

Mathematics

Teachers' Training Module

For Elementary School Teachers (Grade 6-7-8)



Quaid-e-Azam Academy for Educational Development (QAED)

June 2023

Wahdat Colony, Wahdat Road, Lahore.

Tel: +92 042 99260108

Email: infoqaed.edu.pk

Web: qaed.edu.pk

This module is developed under Transformation in Access, Learning, Equity and Education Management (TALEEM) programme implemented through the financial and technical support of Global Partnership in Education (GPE) and UNICEF. The training module is prepared for the professional development of teachers from elementary schools established by School Education Department (SED) under Afternoon School Programme (ASP). QAED will also use these modules for the professional development of all middle school teachers in the province.

Sr.No	Name	Designation	Organization
Developed by:			
1.	Ms. Hina Farrukh Khan	Developer	LEARNOGATE Education, Pvt
2.	Ms. Aleena Tasneem Khan	Developer/Consultant	Freelance
3.	Mr. Hafiz M. Umair	Developer/IT Head	The Punjab School
4.	Ms. Sumaira Khan	Principal	QAED, Bosan Road Multan
5.	Ms. Abdul Hameed	Developer/ Reviewer	LEARNOGATE Education, Pvt
6.	Ms. Muneza Junaid	Developer/ Reviewer	Freelance
7.	Dr. Alia Sadiq	Sr. Subject Specialist	QAED, Punjab
8.	Dr. Tahseen Fatima	Developer/ Reviewer	Freelance
Coordinated by:			
1.	Ms. Saif ur Rehman Toor	Course Coordinator- M.D	QAED, Punjab
2.	Dr. Alia Sadiq	Senior Subject Specialist	QAED, Punjab
3.	Ms. Fozia Inam	Senior Subject Specialist	QAED, Punjab
4.	Ms. Parveen Din Muhammad	Subject Specialist	QAED, Punjab
5.	Dr. Adila Khanam	Subject Specialist	QAED, Punjab
Supervised by:			
1.	Ms. Sarah Rashid	Director General	QAED, Punjab
2.	Mr. Jameel Ahmad Jameel	Additional Director	QAED, Punjab
Composed & Designed by:			
1.	Mr. Asim Jacob	Assistant	QAED, Punjab
2.	Mr. Muhammad Shahid	Designer	Freelance
3.	Mr. Saleem Khan	Designer	Freelance

TABLE OF CONTENT

ABBREVIATIONS	iv
PREFACE	v
Introduction to Modules.....	vi
Instructions for Trainers.....	vii
Training Schedule.....	viii
Session Plan 1: Rational Numbers and Decimal Numbers.....	1
Session Plan 2: Law of Integers.....	8
Session Plan 3: Ratio, Rate and Percentage.....	15
Session Plan 4: Financial Arithmetic	21
Session Plan 5: Algebraic Expression	27
Session Plan 6: Perimeter, Area and Volume	32
Session Plan 7: Measurement of Distance, Speed and Time.....	38
Session Plan 8: Practical Geometry.....	43

ABBREVIATIONS

ASP	Afternoon School Programme
AEOs	Assistant Education officers
DEOs	District Education officers
Dy. DEOs	Deputy District Education officers
ESPIG	Education Sector Programme Implementation Grant
ESTs	Elementary School Teachers
GPE	Global Partnership for Education
LTs	Lead Trainers
OOSC	Out of School Children
PCK	Pedagogical Content Knowledge
PEC	Punjab Examination Commission
PEIMA	Punjab Education Initiative Management Authority
PMIU	Programme Monitoring and Implementation Unit
QAED	Quaid-e-Azam Academy for Educational Development
SED	School Education Department
SLOs	Student learning outcomes
SNC	Single National Curriculum
SS	Subject Specialist
SSS	Sr. Subject Specialist
TNA	Training Need Assessment
TALEEM	Transformation in Access, Learning, Equity and Education Management
TA	Technical Assistance
UNICEF	United Nations Children Fund

PREFACE

Quaid-e-Azam Academy for Educational Development (QAED) is rendering its meritorious services in the field of teacher training from almost last 60 years. Since its inception, it is positively contributing to the professional development of teachers to achieve the quality of education in the province. The mandate of QAED is to conduct induction, continuous professional development, in-service, and promotion linked mandatory training of teachers and education managers. QAED also facilitate other departments and provinces in their training needs. This include Higher Education, Divisional Public School Lahore, Thal Public School, Punjab Daanish Schools, Punjab Education Initiative Management Authority (PEIMA), Staff of schools run under Mines and Mineral Department, and Education Department of AJK and GB.

The province of Punjab is facing serious challenges with respect to supply side of education particularly at the middle school level. The fewer middle schools result in higher post primary dropouts and increased number of OOSC in the age group of 10-14 years old. To address this challenge, SED has launched a new cost-efficient and innovative approach of afternoon schools in remote areas. The evidence, from the Afternoon School Programme (ASP), validates the approach and attest the enrolment gains especially for girls.

Considering the need for post primary education, the priorities of the Education Sector Plan (ESP), SED in collaboration of Global Partnership in Education (GPE) and UNICEF has established 1000 afternoon schools in 14 districts of Punjab through Transformation in Access, Learning, Equity and Education Management (TALEEM) Programme. These 14 districts are selected because there is huge disparity between primary and middle schools, not a single ASP school available in these districts and share similar socio-economic status, urban centers with underdeveloped rural and remote areas, and mainly concentrated in the northern areas of the province.

The primary school teachers of morning classes teach the students of elementary classes in the second shift. These teachers need support in content and pedagogical skills. QAED has developed training modules primarily based on the content of middle level grade 6-8 identified by the teachers from Afternoon School Programme through Training Need Assessment (TNA). The training modules covers the difficult areas of Science, English and Mathematics. QAED has designed training modules using Pedagogical Content Knowledge (PCK) approach in a way that it would not only strengthen their content knowledge but will also polish their pedagogical skills to teach these contents.

These training modules developed will not only benefit 1000 middle school teachers in 14 districts, but it will be rollout for all the ASP teachers and other regular middle school teachers in the province, thereby leading to increased learning levels of the children.

QAED acknowledges and appreciates the commendable inputs of all the developers, reviewers and material development team of QAED in development of this training module. QAED also acknowledge the GPE and UNICEF team in providing technical support in finalizing the training modules and also training of teachers.

I sincerely hope that this manual will provide skills and knowledge necessary for the conduct of training effectively.

Sarah Rashid
Director General QAED

Introduction to Modules

The Afternoon School Program aims to provide equitable educational opportunities to children in areas where access to schools remains a challenge along with low retention and high drop-out rates. The program is designed to 'upgrade' the existing primary or middle schools to middle or high school level respectively, thereby allowing the students to transition into higher grades within the same premises and existing infrastructure. This provides easy access to the students and results in an increase in retention.

Keeping in mind the intensive need of the programme as well as to improve the quality of teaching and learning in ASP a comprehensive subject-based training module have been designed for teachers to enhance their content knowledge on difficult SLOs. This six-days subject based training course, 2 days for each subject, is planned to be delivered through face to face training. In addition, lesson plans are also prepared for further understanding of the teachers which to be given as Teaching Resource.

These training modules have been specially designed to provide with all the tools and materials necessary to effectively train master trainers (MTs) and middle school teachers. It consists of two main parts: first part consists of SLOs based training session plans including teaching and learning activities and assessments for learning; and second part consists of lesson plans for the same subjects for further clarity and understanding.

Instructions for Trainers

Following are some of the instructions for trainers:

1. Read each session plan carefully before delivering the training, review all the Handouts, Worksheets, and Video resources according to the designed activities.
2. Practice the session plans and prepare all the required materials/handouts / charts.
3. Ensure the availability of all the required teaching and learning material like whiteboard/ blackboard, marker, charts and required material of the activities mentioned.
4. Ask trainee teachers to bring Textbooks of Mathematics, Science and English from grade 6 to 8 to be used during the training course.
5. Make sure seating arrangement of the training room is made according to the session plans and supportive for adults teaching.
6. Reach the venue at least 30 minutes before the start of the session.

It is hoped that this manual will be helpful and useful for the trainers and trainee teachers.


Wish you good luck

Training Schedule

Day	Subject	08:30am to 09:00am	09:00am to 10:30am	10:30am to 11:00am	11:00am to 12:30pm	12:30pm to 01:30pm	01:30pm to 03:00pm	03:00pm to 04:30pm
1	English	Registration	Oral Communication Skills	Tea Break	Reading Strategies and Reading Comprehension	Lunch & Prayer Break	Vocabulary Building	Modal Verbs
2		Previous Day Report	Adverbs and Conjunctions		Pre-writing Strategies		Story Writing	Proofreading and Editing
3	Maths	Registration	Rational Numbers & Decimal Number		Laws of Integers		Rate, Ratio & Percentage	Financial Arithmetic
4		Previous Day Report	Algebraic Expression		Perimeter, Area and Volume		Measurement of Distance, Speed and Time	Practical Geometry
5	Science	Registration	Human Nervous System		Digestive System		Human Respiratory and Circulatory System	Solar System
6		Previous Day Report	Biotechnology		Cellular Organization		Balanced Diet	Application of Technology

Mathematics

Grade 6 - 8

**Session Plan 1: Rational Numbers and
Decimal Numbers**
 **Time: 90 Minutes**

STUDENT LEARNING OUTCOMES


At the end of this session, the participants will be able to:

1. recall, recognize, identify, and represent integers (positive, negative, & neutral integers) and their absolute or numerical value
2. differentiate rational and irrational numbers
3. solve real-world word problems involving operations on rational numbers
4. solve real life situations/word problems involving calculation with decimals and fractions

MATERIALS


- Textbook Grade 6, 7 & 8
- writing board, board markers/ chalk
- coloured markers
- sticky notes /strips of blank papers
- shoe box/small basket
- number line chart

Opening:

 **03 minutes**

1. Ask one of the participants to recite a few verses of the Holy Quran.
2. Brief introduction of the trainer and the training modules.
3. Instruct the participants to bring their Textbooks Grade 6-8 along with them in all the sessions.

Activity 1:

 **07 minutes**

1. Display the topics of the eight sessions on the white board/PPT slide.
 - Rational Numbers and Decimal Numbers
 - Laws of Integers
 - Rate, Ratio and Percentages

- Financial Arithmetic
 - Algebraic Expressions
 - Area & Perimeter, Measurement of Surface Area and Volume
 - Measurement of Distance, Speed and Time
 - Practical Geometry
2. Distribute the sticky notes / strips of blank papers to each participant.
 3. Ask the participants to choose any one of the given topics and answer the following question:
 - Why do you find this topic difficult to teach?
 4. Ask participants to write answer on the given sticky note/ strip of a paper.
 5. Ask them to come and stick the sticky notes on a display chart /board.
 6. Make the participants select the topic which they find difficult.
 7. Take participants' responses randomly and see which topics are considered difficult by most participants.
 8. Ask them to write their one fear and one expectation for the selected topic on the given sticky notes.
 9. Ask the participants to come and stick them on a display chart showing two columns: 'Expectations' and 'Fears'.
 10. Inform the participants that the selected topic will be thoroughly discussed in the upcoming sessions.
 11. Share the learning outcome of the first session with the participants.

Activity 2:**15 minutes**

1. Ask the participants to work in pairs and define "Integers".
2. Ask a few pairs to share their definition with the whole class.

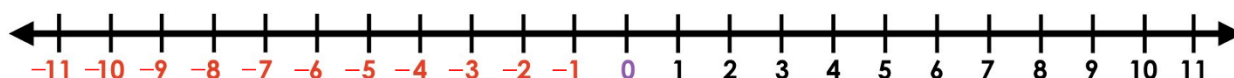
The word integer originated from the Latin word "Integer" which means whole or intact. **Integers** is a special set of numbers comprising zero, positive numbers and negative numbers.

Examples of Integers: – 1, -12, 6, 15.

Symbol: The integers are represented by the symbol 'Z'.

$Z = \{\dots -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, \dots\}$

3. Draw the following number line on the board/chart paper/PPT slide.

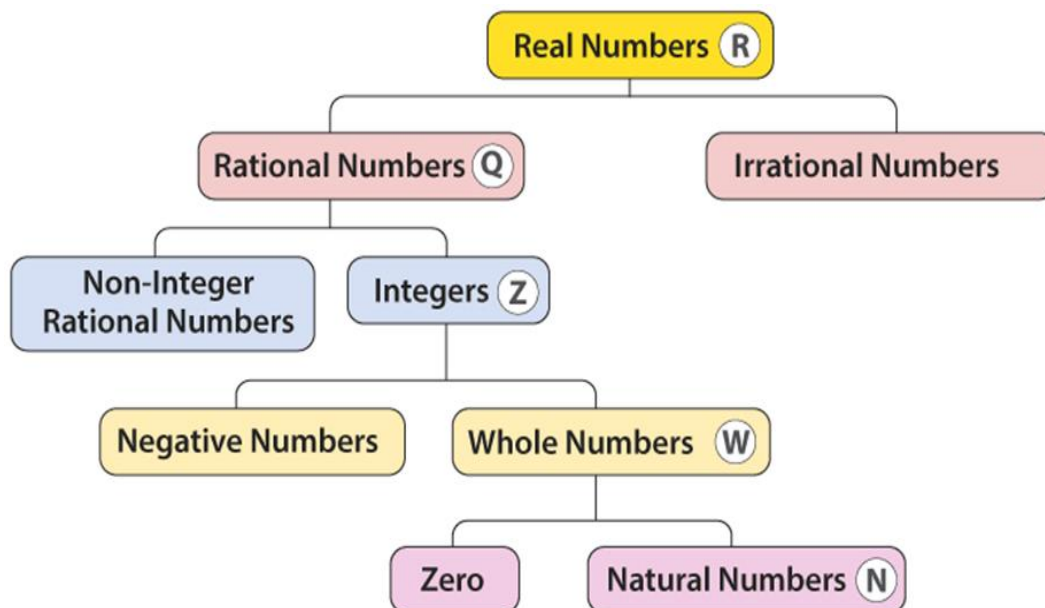


4. Label the number line from negative to positive, including zero. Make sure it covers a wide range of integers.
5. Explain the concept of absolute or numerical value and how it represents the distance of a number from zero. Discuss how the absolute value is always positive.
6. Share an example: Circle integers – 5 and +5, they are the same distance apart from 0, so, we can say that – 5 and +5 have the same numerical value or absolute value.
7. Write on the board that the absolute value of – 5 and +5 is written as $|-5|$.

8. Give sticky notes/ strips of paper to each teacher and ask them to write down various integers on the sticky notes/strips of paper, ensuring they include positive, negative, and neutral numbers.
9. Ask a few volunteers to place the sticky notes/slip of paper on the appropriate positions on the number line, representing the integers they have written.
10. Encourage them to consider the absolute value while placing the numbers.
11. To consolidate, ask the following questions from the participants.
 - What are positive, negative, and neutral integers?
 - How can we determine the absolute value of an integer?
 - What does the distance between two points on the number line represent?

Activity 3:**10 minutes**

1. Divide the participants in four groups.
2. Distribute half chart paper and coloured markers to each group.
3. Allocate one question to each group, ask them to discuss and make a poster/info graph of their answer with example.
 - What are real numbers?
 - What is the difference between natural and whole numbers?
 - What is the difference between whole numbers and integers?
 - What are rational and irrational numbers?
4. After their presentation, show the Real number chart and bring their focus on rational and irrational numbers.

**Activity 4:****10 minutes**

1. Divide the class into pairs.
2. Ask them to recall what they have learnt in the previous activity about rational and irrational numbers.
3. Elicit what they have learnt.
4. Tell them to share their thoughts with their partner.

A number that can be written in the form of p/q , where p and q are integers and $q \neq 0$ is called a **rational number**. e.g., $5/8$, $1/4$, $2/5$, etc.

A number that cannot be written in the form of p/q is called an **irrational number**. e.g., $\sqrt{2}$, $\sqrt{5}$, etc

5. Take a few random responses to clarify any misconception.
6. Instruct the whole class to stand in a straight line.
 - Explain the rules of the game.
 - The trainer will show a number card/write on the board, an example of Rational and Irrational numbers (given below) one by one and will pause after each example.
 - The participants will listen to the given example attentively, then decide to express their opinion through gestures.
 - If the participants feel the example is of Rational number, then they will move to the right side of the line.
 - If the participants feel the example is of Irrational number, then they will move to the left side of the line.
 - If they are not sure, they should keep on standing in their place.
 - After each example, instruct them to come back to their initial position.
7. The trainer should model at least one example before starting the game.

Rational Numbers Examples	Irrational Numbers Examples
$1/7$	π
2.152	$\sqrt{5}$
-3	$\sqrt{14}$
$\sqrt{25}$	ϕ

Activity 5:



20 minutes

1. Divide the class into pairs.
2. Briefly review the basic operations of decimals and fractions, including addition, subtraction, multiplication, and division.
3. Write the following questions on the board.

Solve $\frac{3}{4} + \left(\frac{-2}{5}\right) - \left(\frac{-7}{20}\right)$
4. Inquire from participants about the steps involved in its solution.
5. Solve the question on the board with the participants' input.

Solution: $\frac{3}{4} + \left(\frac{-2}{5}\right) - \left(\frac{-7}{20}\right)$

$$= \frac{3}{4} - \frac{2}{5} + \frac{7}{20} \text{ (remove the brackets and change the signs)}$$

$$= \frac{3 \times 5}{4 \times 5} - \frac{2 \times 4}{5 \times 4} + \frac{7}{20} \text{ (make the denominator same)}$$

$$= \frac{15}{20} - \frac{8}{20} + \frac{7}{20} \text{ (simplify the numerator by applying BODMAS)}$$

$$= \frac{14}{20} = \frac{7}{10} \text{ (simplify the answer to the lowest term)}$$

6. Write the following questions on the board.

$\frac{-13}{4} + \frac{9}{14}$	$615.20 + 125.36 - 895.250$
$\frac{20}{5} \div \frac{4}{5}$	$137.5 \div 5.5$
$\frac{3}{7} \times \left(\frac{-4}{5}\right)$	$\frac{-6}{5} \div 8$

- Divide the class in 6 groups and give them with a chart paper and markers.
- Ask them to solve the given questions on a chart paper.
- Once all the groups are done with their work, call one participant from each group to solve the question on the board one by one.
- Encourage the class to provide feedback and corrections as needed.

Activity 6:



20 minutes

- Ask the participant to work in trios and brainstorm the reasons why students find word problems/real-life situation difficult to understand.
- Now ask them to discuss ways to overcome this problem and share with the whole class.
- Write/share the following real-life situation on the board/ PPT slide.

$50\frac{3}{4}$ Kilograms of rice is to be packed equally in $5\frac{1}{2}$ kilograms packet. Find:

- How many packets of rice will be packed?
- How much rice will be there in 8 packets of mass $5\frac{1}{2}$ kilograms?

- Display the following steps of solving word problems/real life situations on the board/chart paper/PPT slide.
 - Read the word problem/real life situation.
 - Identify the key information.
 - Highlight the word which shows operation.
 - Change words into mathematical statements.
 - Find the solution.
- Briefly discuss each step with the participants for clarity.
- Divide the participants in groups of 4-5 members in each group and ask them to discuss possible solutions.
- Give them 3 minutes to devise the answer.
- Inquire from participants about the steps involved in its solution.
- Solve the question on the board with the participants' input.

Step 1: Read the word problem/real life situation.

$50\frac{3}{4}$ Kilograms of rice is to be packed equally in $5\frac{1}{2}$ kilograms packet. Find:

(a) How many packets of rice will be packed?

How much rice will be there in 8 packets of mass $5\frac{1}{2}$ kilograms?

Step 2: Identify the key information.

Key information:

Total mass of Rice = $50\frac{3}{4}$ kilograms

Mass of each packet to be packed = $5\frac{1}{2}$ kilograms

Step 3: Highlight the word which shows operation.

Words that show operation: pack equally (means to divide them into equal parts)

Step 4: Change words into mathematical statements.

Mathematical form:

Number of packets = Total mass of rice \div mass of each packet of rice

Number of packets = $50\frac{3}{4} \div 5\frac{1}{2}$

Step 5: Find the solution.

Solution:

$$\begin{aligned} \text{Number of packets} &= \frac{203}{4} \div \frac{11}{2} \quad (\text{Converting mixed number to fraction}) \\ &= \frac{203}{4} \times \frac{2}{11} \quad (\text{Changing divide into multiply by taking reciprocal}) \\ &= \frac{203}{22} \end{aligned}$$

Number of packets = $9.2 \approx 10$ packets

Solution part (b)

Key information:

Mass of each packet = $5\frac{1}{2}$ kilograms

Total number of packets = 8

Words that show operation: How much (To find total amount of rice we multiply)

Mathematical form:

Total mass of rice = Number of packets \times mass of each packet of rice

Total mass of rice = $8 \times 5\frac{1}{2}$

Solution:

$$\begin{aligned} \text{Total mass of rice} &= 8 \times \frac{11}{2} \quad (\text{Converting mixed number to a fraction}) \\ &= 4 \times 11 \quad (\text{simplification}) \end{aligned}$$

Total mass of rice = 44 Kilograms

10. Now ask them to work in pairs and use the above-mentioned problem-solving strategy to any real-life situation/word problem from Ex:1.3, Textbook Grade 7 or Ex:1.1, Textbook Grade 8.
11. Give them 5 minutes to find the solution.
12. Ask a few pairs to share their answers with the class.
13. Ask them to reflect on their experience and share with the class.

CONCLUSION / SUM UP/ WRAP UP: **05 Minutes**

1. Distribute sticky notes in the class.
2. Tell them to write at least three take-away from the session.
3. Take 2-3 responses to conclude the session.

Grade 6 - 8

Session Plan 2: Law of Integers



Time: 90 Minutes

STUDENT LEARNING OUTCOMES**At the end of this session, the participants will be able to:**

1. add up to 2-digits like and unlike integers
2. subtract up to 2-digits like and unlike integers
3. multiply up to 2-digits like and unlike integers
4. divide like and unlike integers up to 2-digits
5. explain the order of mathematical operations by applying the BODMAS rule

MATERIALS

- Textbook Grade 6, 7 & 8
- writing board, board markers/ chalk
- coloured markers
- sticky notes /strips papers
- handout (Question Bank)
- KWL Chart
- worksheet
- coloured counters / buttons

Opening:

05 minutes

1. Ask any volunteer to verbally recap the main learning points of the previous session.
2. Display the topic and learning outcomes of Session 2 on a chart paper/ PPT slide.

Activity 1:

10 minutes

1. Draw a "K-W-L" table on the whiteboard/ Paste a K-W-L chart on the board/wall/PPT slide.

K	W	L
What I Know?	What I Want to Know?	What I learned?

2. The trainer must write an example on the table to clarify the concept.
3. Distribute coloured sticky notes/ strips of paper. Tell the participants to work in pairs, discuss and write what do they know about integers and what they want to know on the given sticky notes/strips of paper.
4. Ask them to paste it in the relevant columns.
5. Instruct them to leave the third column it will be filled at the end of the activity.

6. Ask a few pairs to share their work with the whole class.

Activity 2:

20 minutes

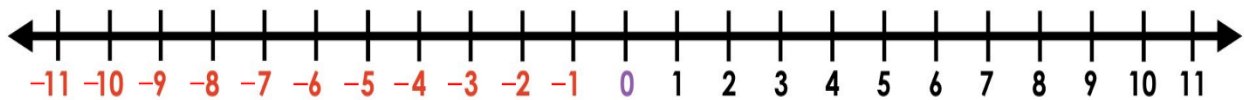
1. Divide the participants into pairs.
2. Ask them to discuss about like integers and unlike integers.
3. Elicit few examples and write on the board.

The integers which have the same signs (like positive-positive or negative-negative)

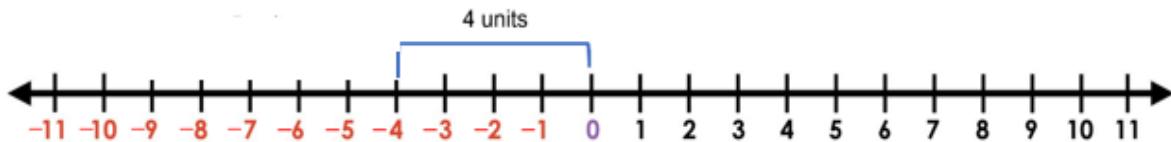
2, 5 and -2, -5 are **like integers**.

The integers which have opposite signs (like positive-negative or negative-positive). 2, -5 and -2, 5 are **unlike integers**.

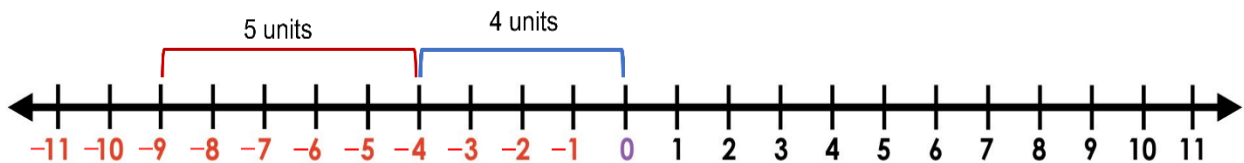
4. Recall the steps of adding integers using number line.
5. Write the following question on the board using like integers (-4, -5).
Use the number line to find the sum of -4 and -5.
6. Draw the number line on the board/chart paper.



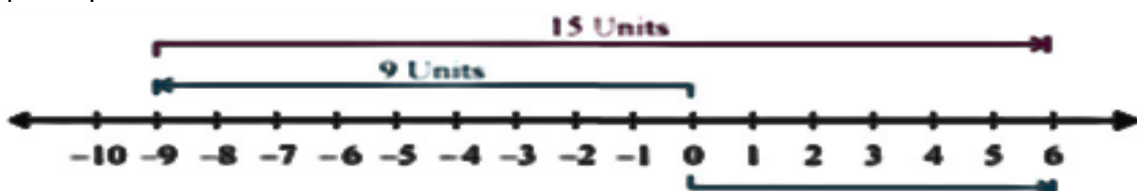
7. Consider "0" as starting point and move 4 steps towards left reaching at -4.



8. Now move 5 more steps towards left reaching at -9.



9. Deduce and share the result that the sum of two like integers is always addition with same sign. Hence, $(-4) + (-5) = -9$
10. Now write the following question on the board and ask them to solve in pairs.
Solve $(-9) - (-15)$
11. Invite volunteer to come and solve the question on the board.
12. Demonstrate the subtraction of -9 and -15 using number line on the board with the help of participants.



13. Conclude this activity by allowing the participants to ask questions (if any).
14. Share the following charts with the participants.
15. Ask them to discuss the rules for adding and subtracting integers.

Rules for Adding Integers

Signs of Integers	Operation to Use	Answer Sign	Quick Example
+	Add	Positive (+)	$4+3=7$
+	Add	Negative (-)	$(-5)+(-3)=-8$
+	Subtract	Use the SIGN of the integer with BIGGER absolute value	$6+(-2)=4$
+	Subtract		$(-9)+(4)=-5$

Keep the first number the same

$12 - (-6) =$

$12 + 6 = 18$

So... $12 - (-6) = 18$

Change the sign of the second number to its 'opposite'. (In this case, a negative to a positive)

Change the subtraction sign to an addition sign.

16. Ask the participants to choose 4 questions from the question bank (given at the end of the session) and solve the sums.
17. Share your work with another pair.
18. Take whole class feedback.

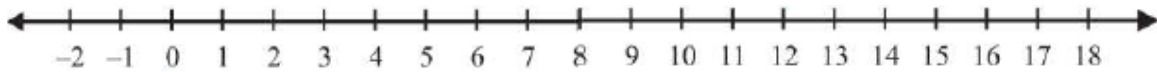
Activity 3:

15 minutes

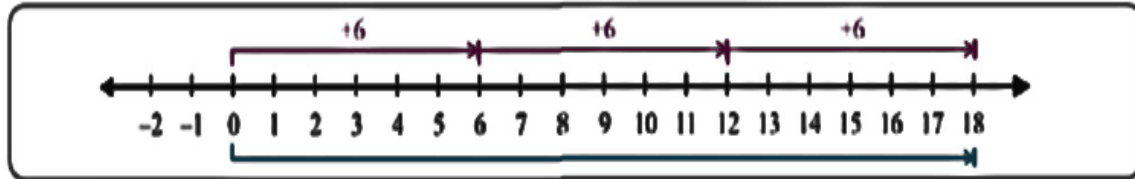
1. Display the following chart in front of the class.

Same signs	}	× =	always add up
		× =	
Opposite signs	}	× =	always subtract
		× =	

2. Draw the following number line on the board.



3. Write the following question on the board. $(+3) \times (+6)$
 4. Demonstrate to them that multiplying $(+3)$ with $(+6)$ means three jumps, each jump is 6 steps in the same direction.
 5. Show the process on the board as shown below.



6. Demonstrate to them that we will then count the total units and that will be our required answer.
 7. Now write 2 – 3 single-digit multiplication questions on the board.
 8. Call 2-3 participants and ask them to solve them using number line.

Activity 4:



15 minutes

1. Write the following question on the board.

Multiply $(+13) \times (-16)$

2. Explain that first, we will multiply the signs of 13 and 16.
 3. Write the following solution on the board.

$$\begin{aligned} & (+13) \times (-16) \\ & = - (13 \times 16) \\ & = - 208 \end{aligned}$$

4. Tell them to open and discuss Example 17, pg. 36, Textbook Grade 6.
 5. Write the following question on the board.

Divide (-54) by (-6)

6. Write the following solution on the board.

$$\begin{aligned} & (-54) \div (-6) \\ & = (-54) \times \left(\frac{-1}{6}\right) \\ & = + \left(\frac{54}{6}\right) \end{aligned} \quad \therefore (-) \times (-) = (+)$$

7. Provide them with a worksheet. Ask them to solve it in pairs. (Refer to worksheet)
 8. Allocate 5-7 minutes to solve the worksheet.

Activity 5:**20 minutes**

1. Display the BODMAS chart in the class.
2. Tell them that there is a specific rule to solve such problems. That rule is called the BODMAS rule.

Ordering Mathematical Operations

B	O	D	M	A	S
Brackets (...)	Orders \sqrt{x} x^2	Division \div	Multiplication \times	Addition $+$	Subtraction $-$

3. Demonstrate the order of BODMAS rule to the participants.
4. Write the following question on the board.
Simplify $3 \times 11 + 4 - 2 + (64 \div 8)$
5. Elicit from the participants steps of solving the question given above.
6. Now solve the above question on the board by participants input using BODMAS rule.

Solution:

$$\begin{aligned}
 &= 3 \times 11 + 4 - 2 + (64 \div 8) \text{ (solve the brackets first)} \\
 &= 33 + 4 - 2 + 8 \text{ (multiply)} \\
 &= 37 - 2 + 8 \text{ (start from left to right)} \\
 &= 35 + 8 = 43
 \end{aligned}$$

7. Divide the participants into pairs.
8. Assign each pair a question about BODMAS from Ex: 3.3, pg. 44 of the Textbook Grade 6.
9. Ask them to solve the assigned question using the BODMAS rule.
10. After 5 minutes, call a few random pairs to solve the question on the board.

CONCLUSION / SUM UP/ WRAP UP:**05 Minutes**

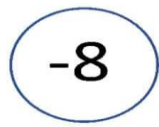
1. Conclude the session by referring to **K-W-L activity**.
2. Ask the participants to reflect on the following questions:
 - “What was the most important thing you have learned today?”
 - “What question still remains in your mind?”
3. Take random responses and encourage the participants to answer the second question of their peers.

Handout 2.1: Question Bank

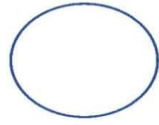
$(+10) + (-7)$	$(+11) + (-15)$	$(+1) - (-8)$	$(-6) - (-6)$
$(-10) - (-6)$	$(+8) - (-2)$	$(-9) - (-10)$	$(-3) + (-1)$
$(+4) + (+3)$	$(+1) + (-6)$	$(+7) + (-7)$	$(+5) - (-10)$
$(-9) - (+2)$	$(-4) + (-5)$	$(-11) + (+18)$	$(-11) + (+3)$
$(-3) - (+2)$	$(-7) + (-4)$	$(-11) + (+11)$	$(-11) - (-13)$

Handout 2.2: Worksheet

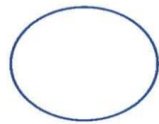
START



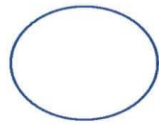
\downarrow $\times (-2)$



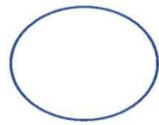
\downarrow $\times (+3)$



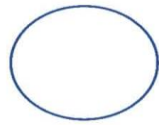
\downarrow $\times (-3)$



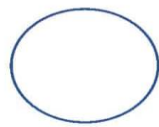
\downarrow $\div (+2)$



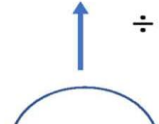
\downarrow $\times (+5)$



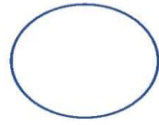
\rightarrow $\div (-9)$



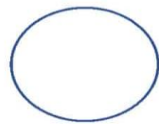
\rightarrow $\div (+2)$



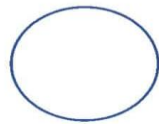
\uparrow $\div (-4)$



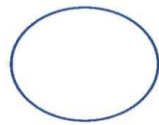
\uparrow $\times (+3)$



\uparrow $\times (-4)$



\uparrow $\div (+2)$

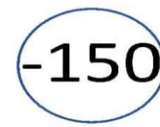


\uparrow $\times (-5)$

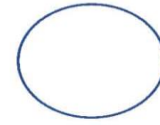


CHECKPOINT

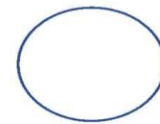
CHECKPOINT



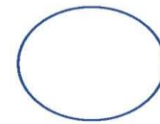
\downarrow $\times (-5)$



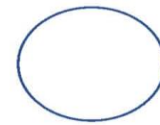
\downarrow $\div (-5)$



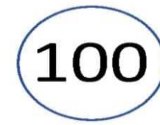
\downarrow $\div (-2)$



\downarrow $\times (-4)$



\downarrow $\div (-3)$



END

Grade 6 - 8

Session Plan 3: Ratio, Rate and Percentage**Time: 90 Minutes****STUDENT LEARNING OUTCOMES**

At the end of this session, the participants will be able to:

1. define and calculate ratio, equivalent ratio, rate, and percentage
2. solve real life problems involving ratio, rate, and percentage
3. calculate rate and average rate of quantities
4. explain and calculate direct and inverse proportion
5. solve problems involving direct proportions of two quantities using:
 - Table
 - Equation
 - Graph

MATERIALS

- Textbooks of Grade 6, 7 & 8
- writing board, marker/chalk
- chart papers/permanent markers
- tape/scissors
- coloured counters/button
- shoebox/ small basket
- worksheet
- empty glass/ clear container/jug
- small objects (marbles, pebbles, buttons, or paper clips)

Opening:**05 minutes**

1. Display the topic and learning outcomes of Session 3 on a chart paper/ PPT slide.

Activity 1:**15 minutes**

1. Elicit the definition of a ratio from the participants.

Definition: A ratio is a comparison of two or more quantities or values.

Explanation: Ratios express how one quantity is related to another. They are usually written in the form of "a: b" or "a/b" and can be simplified if possible.

Example: If there are 3 boys and 5 girls in a class, the ratio of boys to girls is 3:5


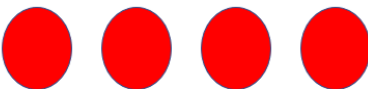

2. Explain the definition of a ratio.
3. Give a real-world example to illustrate the concept. For instance, you can talk about the ratio of male to female participants in the class.
4. Divide the participants into pairs or small groups and distribute the coloured counters or

objects.

5. Instruct each group to create different ratios using the objects. For example:

- Ask them to create a ratio of blue counters to red counters.
- Have them create a ratio of green counters to red counters.
- Have them create a ratio of blue counters to red counters to green counters.

Ratio

Blue : Red
3 : 4

Blue : Red: Green
3 : 4: 6

Green : Red
6 : 4

6. Encourage them to come up with their own ratios using the available counters.
7. Once the groups have created their ratios, invite them to share their findings with the whole class.
8. Encourage them to explain how they have determined the ratio and what it represents.
9. Write down the term “Equivalent ratio” on the board.
10. Ask participants to reflect and discuss what is meant by this term.
11. After getting their responses, tell them that:

Definition: Equivalent ratios are ratios that have the same relative comparison but with different values.

Explanation: Two ratios are equivalent if they simplify to the same value when reduced to the simplest form.

Example: The ratios 2:3 and 4:6 are equivalent because both simplify to 2:3.

12. Divide the participants into pairs.
13. Ask each pair to solve the following questions from the Textbook Grade 6.

Ex: 4.1, Q. 2(ii, v, viii), pg.54

14. Invite different pairs randomly to solve the questions on the board.

Activity 2:



12 minutes

1. Ask the participants to work in pairs and differentiate between ratio and rate.
2. After getting their responses tell them:

Ratio is comparison of two or more numbers or things with the same units.

Rate is special kind of ratio in which we compare two or more quantities with different units.

3. Display the following steps of solving word problems/real life situations on the board/chart paper/PPT slide.

4. Read the word problem/real life situation.
5. Identify the key information.
6. Highlight the word which shows operation.
7. Change words into mathematical statements.
8. Find the solution.
9. Ask the participants to solve the following questions from the Textbook Grade 6.

Ex: 4.2, Q.1, 5 & 6, pg. 55

10. Give them 5 minutes to solve.
11. After 5 minutes, ask random pairs to solve the questions on the board.

Activity 3:



20 minutes

1. Write the word 'percentage' on the board.
2. Start discussion by asking the participants to define percentage and give real life examples.

A **percentage** is a way of expressing a part of a whole as a fraction of 100. The word "percent" is derived from the Latin phrase "per centum," which means "per hundred." It is denoted by the symbol "%".

3. Distribute one worksheet per pair.
4. Ask the participants to shade the squares so the following percentages are represented.

5%	15%	80%	70%	50%	40%
----	-----	-----	-----	-----	-----

5. Divide the class in groups.
6. Distribute chart papers and markers.
7. Share with the participants ways to express percentages using the example given below:

percentage	fraction	decimal
30%	$\frac{3}{10}$	0.3
↑	↓	
<p>to go from a fraction to a percentage we can convert to a decimal first</p> <p>$\frac{3}{5} \rightarrow 0.6 \rightarrow 60\%$</p>		

8. Instruct each group to choose three different percentages of their choice. For example, they could select 25%, 60%, and 90%.
9. Ask each group to work together to express their chosen percentages as fractions and decimals. They should write down their calculations and results.
10. Provide the groups with sufficient time to complete the task.
11. Once the groups have finished, ask them to present their results to the whole class.
12. Each group should explain how they converted their chosen percentages into fractions and decimals.
13. Encourage other participants to ask questions or provide feedback after each group's presentation.

Activity 4:**20 minutes****Round 1: (Direct Proportion)**

1. Fill a container with water to a certain level. (This level will serve as the reference point.)
2. Start by dropping one object (e.g., a marble) into the water and observe the water level rise.
3. Add another object and observe the water level rise again.
4. Continue adding objects one by one and observe the corresponding increase in the water level each time.
5. Discuss with the participants how the number of objects added directly affects the water level. As more objects are added, the water level rises proportionally.
6. Eliciting the definition and real-life examples of direct proportion from the participants.

Direct Proportion: A relation in which increase/decrease in one quantity causes a proportional increase/decrease in the other quantity.

Examples: increasing the number of eggs will increase cost incurred.

Round 2: (Inverse Proportion)

1. Empty the same container and refill it to the reference level.
2. Begin by dropping all the objects into the water and observe the rise in water level.
3. Now, instead of adding more objects, remove one object and observe the water level decrease.
4. Remove another object and observe the further decrease in the water level.
5. Continue removing objects one by one and observe the corresponding decrease in the water level each time.
6. Discuss with the participants how the removal of objects inversely affects the water level. As more objects are removed, the water level decreases proportionally.
7. Eliciting the definition and real-life examples of Inverse proportion from the participants.

Inverse Proportion: A relation in which if one quantity increases/decreases then the other quantity decreases/increases proportionally.

Examples: increasing speed of car will take less time to reach the destination.

Activity 5:**15 minutes**

1. Divide the class in 3 different groups.
2. Inform them that they will pick up a method from a box/ small basket having three different methods of calculating direct proportions (Table method, Graphical method, and Equation method) written on the sticky notes/ slips of paper.
3. Instruct the groups to first read the application of assigned method from the Textbook Grade 8 pg. 53-55.
4. Ask the participants to solve any one of the following questions using the assigned method from the Textbook Grade 8.

Ex: 1.1, Question 3 - 8, pg. 58

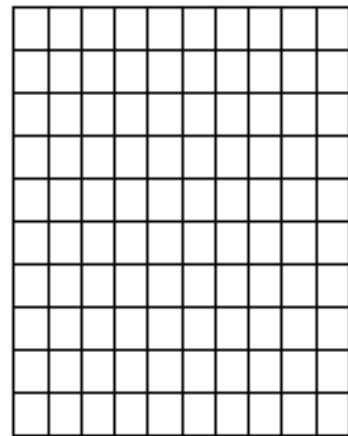
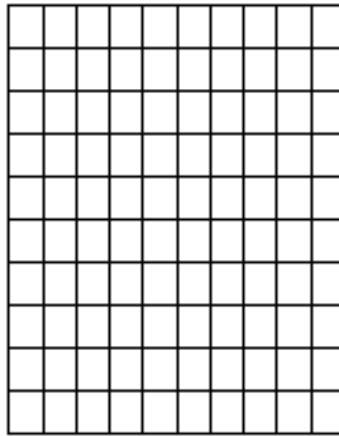
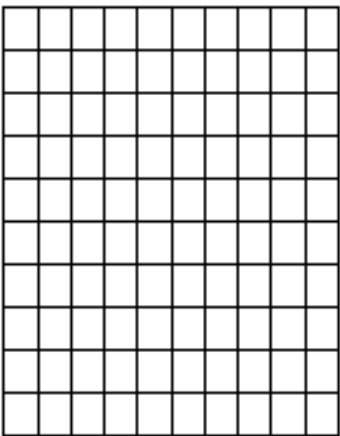
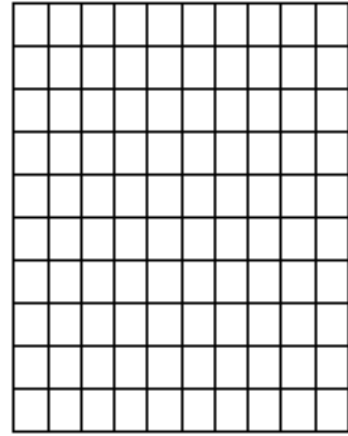
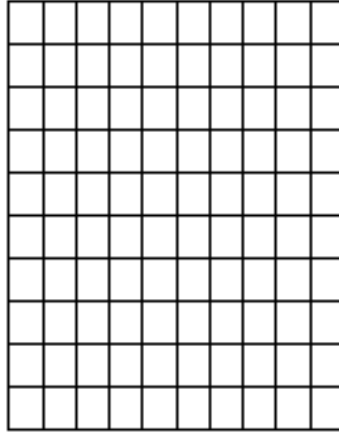
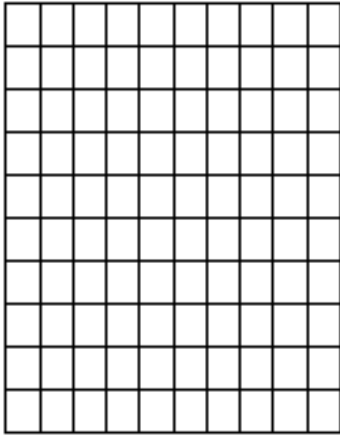
5. After completion, ask groups to share their methods with the class.

CONCLUSION / SUM UP/ WRAP UP:**03 Minutes**

1. Distribute sticky notes in the class.
2. Tell them to reflect on today's session and write:
 - 3 things the participants understood.
 - 2 things that were challenging.
 - 1 thing that they do not understand still.
3. Take a few random responses to conclude the session.

Handout 3.1: Worksheet

Follow the instructions of the trainer and fill in the grid to indicate the correct percentage.



Grade 6 - 8

Session Plan 4: Financial Arithmetic



Time: 90 Minutes

STUDENT LEARNING OUTCOMES**At the end of this session, the participants will be able to:**

1. solve real world word problems involving profit, loss, discount, commission, tax, zakat and ushr
2. calculate profit percentage and loss percentage
3. calculate percentage discount
4. solve problems from real life situation involving profit/ markup
5. solve real life problems involving:
 - insurance
 - partnership
 - inheritance (according to Islamic principles)

MATERIALS

- Textbooks of Grade 6, 7 & 8
- writing board, marker/chalk
- A4 papers/chart papers
- notepads/sticky notes
- speaker
- picture cards(oven, iron, food factory & washing machine)

Opening:**05 minutes**

1. Display the topics and learning outcomes of Session 4 on a chart paper/ PPT slide.

Activity 1:**15 minutes**

1. Show a video (Link: <https://www.youtube.com/watch?v=1u0qwjw0YZQ>) to the class.

Show the video from 0:01 till 03: 46 and then pause it. After the group presentation use the exercise to clarify any misconceptions.

2. Ask them to focus on the following questions while watching the video.
3. Remind them to take notes.
 - What is selling price?
 - What is cost price?
 - What is profit?
 - What is the formula to calculate the profit percentage?
 - What is loss?
 - What is the formula to calculate the loss percentage?
 - What is the similarity between profit percentage and loss percentage?
4. Divide the participants into four groups and ask them to share their learning.

5. Give them time to discuss their learning.
6. Ask each group to share their work with the whole class.
7. Now show the video on wards from 03:47.
8. Pause video at the last question and solve the question on the board with the help of the participants checking the solution in the end.
9. To consolidate the concept, ask the participants to do a few questions individually from **Ex.1.14 pg.57, Textbook Grade 7**
10. Ask them to share their work with the person sitting next to them.

Activity 2:**20 minutes**

1. Ask participants to define “discount”, “discount percentage” with real life examples.
2. After getting their responses, share the following information.

A **discount** is a reduction in the price of a product or service.

Discount percentage is the rate at which the original price is reduced. The discounts are commonly used by businesses to attract customers and increase sales. The discounts are often expressed as a percentage of the original price.

3. Discuss real-life scenarios where discounts are commonly used, such as sales at stores, online shopping, or promotional campaigns.
4. Elicit examples of discounts in different contexts.
5. Emphasize the importance of understanding discount percentages to make informed purchasing decisions.
6. Divide the participants into four groups.
7. Allocate each group an item card like ball, bat, book and school bag.



8. Ask the participants to put a price on their item. (Ask them to keep prices between Rs.1,000-Rs. 1,500)
9. Instruct them to make 3 discount coupons or signs for a percentage off e.g., 30%, 25%, etc., on three different coloured sticky notes.



10. Allocate time for each group to calculate the selling price of their allocated item and note down their calculations on the given worksheet.
11. Inform each group that they have a budget of Rs.1500 to purchase any two items from the other groups.
12. While purchasing they can avail any one discount coupon from each group.
13. Allocate 4- 5 minutes for groups to select the items they want to buy and present their estimated bill to the whole class.
14. While one group is presenting its bill, the other groups check their bill amount.
15. Move around in the class and guide the participants where necessary.

Activity 3:**20 minutes**


1. Elicit from the participant that Tax is the most important source of government income.
1. Divide the class in five groups.
2. Allocate one of the following topics to each group.
Tax, Income Tax, Property Tax, General Sale Tax, Value added Tax.
3. Ask them to read and discuss the information given on pg. 58- 60, Textbook Grade 7 related to their topic.
4. Distribute chart paper and coloured markers to each group.
5. Ask them to make a 2-minute presentation on the charts on the given topic, may add more information using to make the presentation comprehensive.
6. Ask each group to present their work.
7. Assign any 3 questions from the **Ex: 1.15, pg. 61-62, Textbook Grade 7** to each group.
8. Move around in the class and observe the working of groups.
9. Allocate them 5 minutes to solve the questions.
10. Now invite one participant from each group to solve one question on the board.
11. Conclude the activity by recapping the formula for the calculation of income tax, property tax, general sales tax, and value added tax.

Activity 4:**25 minutes**

1. Introduce the teaching strategy “Jigsaw” to teach different mathematic topics in groups.
2. Emphasize that the Jigsaw strategy encourages collaboration, communication, and active participation among students.
3. Divide the participants into five different groups, assigning them a specific topic.
 - **Group 1:** Commission
 - **Group 2:** Zakat & Ushr

- **Group 3:** Profit Markup
 - **Group 4:** Insurance, Partnership
 - **Group 5:** Inheritance
4. Explain that within their expert group, participants should discuss and become expert of the topic assigned to them, taking help from the Textbook Grade 7-8.
 5. Encourage them to ask questions, explain concepts to one another and solve problems related to their topics.
 6. Remind them to take notes or create a summary of their topic/topics.
 7. After 10 minutes, when all the groups have completed the task, divide the class into new groups.
 8. There should be one participant from each of the original groups in the newly formed groups.
 9. Ensure that each group consist of one member from the expert group.
 10. Set a specific time limit (e.g., 2 minutes) for each participant to present their topic and answer any questions from their group members.
 11. Each member of the group shares the important points of their topics which they originally discussed in their previous groups.
 12. Encourage active listening and note-taking by home group members during the presentations.
 13. Once each member has shared their topic, allow time for group discussion and clarification of any misunderstandings.
 14. Ask the group to solve the given worksheet.
 15. Monitor the groups and offer guidance or assistance as needed.
 16. Facilitate a brief whole-class discussion to recap the key points from each topic and address any remaining questions or concerns.
 17. Encourage the participants to reflect on the Jigsaw strategy experience, discussing the benefits of collaborative learning and the new insights gained.

CONCLUSION / SUM UP/ WRAP UP:

 **05 Minutes**

Rose	Thorn	Bud
A highlight, a success or something positive that happened	A challenge you experienced, or something you can use more support with.	New ideas or something you are looking forward to knowing to knowing or understanding more
<ul style="list-style-type: none"> • What was the highlight today? • How have you been successful? 	<ul style="list-style-type: none"> • Identify causes of difficulty. • What made it hard to be successful 	<ul style="list-style-type: none"> • What are you looking forward to? • Describe opportunities for learning that excite you

1. Ask participants to read the description of rose/ thorn /bud reflections on the slide.
2. Ask them to think of one example of a rose, thorn, and bud from Session 1- 4 on a coloured sticky note.
3. Ask a few volunteers to share their reflection with the whole class.

Handout 4.1: Worksheet

Item	Quantity	Marked Price	Discount %	Selling Price
Payment Bill for items purchased				
Item	Quantity	Marked Price	Discount %	Selling Price

Handout 4.2: Worksheet

Solve the following questions:

Q1. Zawar has annual income of Rs. 1000000. Find the amount of income tax.

Q2. a) Find the amount of zakat on total of 9 tola gold and 50 tola silver if the values of 1 tola gold and 1 tola silver are Rs. 130000 and Rs. 1500 respectively.

b) Ahsan has a crop wheat of worth Rs. 400000 irrigated by natural sources. Find the amount of ushr on it.

Q3. Saud borrows Rs. 25000 from bank at the rate of 6% per year for 3 years. Find the mark up of the bank.


Q4. a) Zahid got a life insurance policy of 500000 at the rate of 5.2% and the policy fee is 0.25%. Calculate half yearly premium at 52% of the annual premium.

b) Aslam and Akram invested Rs. 27000 and Rs. 30000 to start a business. If they earned a profit of Rs. 66,500 at the end of the year, find the profit of each one.

Q5. A man died leaving a saving of Rs. 72,000 in the bank. Find the share of each: widow, one son and one daughter.

Grade 6-8

Session Plan 5: Algebraic Expression

 Time: 90 Minutes

STUDENT LEARNING OUTCOMES

At the end of this session, the participants will be able to:

1. recognize like and unlike terms, open and close sentences, variables, constants, expressions, and inequality
2. differentiate between linear algebraic equations and linear algebraic expressions
3. evaluate algebraic expressions, add and subtract linear expressions
4. simplify algebraic expressions (by expanding products of algebraic expressions by a number, a variable, or an algebraic expression) involving addition, subtraction, multiplication, and division
5. add and subtract two or more polynomials

MATERIALS

- Textbooks of Grade 6, 7 & 8
- writing board, marker/chalk
- A4 papers/chart papers
- coloured markers

Opening:



05 minutes

1. Display the topics and learning outcomes of Session 5 on a chart paper/ PPT slide.

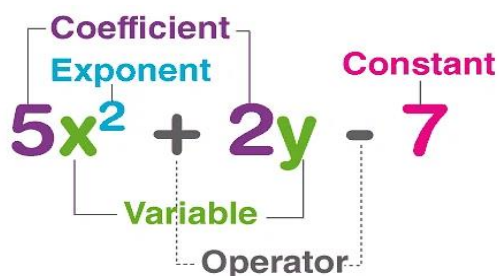
Activity 1:



15 minutes

1. Divide the participants in pairs.
2. Display the following questions on the board/PPT slide.

$\square + 2 = 6$ (ii) $4 \times \square = 8$ (iii) $9 \div \square = 3$
3. With the help of the participant solve the questions.
4. Ask them to reflect on “Open sentence” and “Close sentences” in mathematics.
5. Elicit that the questions given above were examples of Open sentences which have one or more unknowns.
6. Elicit that any mathematical close sentence is always true or false.
7. Ask them to share few examples of “Close sentences”.
8. Tell them to think about the topic “Algebraic Expressions” and share their thoughts with their partner.



9. Review the terminology associated with this algebraic expression. (coefficients, variables, exponents).
10. Write an algebraic expression $5x^2 + 2y - 7$ on the board.
11. Elicit variables, constant, terms, exponents and co-efficient in the given expression.
12. After getting their responses, conclude that:

An algebraic expression in mathematics is an expression which is made up of variables and constants, along with algebraic operations (addition, subtraction, etc.). Expressions are made up of terms. **Examples** $3x + 4y - 7$, $4x - 10$, etc. These expressions are represented with the help of unknown variables, constants, and coefficients. The combination of these three (as terms) is said to be an expression.

Activity 2:**15 minutes**

1. Show a video (Link: <https://youtu.be/Xm8nQm1KKuE>) to the class and ask them to watch attentively.
2. Tell them to take short notes of any important information shown in the video on a note pad.
3. Divide them into 3 groups and ask them to share their learning.
4. Allocate one topic to each group: "Expressions, Equation, and Inequality".
5. Assign them the task of making an informative poster and then teach the topic to the rest of the class.
6. Distribute a chart paper and coloured markers to each group.
7. Allocate 3 minutes for making poster of the topic, take examples from the Textbook to teach.
8. Once prepared, give each group 3 minutes to present their task.
9. Encourage maximum participation and clarify any misconceptions.
10. To consolidate, ask a few volunteers to recap main points of expressions, equation, and inequality.

Algebraic Expression: An expression which connects constants and variables by mathematical operation.

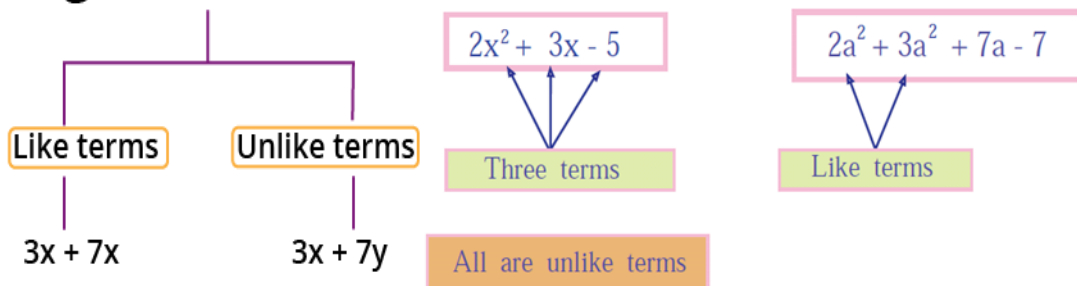
Equation: When two algebraic expressions are connected by equality sign (=).

Inequality: When two algebraic expressions are not equal and are connected by the symbol (<, >, ≤ or ≥).

Activity 3:**10 minutes**

1. Ask the participants that how they can add or subtract algebraic expressions.
2. Elicit like and unlike term in algebraic expressions.
3. Write these examples on the board: $3x + 7x$, $2x^2 + 3x - 5$, $2a^2 + 3a^2 + 7a - 7$
4. Ask a few volunteers to come on board and identify the like and unlike terms.

Algebraic Terms



- After getting their response, write the following on the board.
 - Add $4xy$, $3xy$ and $21xy$
 - Subtract $17a$ from $30a$
- Ask the participants, to think in pairs ways to solve these questions.
- Invite 2-3 volunteers on the board to solve.
- Solve a few more examples on the board with the help of the participants.
- Conclude that in addition, or subtraction of algebraic expressions, we add or subtract only like terms to give a single term.

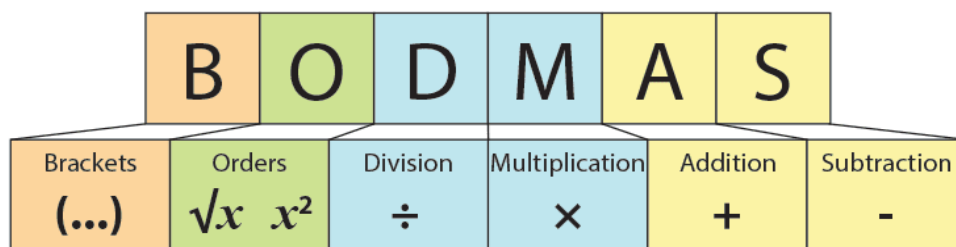
Activity 4:



20 minutes

- Write the following on the board:
"Evaluation and simplification of an algebraic expression"
- Ask the participants to reflect on the following questions:
 - What is the rule to simplify an algebraic expression?
 - What is an evaluation of an algebraic expression?
- Take responses randomly and elicit that there is a specific rule to evaluate an algebraic expression, which is BODMAS rule.

Ordering Mathematical Operations



- Elicit the order of BODMAS rule from the participants.
- Write the following questions on the board:
 - Simplify $3a + [3b - \{5c + (2b + 4c)\}]$
 - If $a = 2$ and $b = 1$ then evaluate the following:

$$3a + \frac{1}{3}b + 3\{a + (2b - a + 4b \times 3)\}$$
- Solve the questions using participants' input.

1. Simplify $3a + [3b - \{5c + (2b + 4c)\}]$

Solution:

$$\begin{aligned}
 &= 3a + [3b - \{5c + 2b + 4c\}] \quad (\text{solve the } () \text{ brackets}) \\
 &= 3a + [3b - \{9c + 2b\}] \quad (\text{solve the } \{ \} \text{ brackets}) \\
 &= 3a + [3b - 9c - 2b] \quad (\text{open } \{ \} \text{ brackets and simplify}) \\
 &= 3a + [3b - 2b - 9c] \quad (\text{arrange like terms and simplify}) \\
 &= 3a + [b - 9c] \\
 &= 3a + b - 9c
 \end{aligned}$$

2. If $a = 2$ and $b = 4$ then evaluate the following:

$$3a + \frac{1}{3}b + 3\{a + (2b - a + 4b \times 3)\}$$

Solution:

$$\begin{aligned}
 &= 3a + \frac{1}{3}b + 3\{a + (2b - a + 4b \times 3)\} \quad (\text{first simplify}) = 3a + \frac{1}{3}b + 3\{a - a + 2b + 12b\} \\
 &= 3a + \frac{1}{3}b + 3\{14b\} \\
 &= 3a + \frac{1}{3}b + 42b \\
 &= 3a + \frac{b}{3} + \frac{126b}{3} \\
 &= 3a + \frac{127b}{3} \quad (\text{putting the value of } a = 2 \text{ \& } b = 4) \\
 &= 3(2) + \frac{127(4)}{3} \\
 &= \frac{18 + 127 \times 4}{3} = \frac{18 + 508}{3} = \frac{526}{3} = 175\frac{1}{3} \quad (\text{answer in the lowest term})
 \end{aligned}$$

7. To consolidate the concept, ask them work in pairs to solve the following questions from the Textbook Grade 6: **Ex.6.5, Q.8 (ii) and 9, pg.92.**
8. Once finished ask them to swap their solutions with others for peer assessment.
9. Take random feedback and encourage participants to share their learning.

Activity 5:



20 minutes

1. Write on the board word 'polynomial'.
2. Elicit the definition of a polynomial as an expression that contains one or more terms, where each term is made up of a coefficient and a variable raised to a power.
3. Display the following questions on the board.
4. Ask the participants to reflect on these questions and discuss them with their partners.
 - What do you mean by the degree of a polynomial?
 - What are the types of polynomials?
 - What are the rules to add polynomials?
 - What are the rules to subtract polynomials?
 - What are the methods to add and subtract polynomials?

5. Take random responses from the participants to clarify any misconception.
6. Divide the class in 5 groups and distribute a chart paper and coloured markers.
7. Inform them that they will pick up one of the questions given above and make a quiz on it.
8. Give the following instructions for making the quiz.
 - Time limit of the quiz should be 3minutes.
 - The quiz should have 5 questions.
 - Out of these 5 questions 3 should be addressing understanding and remembering and should be addressing application level of Bloom's Taxonomy.
 - Make a key for the quiz on a separate page for your reference.
9. After completion, swap quiz worksheets with other groups to solve.
10. Take random responses to review the concept.

CONCLUSION / SUM UP/ WRAP UP:**05 Minutes**

1. Distribute sticky notes in the class.
2. Tell them to reflect on today's session and write:
 - 3 things the participants understood.
 - 2 things that were challenging.
 - 1 thing that they do not understand still.
3. Take a few random responses to conclude the session.

Grade 6 - 8

Session Plan 6: Perimeter, Area and Volume**Time: 90 Minutes****STUDENT LEARNING OUTCOMES****At the end of this session, the participants will be able to:**

1. state and differentiate between area, perimeter and their units
2. recognize the formulae to calculate the area, and perimeter, surface area, volume of different 2D and 3D shapes
3. calculate the circumference and area of a circle
4. calculate the surface area and volume of any simple 3D shape including right prism and cylinders

MATERIALS

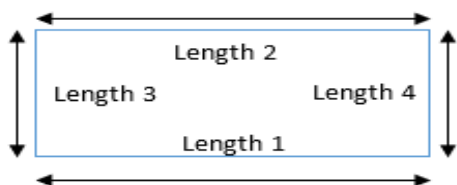
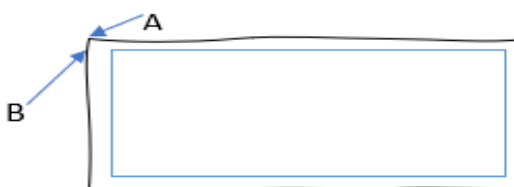
- Textbooks of Grade 6 & 7
- writing board, marker/chalk
- board/markers/glue/tape
- sticky notes/strips of blank paper
- rulers (one for each group)
- thread (about 20 cm for each group)
- cube objects (such as dice), cuboid object (such as duster, tissue box)
- cylinder (hollow cardboard of tissue rolls)
- 6 cut-outs of triangles
- nets of cube, cuboid, cylinder & triangular prism

Opening:**05 minutes**

1. Share the topic of the session “Perimeter, Area, and Volume”.
2. Distribute sticky notes to the participants.
3. Ask participants to write down:
 - three things that confuse them about the topic
 - two things that they find very difficult
 - one question they would like to ask about the topic
4. Once completed they should paste it on a side wall.
5. Allocate 3 minutes for this activity.
6. Quickly skim after the activity and tell the participants that we will discuss these points during the session.
7. Share the learning outcomes of Session 6 with the participants.
8. Put up a chart paper, titled “Useful Formula” on a wall visible to the participants and tell that we will fill it during the session.

Activity 1:**20 minutes**

1. Ask the participants to recall real-life examples of 2-D objects.
2. After getting their response, share with them examples of 2-D shapes.
3. Divide the participants in groups.
4. Ask each group to draw a rectangle, of any dimension, on a chart paper with the help of a marker and then use a ruler to measure each of its four sides.
5. Now ask them to add all the four lengths and write down the answer next to the shape.
6. Next, tell each group to measure all the sides using a thread, as shown in the Figure 1
7. All groups should be able to verify that the length of the thread and the sum of four lengths calculated is the same.

**Figure 1**

A thread wrapped around the edges of the shape to make length measurement.

8. Use the results and group discussion to define perimeter and state its units.
9. Discuss that the method to calculate the perimeter remains same for all the shapes including squares, triangles etc.
10. Elicit from the participants that the edges/boundaries which enclose a region, the space in between is known as Area.
11. Ask participants what they know about calculating areas.
12. Take 2-3 random responses.
13. Use the discussion to elicit the formula for calculating area for a rectangle and a square.
14. Ask each group to calculate the area of their drawn rectangles.
15. Now ask each group to solve the following questions from the Textbook Grade 6:
Ex. 8.1: Q. 1 (ii, iii) and 3, pg.110
16. Ask volunteers to explain their process and solution of the questions on the board so that the rest can self-assess their work.
17. Add the formula from this session on the board/chart paper under the title "Useful Formulas" before moving to the next activity.


$$\text{Area of square} = l \times l \text{ or } l^2$$

$$\text{Area of rectangle} = l \times b$$

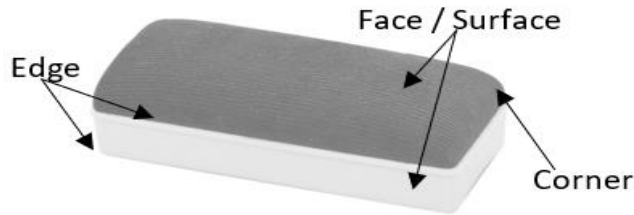
$$\text{Perimeter of square} = 4 l$$

$$\text{Perimeter of rectangle} = 2l + 2b$$

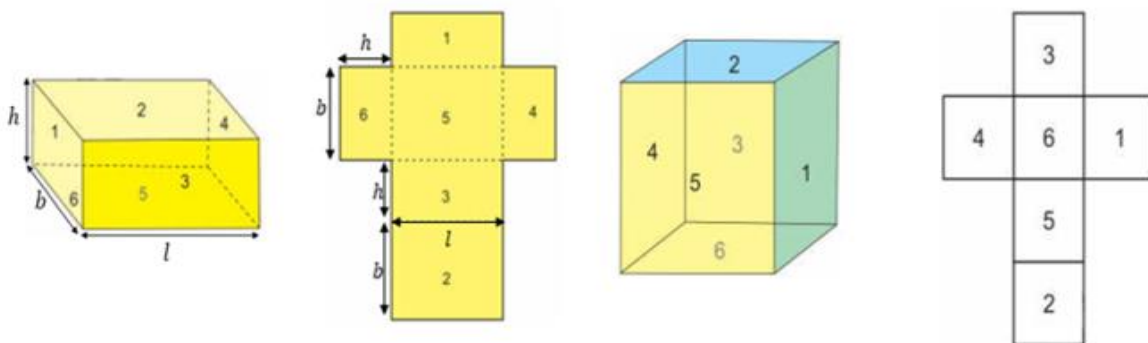
Activity 2:

 **20 minutes**

1. Recall that 3D shapes are solid figures having length, width, and height.
2. Use a real-life object such as duster (for a cuboid) and dice (for a cube) to indicate edges, faces/surfaces, and corners of the shape.



3. Divide the class into pairs.
4. Provide each pair with either net of cube or cuboid.
5. Instruct the participants to cut out the net along the edges carefully.
6. Once the net is cut out, ask the participants to fold the net along the edges to form a cube or cuboid. They can use tape or glue to secure the edges.
7. Once the cube/cuboid is formed, have the participants measure the length /length and breadth of one side of the cube/cuboid using a ruler.
8. Show the participants the following nets of cube and cuboid on a chart paper/PPT slide.



9. Elicit the formula of the surface area of cube and cuboids.

$$\text{Surface Area of Cube} = 6l^2$$

$$\text{Surface Area of Cuboid} = 2[(l \times b) + (b \times h) + (h \times l)]$$

10. Using the measured length, instruct the participants to calculate the surface area of the cube and cuboid.
11. Ask participants to discuss within their group, how can volume of cube and cuboid can be calculated.

$$\text{Volume of cube} = l^3$$


$$\text{Volume of cuboid} = l \times b \times h$$

12. List the formula from this session on the board/chart paper under the title “Useful Formula”.
13. Divide the class in pairs and complete the given table in the Textbook Grade 6:

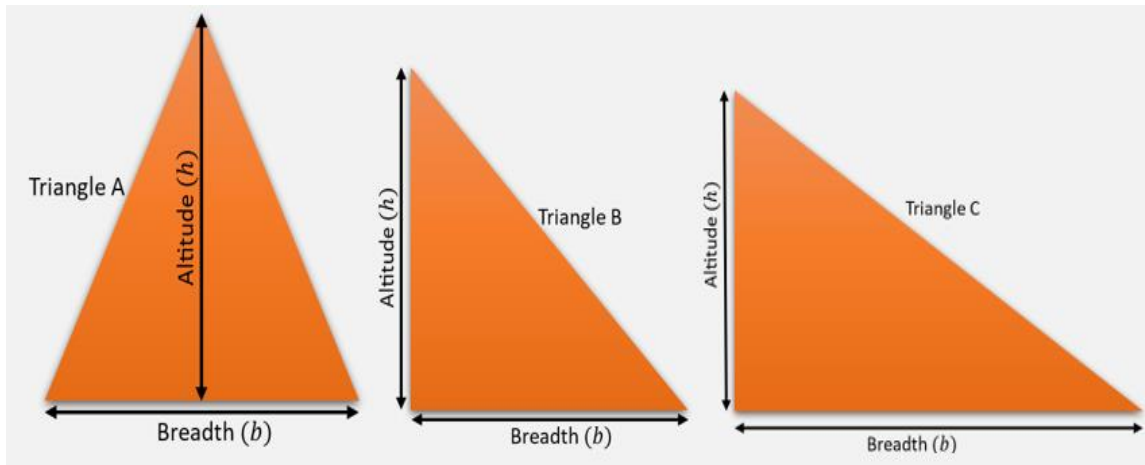
Ex. 8.3, Q. 2, pg.121

14. Ask pairs to swap their solutions for peer assessment.

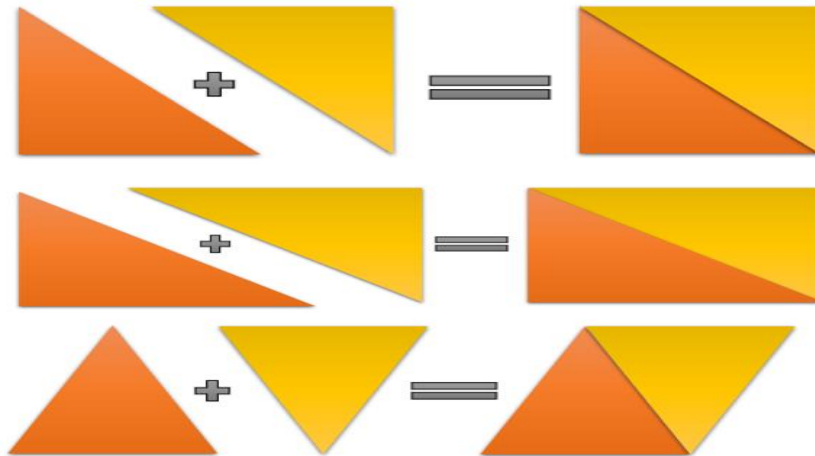
Activity 3:

 20 minutes

- Place the following cut-outs of triangle in front of class.



- Use the cut-out of Triangle A to explain Altitude and breadth of the shape.
- Ask the participants to work in pairs and make more shapes by joining the cut-outs.

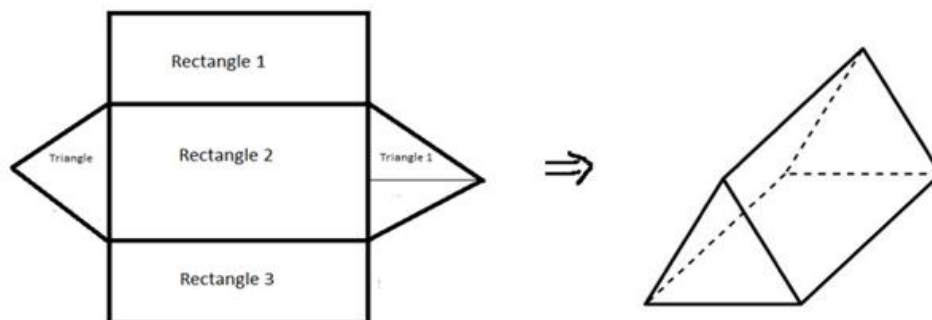


- Discuss how perimeter and area of the triangle is calculated.
- Encourage the participants to share their feedback.
- Elicit the formula to calculate the area of a triangle using the shapes.

$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Perimeter} = \text{sum of all sides}$$

- Display/draw or show the net of a Triangular prism on the board/chart paper/PPT slide.



8. Elicit the formula for surface area and volume of the triangular prism using the net drawn.

$$\text{Volume of Triangular Prism} = \frac{1}{2} \times b \times h \times l$$

$$\text{Surface Area of Triangular Prism} = 3lb + bh$$

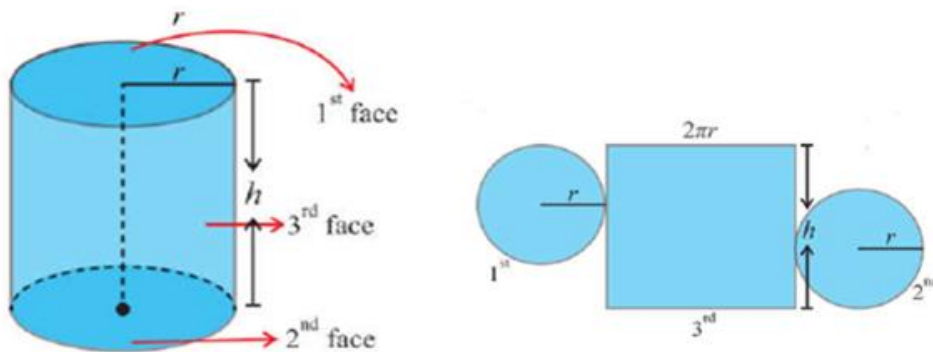
9. With the participants' input, find the solution of the questions from the Textbook Grade 7 on the board. Ex.3.7, Q. 4&10. Pg.137
10. Encourage maximum participation.

Activity 4:



20 minutes

- Write the word "Circumference" on the board.
- Ask the participants to reflect on the following questions:
 - What is circumference?
 - How can we find a circumference of an object?
- Divide the participants in groups.
- Provide each group with an empty cylindrical container (such as a soup can or a cardboard tube).
- Instruct them to use the thread and ruler to find the perimeter and diameter of the circular face of that object.
- Ask each group to calculate the ratio: $\frac{\text{circumference}}{\text{diameter}}$ to find the value of "pi(π)".
- Instruct them to measure the height (h) and the diameter (d) of the cylinder using a ruler or measuring tape.
- Once the measurements are taken, ask the participants to record the values of height (h) and diameter (d) on a piece of paper.
- Display the net of a cylinder on the board/ PPT slide to explain how the surface area is calculated.



10. Explain that the surface area of a cylinder consists of the sum of the areas of the two circular faces and the curved surface area.
11. Instruct the participants to calculate the surface area of the cylinder using the following formula:

$$\text{Circumference} = \pi d = 2\pi r$$

$$\text{Area of circle} = \pi r^2 = \frac{\pi d^2}{4}$$

$$\text{Surface Area of a Cylinder} = 2\pi r(r + h)$$

12. Generate discussion on calculating volume of a cylinder by using the formula.

$$\text{Volume of a cylinder} = \pi r^2 \times h = \pi r^2 h$$

13. Instruct them to make a question on calculating volume and surface area of any cylinder.

14. Swap your question with the other groups and find the solution.

15. Ask a few participants to share their question and its answer.

CONCLUSION / SUM UP/ WRAP UP:



05 Minutes

1. Ask the participants to think how this session will help them in their own classroom scenarios.
2. Ask any two or three volunteers to share their ideas with the whole class.

Grade 6 - 8

Session Plan 7: Measurement of Distance, Speed and Time**Time: 90 Minutes****STUDENT LEARNING OUTCOMES****At the end of this session, the participants will be able to:**

1. convert between different units of distance, time and speed
2. convert 12-hour clock to 24-hour clock and vice-versa
3. solve real-world word problems involving distance time and average speed
4. calculate arrival time, departure time and journey time in a given situation (on the previous day and the next day)

MATERIALS

- Textbooks of Grade 6, 7 & 8
- board/markers /chalk
- chart papers
- permanent markers
- stopwatches, measuring tapes, Traffic cones (filled water bottles, rocks, chairs)
- worksheet

Opening:**05 minutes**

1. Display the topics and learning outcomes of Session 7 on a chart paper/ PPT slide.

Activity 1:**15 minutes**

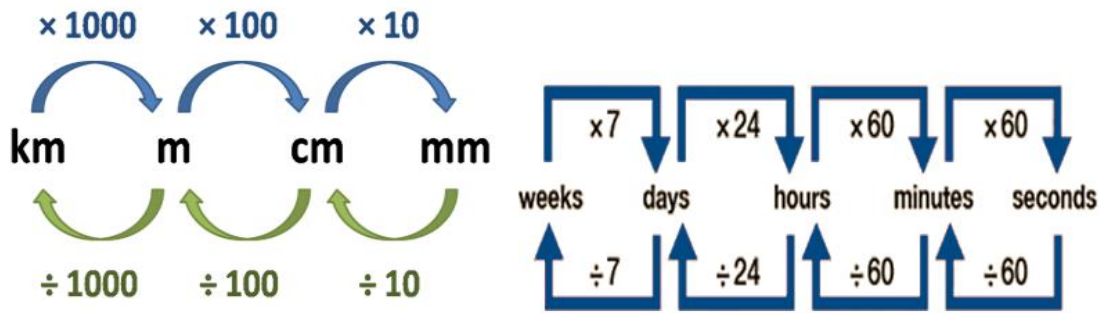
1. Divide the class into pairs.
2. Ask the participants to discuss the following questions with their partner.
 - How far is your house from the training venue?
 - What factors do you consider when planning an out-of-city trip?
 - How do you decide how far some place is?
3. After taking random responses, define the terms distance, time, and speed.

Distance: The length of space between two points.

Time: Duration of a period in which an action, process or condition exists or continues.

Speed: Rate of change of distance per unit time.

4. Briefly discuss that distance, time and speed have specific units.
5. Elicit the importance of conversion in our daily life.
6. Draw/display the conversion chart on the board/PPT slide.



7. Write the following questions on the board.
 - Convert 15 km 200m into meters.
 - Convert 4000m into km.
 - Convert 72m into cm.
 - Convert 365 days into weeks.
 - Convert 2400 mins into hours.
8. Ask the participants to work in pairs and solve the given questions using the chart given above.
9. To check their understanding, ask a few volunteers to solve these questions on the board.

Activity 2:



20 minutes

1. Elicit from the participants how we represent time in our life, including the use of am and pm.
2. Invite a volunteer to draw/display 12-hour clock dial and 24-hour clock dial on the board/PPT slide.



3. Show the video (https://www.youtube.com/watch?v=atP_vY79QfA&t=203s) and ask participants to make notes where needed.
 - Pause the video at 4:52 and allow 4 minutes for participants to solve the questions individually.
 - Complete the video to allow participants to assess their work.
 - Stop the video at 6:05.
4. Divide participants into pairs and ask them to complete the following questions from the **Textbook Grade 7: Ex. 3.2, Q.2&5,pg.119**
5. To consolidate, ask a few volunteers to share their learning with the whole class.

Activity 3:**25 minutes**

1. Divide the participants into groups of 4.
2. Provide each group with the following: one stopwatch, one measuring tape, 5 Traffic cones (filled water bottles).
3. Give the following instructions to the participants:
 - Each group should identify a group leader.
 - Each group creates a walking track of 50 m by placing their traffic cones.
 - Use measuring tape to measure and place a cone at every 10 m.
 - Each group leader will assign the following roles in their groups: runner, recorder, timer, and observer.
 - The “**runner**” will be moving from the starting till the ending point. They are allowed to move in any way they want; crawl, run, walk, jog etc. Go as slow as they want or as fast as they want.
 - The “**recorder**” will have the worksheet and pen and will be noting down the measurements in the given table.
 - The “**observer**” will announce, when the runner crosses a marker to allow timer and recorder to make observations.
 - The “**timer**” will be using the stopwatch to time the movement according to the observer.
4. Allow 10minutes for this activity. Some groups will finish early, and some will finish later, depending on the speed of the “runner”.
5. Ask each group to calculate speed and complete the table given in the worksheet.

Interval / m	10	20	30	40	50
Time / s					
Speed / (m/s)					

6. Now ask all groups to calculate the average speed.
7. Ask them to share their results with other groups.
8. To consolidate the concepts, ask participants to complete the following questions from the Textbook Grade 7: **Ex.3.4, Q. 2, 3 & 4, pg.124**
9. Randomly invite participants to solve the questions on the board.
10. Take random feedback from the participants and clarify any misconceptions.

Activity 4:**20 minutes**

1. Divide participants into 3 groups.
2. Allocate one topic to each group: “**Arrival Time, Departure Time, Journey Time**”.
3. Assign them the task of making an informative poster and then teach the topic to the rest of the class.
4. Distribute a chart paper and coloured markers to each group.
5. Allocate 3 minutes for making a poster of the topic.
6. Encourage them to use the information given on **pg.120 Textbook Grade 7**.

7. Once prepared, give each group 3 mins to present their task.
8. To consolidate, ask each group to do questions from **Ex. 3.3, Q.1, 3 & 5, pg.122**
9. Invite volunteers to solve the question and explain their process.
10. Encourage maximum participation and clarify any misconceptions.

CONCLUSION / SUM UP/ WRAP UP:**05 Minutes**

1. Distribute sticky notes in the class.
2. Tell them to write at least three take-away from the session.
3. Take 2-3 responses to conclude the session.

Handout 7.1: Worksheet

Interval/m	10	20	30	40	50
Time/s					
Speed/(m/s)					
Average Speed= $\frac{\text{Total Distance}}{\text{Total time taken}}$					

Grade 6 - 8

Session Plan 8: Practical Geometry



Time: 90 Minutes

STUDENT LEARNING OUTCOMES**At the end of this session, the participants will be able to:**

1. identify 2D,3D shapes with respect to their characteristics, parallel and intersecting lines
2. identify transversal angles related to them and recognize rotational symmetry
3. recognize quadrilaterals and their characteristics (parallel sides, equal sides, equal angles, right angles, lines of symmetry, etc.) square, rectangle, parallelogram, rhombus, trapezium, and kite
4. apply the properties of congruency and similarity for 2 figures
5. apply following postulates for congruency between triangles
 - SAS \cong SAS
 - SSS \cong SSS
 - ASA \cong ASA
 - RHS \cong RHS

MATERIALS

- Textbooks of Grade 6, 7 & 8
- writing board/chalk /coloured markers
- sticky notes
- rubik's cube/3D objects (dice, shoebox, tin can, birthday hat, half lemon)
- shape Cards
- cut-out of different shapes (square, rectangle, circle, triangle, cube, cuboid, cylinder, sphere, hemisphere, cone) in red and blue colour
- A4 sheet
- cardboard/thumb pin

Opening:**05 minutes**

1. Display the topics and learning outcomes of Session 8 on a chart paper/ PPT slide.

Activity 1:**10 minutes**

1. Divide the participants in 4 groups.
2. Ask the participants to look around, observe and list the objects with different dimensions.
3. Ask them to separate them into three categories: 1D, 2D and 3D shapes/objects.
4. Elicit from the random groups, list of objects in each category.
5. Ask them to describe 1D, 2D and 3D shapes.
6. Conclude the discussion that:

1D shapes have only 1 dimension (length).

2D shapes have 2 dimensions (length and width) and can be drawn on paper.

3D shapes have 3 dimensions which are height, width, and depth, and can be held in our hands.

2D shapes are flat, not fat while 3D shapes are fat, not flat.

7. Now divide the participants into 2 teams.
8. Ask each team to select a leader.
9. Provide each team with cut-outs of different shapes (square, rectangle, circle, triangle, cube, cuboid, cylinder, sphere, hemisphere, cone) in different colours.

E.g., Red for Team A and Blue for Team B

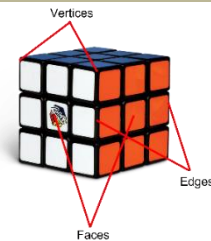
10. Divide the writing board into two halves. Write 2D shapes in the first and 3D shapes in the second half of the board.
11. Call random participants from each team and ask them to take out a shape and paste it in the respective column. Continue until all cut-outs of shapes are used.
12. To consolidate the concept, ask the participants to work in pairs and solve questions from the Textbook Grade 6: **Ex. 9.1, Q. 1- 2, pg.128.**
13. Take a whole class feedback and clarify any misconceptions.

Activity 2:



10 minutes

1. Ask the participants to recall sides, vertices, and edges of a shape.
2. Take a Rubik's and highlight its faces (surfaces), vertices, and edges using your finger.
3. Divide the participants into 5 groups.
4. Provide each group with one of the following 3D objects.



Cube, Cuboid, Cylinder, Cone, Hemisphere.

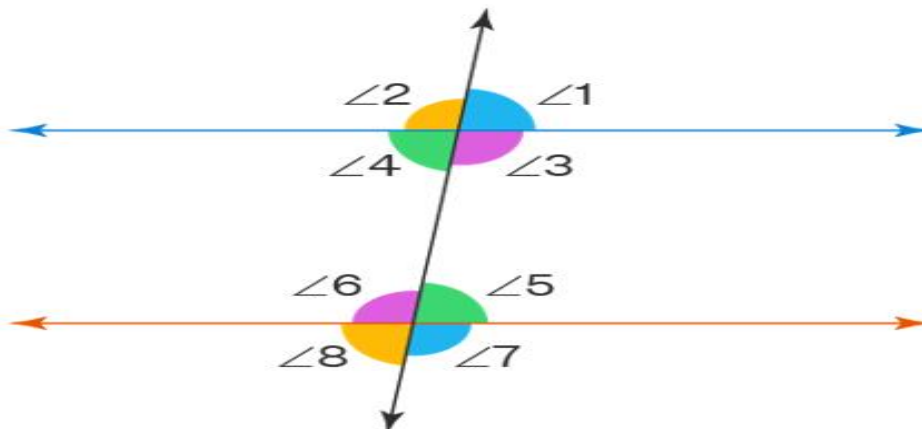
5. Instruct the participants to identify the faces, vertices, and edges of the assigned 3D shape.
6. Give them a few minutes to discuss in their groups.
7. Instruct each group to present their findings one by one.

Activity 3:



15 minutes

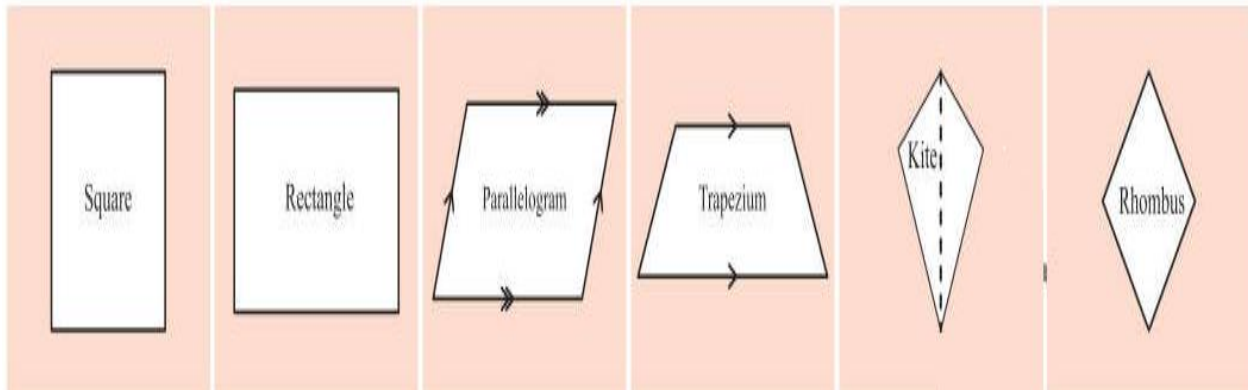
1. Elicit from the participants what are parallel and intersecting lines.
2. Ask them to identify parallel lines in 2D shapes.
3. Elicit some real-life examples of parallel and intersecting lines.
4. Draw/display the following "Transversal on Parallel lines" on the board/PPT slide.



5. Share with them that when a transversal intersects two parallel or non-parallel lines, it forms different kinds of angles, these angles are called transversal angles.
- 6.
7. Show the video (Link: <https://www.youtube.com/watch?v=6RMN5Pf1fHU>) to the participants and ask them to note down important points.
8. Divide the class into pairs.
9. Ask them to discuss properties of transversal angles and share their learning with the whole class.
10. To consolidate, ask a few volunteers about corresponding, alternate and interior angles.

Activity 4:**15 minutes**

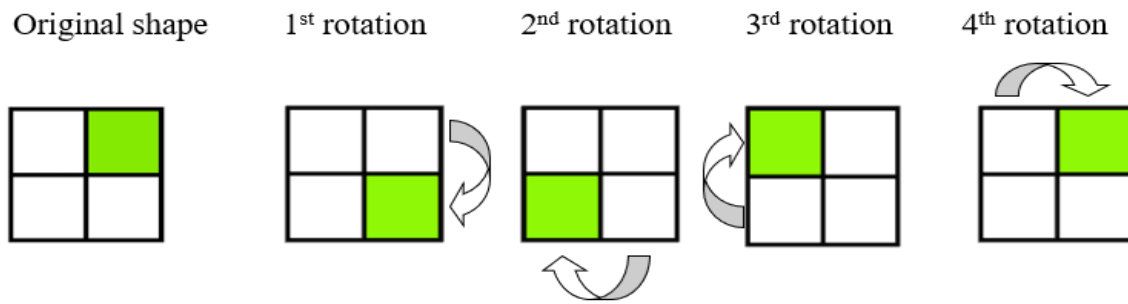
1. Draw/display them the following types of quadrilaterals on the board/PPT slide.



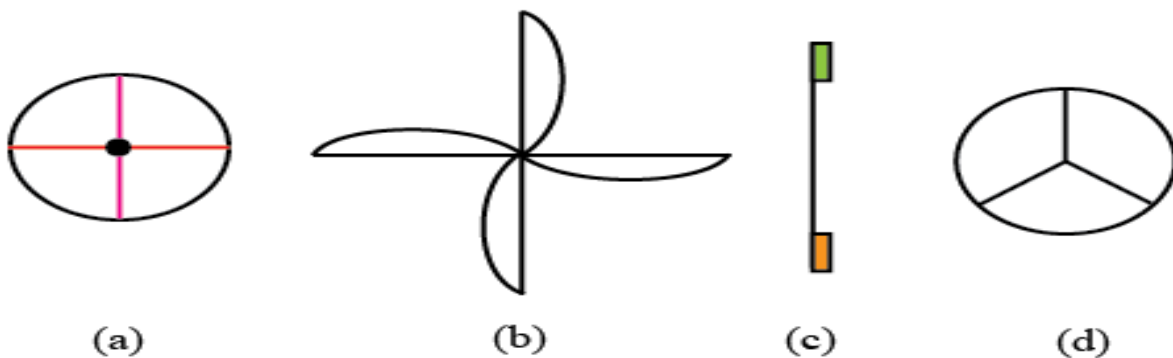
2. Divide the participants into 6 groups.
3. Provide each group with a shape card (refer handout 1) and ask them to complete the shape card.
4. Give the participants 5 minutes to complete the shape card.
5. After that, invite each group to present their findings one by one on the board about each quadrilateral.
6. Take random feedback and clarify any misconceptions.

Activity 5:**10 minutes**

1. Demonstrate symmetry by folding an A4 paper into two equal halves.
2. Show the participants that the two halves are identical to each other. Hence, they are symmetrical.
3. Tell them that the line which divides into two identical halves/parts is called the line of symmetry.
4. To show rotational symmetry, cut a piece of paper in a square and colour its one part.




5. Place the square on cardboard and insert a thumb pin at its centre.
6. Rotate the square in front of the participants. Ask if there is any change in its shape.
7. Deduce that the square remains the same even after rotation. It has rotational symmetry.
8. Now again rotate the square and ask if there is any change in its shape.
9. Keep rotating until it comes back to its original shape.
10. Demonstrate that the coloured part of the square took 4 rotations to come back to its original position. Hence the order of symmetry of the square is 4.
11. Show /display the following objects on the board/PPT slide and ask them to identify order of rotational symmetry.



12. Take whole class feedback and clarify any misconceptions.

Activity 4:

 **18 minutes**

1. Divide the participants into 5 groups.
2. Provide each group with four triangle cutouts.
3. Instruct them to identify which two triangles are congruent and which two triangles are similar.
4. After 2 minutes take their responses.
5. Ask them to provide reasons for their choice.
6. Deduce congruent and similar shapes from them.

Congruent figure or shapes:

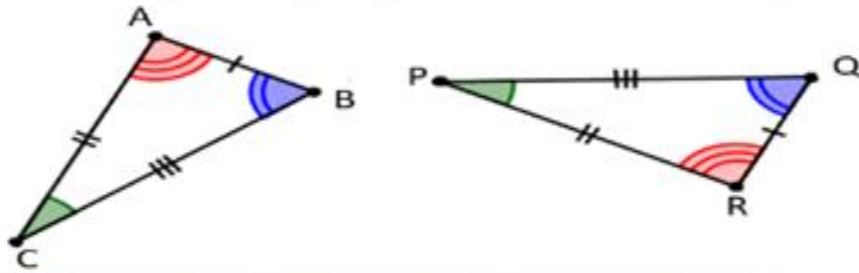
Two figures and objects are **congruent** if the objects/figures have the same shape and size. Objects need not to be identical. They can have different colors and textures.

Similar figures or shapes:

Shapes or figures that have equal angles or the same shape but not the same size.

7. Draw the following triangles on the board.

Their corresponding angles and sides are equal.



Triangle ABC is congruent to triangle RQP

$$\triangle ABC \cong \triangle RQP$$

$$\begin{array}{ll} \angle A = \angle R & \overline{AB} = \overline{QR} \\ \angle B = \angle Q & \overline{BC} = \overline{PQ} \\ \angle C = \angle P & \overline{AC} = \overline{PR} \end{array}$$

8. Demonstrate that if two figures are congruent then their corresponding sides and angles are also congruent.
9. Divide the participants into 4 groups.
10. Assign one postulate for congruency between triangles (SSS, SAS, ASA, RHS) to each group.
11. Ask the groups to use information from pg. 158-159,159, Textbook Grade8 or internet for their presentation.
12. After 5 minutes, ask each group to present their postulate.
13. Take whole class feedback and clarify any misconceptions.

CONCLUSION / SUM UP/ WRAP UP:

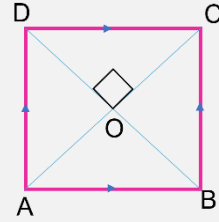
 07 Minutes

1. Divide the participants into 8 groups.
2. Assign each group one session of the module.
3. Ask them to make a poster to review the key learning points of their assigned session.
4. Put the poster on the wall.
5. Walk around and look at the posters from other groups.
6. Conclude the session by revisiting the SLOs' of each session.

Handout 8.1: Worksheet

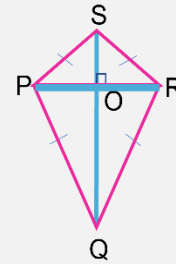
Square

- All four sides are of _____.
i.e., $m\overline{AB} = \text{_____} = m\overline{CD} = \text{_____}$
- Four angles each of measure equal to _____.
i.e., $m\angle A = \text{_____} = m\angle C = \text{_____} = 90^\circ$
- Two pairs of parallel sides. i.e., $\overline{AB} \parallel \text{_____}$ and $\overline{BC} \parallel \text{_____}$.
- Diagonals are of equal length i.e., $m\overline{AC} = \text{_____}$.
- Diagonals bisect each other at point O i.e., midpoint of both diagonals is _____.
- Diagonals are perpendicular to each other i.e., $m\angle AOB = \text{_____} = m\angle COD = \text{_____} = 90^\circ$
- Since $\overline{AB} \parallel \overline{DC}$, so alternate angles formed are _____ i.e., $m\angle CAB = \text{_____}$ etc.



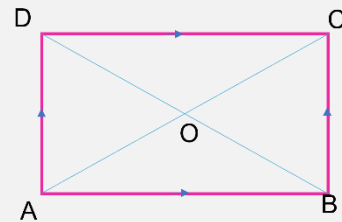
Kite

- Two pairs of adjacent sides are of _____ length.
i.e., $m\overline{PQ} = \text{_____} = m\overline{PS} = \text{_____}$
- One pair of opposite angles are _____.
i.e., $m\angle P = \text{_____}$.
- Diagonals are _____ to each other.
- One diagonal QS _____ the other diagonal PR.



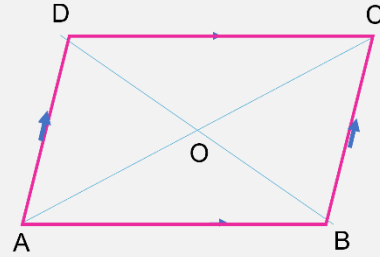
Rectangles

- It has _____ sides. Opposite sides are _____ in length.
i.e., $m\overline{AB} = \text{_____}$ and $m\overline{AD} = \text{_____}$
- Each interior angle is equal to _____.
i.e., $m\angle A = \text{_____} = m\angle C = \text{_____} = 90^\circ$
- Two pairs of parallel sides. i.e., $\overline{AB} \parallel \text{_____}$ and $\overline{BC} \parallel \text{_____}$.
- The following alternate angles are formed with the diagonals.
 $m\angle BAC = \text{_____}$ and $m\angle ABD = \text{_____}$ etc.
- Diagonals are of _____ length i.e., $m\overline{AC} = \text{_____}$.
- Diagonals bisect each other at point _____ and the midpoint of diagonal AC = midpoint of diagonal _____.



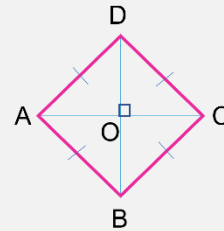
Parallelogram

- It has _____ sides. Opposite sides are of _____ length.
i.e., $m\overline{AB} = \underline{\hspace{2cm}}$ and $m\overline{AD} = \underline{\hspace{2cm}}$
- Two pairs of _____ sides.
i.e., $\overline{AB} \parallel \underline{\hspace{2cm}}$ and $\overline{BC} \parallel \underline{\hspace{2cm}}$.
- The following alternate angles are formed with the diagonals.
 $m\angle BAC = \underline{\hspace{2cm}}$ and $m\angle ABD = \underline{\hspace{2cm}}$ etc.
- Opposite angles are equal i.e., $m\angle A = \underline{\hspace{2cm}}$ and $m\angle B = \underline{\hspace{2cm}}$
- Adjacent angles are supplementary due to parallel lines i.e.,
 $m\angle A + \underline{\hspace{2cm}} = 180^\circ$ and $m\angle B + \underline{\hspace{2cm}} = 180^\circ$
($m\angle A, m\angle D$) and ($m\angle B, m\angle C$) are two pairs of interior angles of parallel lines.
- Diagonals bisect each other at point _____ and the midpoint of diagonal AC = midpoint of diagonal _____.



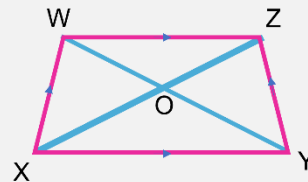
Rhombus

- All four sides are of _____ length.
i.e., $m\overline{AB} = \underline{\hspace{2cm}} = m\overline{AD} = \underline{\hspace{2cm}}$
- Opposite sides are _____.
i.e., $\overline{AB} \parallel \underline{\hspace{2cm}}$ and $\overline{BC} \parallel \underline{\hspace{2cm}}$.
- Diagonals are not of equal length and they bisect the angles $m\angle A$, $m\angle B$, $m\angle C$, and $m\angle D$.
- Diagonals bisect each other at _____ angle at point O and midpoint of diagonal AC = midpoint of diagonal _____.
- Opposite angles are _____ i.e., $m\angle A = \underline{\hspace{2cm}}$ and $m\angle B = \underline{\hspace{2cm}}$

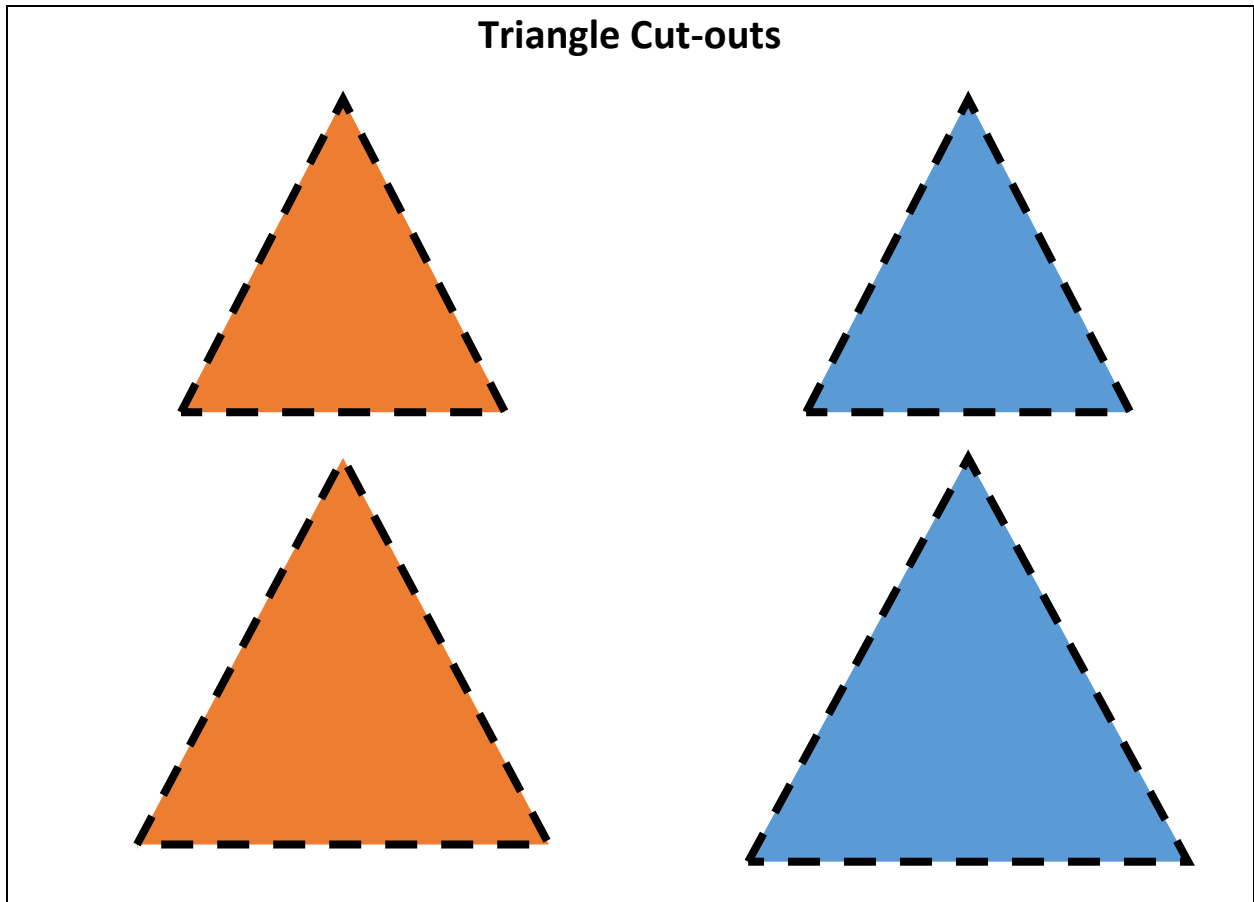


Trapezium

- Only one pair of parallel sides i.e., $\overline{XY} \parallel \underline{\hspace{2cm}}$.
- Two pair of interior angles of parallel line.
i.e., $m\angle WXY + m\angle YWZ = \underline{\hspace{2cm}}$ and
 $m\angle XYZ + m\angle WZY = \underline{\hspace{2cm}}$.
- The pair of alternate angles of parallel lines.
i.e., $m\angle YXZ = \underline{\hspace{2cm}}$ and $m\angle XYW = \underline{\hspace{2cm}}$.
- Vertically opposite angles at point O are:
 $m\angle XYZ = \underline{\hspace{2cm}}$; $m\angle XOW = \underline{\hspace{2cm}}$.



Handout 8.2: Worksheet



**QUAID-E-AZAM ACADEMY FOR
EDUCATIONAL DEVELOPMENT, PUNJAB**

