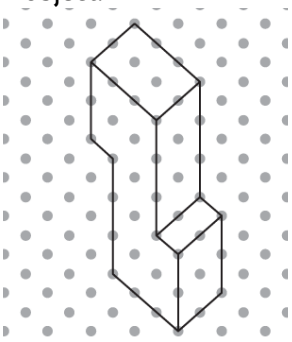
Option 4:

Correct Answer: Option 3

Level of difficulty: Hard

Bloom's Level: Applying

2. Figure shows the isometric sketch of an object.



Tanya and Kavita draw the sketches of the object as shown:

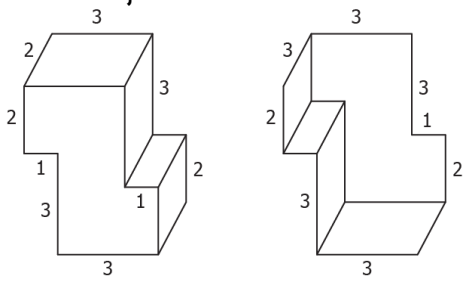


Figure not drawn to scale

Who made the correct sketch of the object?

Option 1: Only Tanya
Option 2: Only Kavita
Option 3: Both Tanya and Kavita
Option 4: Neither Tanya nor Kavita

Correct Answer: Option 1

LG: Draw 3D objects in 2D in order to visualize solid objects from different perspectives.

Level of difficulty: Medium
Bloom's Level: Understanding

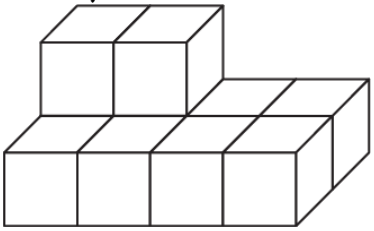
1. To make a cuboid, a student arranges cubes in 2 rows such that each row has 3 cubes. If the side length of each cube is 5 cm, what are the dimensions of the resulting cuboid?

Option 1: 5 cm by 5 cm by 5 cm
Option 2: 10 cm by 5 cm by 5 cm
Option 3: 15 cm by 5 cm by 5 cm
Option 4: 15 cm by 10 cm by 5 cm

Correct Answer: Option 4

Level of difficulty: Hard
Bloom's Level: Analysing

2. Ankita arranges some cubes to form an object shown below.



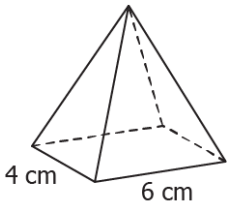
Without changing the given arrangement, what is the fewest number of cubes she needs to make it a cuboid?

Option 1: 2
Option 2: 4
Option 3: 6
Option 4: 8

Correct Answer: Option 3

LG: Examine cross sections of different solid shapes in order to interpret and visualise different planes.

Level of difficulty: Medium
Bloom's Level: Understanding
1. What cross-section will you get if you cut the solid shown horizontally?



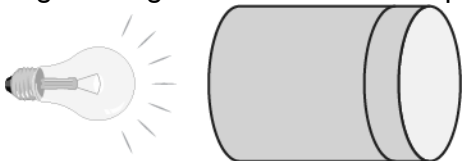
Option 1: A triangle
Option 2: A square
Option 3: A rectangle
Option 4: A circle
Correct Answer: Option 3

Level of difficulty: Hard
Bloom's Level: Applying
2. Consider the two information about the cross-section of a solid.
   - If it is cut vertically, the cross-section is a triangle.
   - If it is cut horizontally, the cross-sections is a circle.

Which of these could be the shape of the solid?
Option 1: A cylinder
Option 2: A cone
Option 3: A square pyramid
Option 4: A sphere
Correct Answer: Option 2

LG: Examine the different figures formed by changing the angle of shadows formed in order to visualise solid figures.

Level of difficulty: Medium
Bloom's Level: Understanding
1. A cylindrical can is placed to the right of a light bulb. What is the shape of the shadow obtained?



Option 1: A rectangle
Option 2: A square
Option 3: A quadrilateral
Option 4: A circle
Correct Answer: Option 4

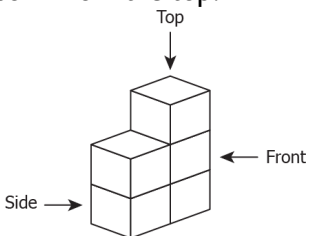
Level of difficulty: Hard
Bloom's Level: Analysing
2. A student placed a light bulb right above an object and noticed the shadow that was formed. Then, he placed the light bulb in front of the object and noticed the shadow again. If the shape of shadow formed both the times is the same, which of these could be the object?
Option 1: A cube
Option 2: A cuboid
Option 3: A cylinder
Option 4: A cone
Correct Answer: Option 1

LG: Examine solid figures from different angles in order to view different sections of solids.

Level of difficulty: Medium

Bloom's Level: Understanding

1. Which option shows the view of the solid from the top?



Option 1:

Option 2:

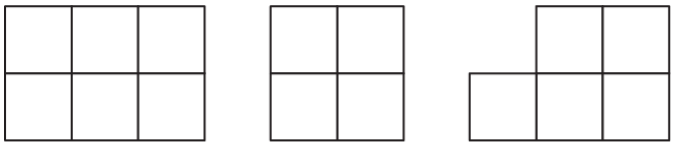
Option 3:

Option 4:

Correct Answer: Option 2

Level of difficulty: Hard
Bloom's Level: Analysing

2. The top view, side view and front view of a solid is shown below:



Which of these can NOT be the solid?

Option 1:

Option 2:

Option 3:

Option 4:

Correct Answer: Option 2

Suggested Teacher Resources

1 Lesson Plan

Objective	To examine different solid shapes in order to identify and count their number of faces, edges and vertices

Material Required	• solid Figures
	  ○ Rectangular prism (book)
	  ○ Cube (Rubik's Cube)
	  ○ Cone (party hat)
	  ○ Pyramid (paperweight or make a pyramid with Legos)
	  ○ Sphere (dodgeball or globe)
	  ○ Cylinder (can)
	• Paper
	• Pencils
	• Pictures of real-life objects representing solid figures (about 10)

Prerequisite Knowledge	2D and 3D Shapes
Procedure	The teacher starts the class by holding up examples of solid figures you have collected. Have the class identify each solid figure. List or name properties that determine the name of each solid figure. • **Example**: A cube is made of six square faces that are all the same size. • invite students to go on a scavenger hunt in the classroom (broaden to other areas if possible). • Allow students to work in partners or small groups to see how many solid figures they can find in the classroom in five minutes. • Then, the teacher would ask students to list down each other things that they found in scavenger hunt e.g. geometry box, etc • Then, the teacher asks students to make a table for each item in the list to calculate the no. of faces, vertices and edges • Then, she asks students to try to classify them in categories and then see which of them they can classify as a solid figure • After this is done, the teacher would ask students to find the properties of solid shapes by analysing the data they have collected till now. • Then, the teacher would ask them to verify Euclid's Formula for the number of faces, vertices and edges for these listings. • Then, the teacher would ask students to try to make nets of these solid figures and others and name the 2D figures that are being produced through these nets.
Source	https://study.com/academy/lesson/properties-of-solid-shapes-lesson-plan.html

2 Activity

Helping pupil sort real objects:
Collect together as many objects of different shapes as you can. You will need at least two objects for every pupil. You could use pictures of shapes from the environment as well.

Divide the class into groups of five or six and give each group a selection of objects
Explain what a 'set' is – a collection of items with some common features, for example, the class is a 'set' of children, who are all taught by you. This 'large set' can be grouped into smaller sets – one example would be a set of boys, and a set of girls. (You may like to physically separate the pupils into these two sets to illustrate this point.)
Explain to the groups that they have a set of different objects. You want them to sort these objects into smaller sets.
Ask them the following question: How many different ways can you sort these objects into sets? This makes the task an open task, so do not specify how many sets or any criteria.
Ask them to explain their reasons for their sorting each set.
As they work, observe them and listen to the discussions they have in their groups, noting carefully what they say. This will help you find out who has clear ideas and who is still exploring the ideas.
Ask each group to share the different ways they sorted their objects and note the main features on the board.
Next, the idea of the game is to hide some interesting, different things (which are familiar to your pupils) in the feely bag/box. You could use regular shaped bowls or pots, tools, or even tins of food. A pupil comes to the front and feels for something in the feely bag/box. He/she doesn't take the object out or show it to the other pupils.

- Instead, the pupil then thinks very carefully of ways to describe the thing, without mentioning its name. He/she uses the sense of touch to list and describe observations. At the same time, the pupil has to be quite scientific/mathematical. He/she has to consider the properties the object is made of. He/she also has to think carefully about the shape, size and form of the item.
- The student can give hints about the Curved surface, flat surface, edge, vertex, faces
-
- Each time the pupil makes an observation, another pupil in the class is given a chance to try to work out what the object is.
- While this is happening, the teacher can act as a scribe (or secretary) and record the observations and the inferences on the board, or on a large sheet of paper. They list the main points only.
- This carries on until someone actually works out what the item is. Then the item can be pulled out of the box and is shown to the rest of the class.
- It is important that a little time is spent discussing the accuracy of the observations – mathematical language skills, the effectiveness of the descriptions, communication skills and the quality of the inferences.

Source:https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=104977&printable=1