GPE Transforming Education

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Mathematics

Lesson Plans

For Elementary School Teachers (Grade 6-8)

QUAID-E-AZAM ACADEMY FOR EDUCATIONAL DEVELOPMENT

Quaid-e-Azam Academy for Educational Development (QAED)
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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 support of Global Partnership for Education (GPE) and technical support from UNICEF as Implementing Partner Grant Agent. The lesson plans are prepared for the support and professional development of teachers from elementary schools established by School Education Department (SED) under Afternoon School Programme (ASP). QAED will also use these lesson plans for the support and professional development of all elementary 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. Muneeza 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. Saleem Khan	Designer	Freelance
3.	Mr. Muhammad Shahid	Designer	Freelance

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ABBREVIATIONS

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

FORWARD

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 Lesson Plans

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 lesson plans have been specially designed to provide with all the tools and materials necessary to effectively teach elementary level students in classrooms. Total 10 sample mathematics lesson plans have been given in this booklet. These lesson plans include necessary information for teachers regarding the relevant topic, SLOs based teaching and learning activities and assessments for learning to improve interactive teaching and learning environment in the classrooms.

Instructions for Teachers

Following are some of the instructions for teachers:

1. Read each lesson plan carefully before delivering it in the classroom, review all the Handouts, Worksheets, and Video resources according to the designed activities.
2. Must read the 'information for teachers' section given at the start of each lesson plan for more clarity and understanding of the topic.
3. Practice the lesson plans and prepare all the required materials/handouts / charts.
4. Ensure the availability of all the required teaching and learning materials like whiteboard/ blackboard, marker, experimental resources, charts and required material of the activities mentioned.
5. Provide hands on and tangible experience to the students to learn the concepts and connect it with daily life examples for more clarity and comprehension.
6. Make sure seating arrangement of the classroom is made according to the lesson plans and supportive for cooperative learning and group work.
7. Ensure equal participation of all students in activities and discussions for learning. Make heterogenous, homogeneous, skill/interest based groups to create conducive learning environment for students.
8. Use scientific apparatus as well as low cost no cost materials to provide practical experience to the students.

It is hoped that these lesson plans will be helpful and useful for the teachers.

Wish you good luck

MATHEMATICS LESSON PLANS

Grade - 8	Lesson Plan 1: Rational Numbers & Decimal Numbers	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. solve real-life situations/word problems involving calculation with decimals and fractions

MATERIALS

- Textbook Grade 8
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- 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
- A decimal is a number that consists of a whole and a fractional part. Decimal numbers lie between integers and represent numerical value for quantities that are whole plus some part of a whole.
- Steps for solving word problems/real life situations:
  1. **Read the word problem/real-life situation:** This step involves carefully reading and understanding the problem or situation presented. Take note of any important details, relationships, and specific requirements mentioned.
  2. **Identify the key information:** In this step, identify the relevant information needed to solve the problem. Determine the given values, variables, and any other relevant data mentioned in the problem.
  3. **Highlight the word which shows operation:** This step helps in identifying the mathematical operation or operations needed to solve the problem. Look for keywords or phrases that indicate addition, subtraction, multiplication, division, or other mathematical operations.
  4. **Change words into mathematical statements:** Convert the information and relationships described in the problem into mathematical equations or statements. This step involves translating the problem into a mathematical representation, using variables to represent unknown quantities, and clearly labeling known values.
  5. **Find the solution:** Apply the appropriate mathematical operations to the equations or statements you set up in step 4. Perform the necessary calculations and solve for the unknown quantity or quantities. Make sure to consider units, decimal places, or any specific conditions mentioned in the problem.

INTRODUCTION

1. Ask students to define decimal/ fractions as part of a whole number.
2. Ask the students if they have ever encountered situations in their daily lives where they needed to use decimals or fractions.
3. Discuss some real-life examples where decimals and fractions are commonly used, such as cooking recipes, measurements, and financial transactions.

DEVELOPMENT

Activity 1:

1. Write their responses on the board and make a sequence of the level of an organization.

Activity 2:

1. Briefly review the basic operations of decimals and fractions, including addition, subtraction, multiplication, and division.
2. Provide examples on the board and solve them together as a class.
3. Encourage the class to provide step by step solution to the questions.
4. Clarify any misconceptions.

$\frac{1}{4}$ x $\frac{15}{2}$	**325.650 + 410.350**
$\frac{20}{5} \div \frac{4}{5}$	**137.5 ÷ 5.5**

Activity 3:

1. Explain to the students that in today's lesson, they will learn how to solve real life situations involving decimals and fractions.
2. Write the steps of solving word problems/real life situations on the board/chart paper.
   - 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.
3. Write the following real-life situation on the board. (Example 3, pg.5 Textbook Grade 8)

   How many pieces of $\frac{1}{4}$ metre of ribbon can be cut from a ribbon which is $\frac{15}{2}$ metres long?
4. Model the process of solving the problem step by step on the board.

   Key information:

   Total length of ribbon = $\frac{15}{2}$ metres

   Length of each piece to be cut = $\frac{1}{4}$ metre

   Words that show operation: Can be cut (means to divide them into equal parts)

Mathematical form:

Number of ribbons = Total length of ribbon ÷ length of each piece of ribbon

Number of ribbons = $\frac{15}{2} \div \frac{1}{4}$

Solution:

Number of ribbons = $\frac{15}{2} \div \frac{1}{4}$

= $\frac{15}{2} \times \frac{4}{1}$ (changing divide into multiply by taking reciprocal)

= 15×2

Number of ribbons = 30

5. Repeat the same process with another real-life situation.
6. Write the following real-life situation on the board. (Example 4, pg.5 Textbook Grade 8)
   Azhar ran 325.650 km on a jogging track in the first month and 410.350 km in the next month. Calculate the total distance covered in both months. Also, tell how many kilometres did he cover per day in the first month?
7. With the help of students' input solve the real-life situation/ word problem.

Activity 4:

1. Divide students into pairs.
2. Each pair to do the following questions from Textbook, Unit 1, Ex-1.1 in their notebooks.
   Student A: Q6 **Student B: Q8**
3. Remind them to follow the problem-solving steps.
4. The students solve their individual questions and then share their notebooks with their paired students.
5. Student B will have to check Student A's work, by solving the question and vice versa.
6. Ask any volunteer pairs to share their solutions with the class.

CONCLUSION / SUM UP/ WRAP UP:

1. Sum up the lesson by asking students to recall the steps of solving word problems/real life situations.

∃ ASSESSMENT

1. Formative assessment has been carried out via Development: Activity 3.

% FOLLOW UP

1. Ask students to solve real-life situations given in Ex 1.1, Q7 and Q9 pg.06, Textbook Grade 8.

Total number of packets = 8

Words that show operation: How much (It means to find total amount of rice which means multiply)

Mathematical form:

Total mass of rice = Number of packets ÷ mass of each packet of rice

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

Solution:

Total mass of rice = $8 \times \frac{11}{2}$ (Converting mixed number to a fraction)

= 4×11 (simplification)

Total mass of rice = 44 Kilograms

Question # 8: If 230.75 kilograms of jaggery powder is to be packed equally in the packets, each packet contains 2.5 kg of jaggery powder. Find the number of required packets. Also, find how much jaggery powder will be there in 15 packets of mass 2.5 kg.

Solution part (a)

Key information:

Total mass of jaggery = 230.75 kilograms

Mass of each packet to be packed = 2.5 kilograms

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

Mathematical form:

Number of packets = Total mass of jaggery ÷ mass of each packet of jaggery

Number of packets = $230.75 \div 2.5$

Solution:

Number of packets = $230.75 \div 2.5$

= $\frac{203.75}{2.5}$ = 81.5

Number of packets = $81.5 \approx 82$ packets

Solution part (b)

Key information:

Mass of each packet = 2.5 kilograms

Total number of packets = 15

Words that show operation: How much (How much means to find total amount of jaggery powder which means multiply)

Mathematical form:

Total mass of jaggery powder = Number of packets ÷ mass of each packet

Total mass of jaggery powder = 15×2.5

Solution:

Total mass of jaggery powder = 15×2.5

Total mass of jaggery powder = 37.5 Kilograms

Grade – 6	Lesson Plan 2: Addition of Integers	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. Add up to 2-digits like and unlike integers

MATERIALS

- Textbook Grade 6
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

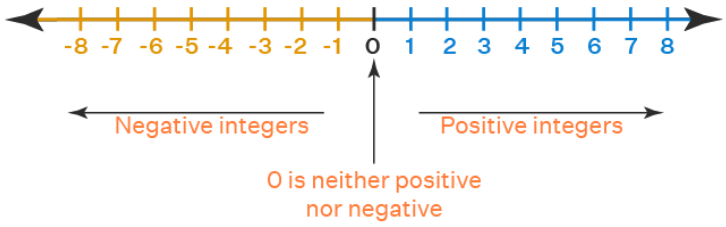
- The integers which have the same signs (like positive-positive or negative-negative). 2, 5 and -2, -5 are like integers.
- The integers which have opposite signs (like positive-negative or negative-positive). 2, -5 and -2, 5 are unlike integers.

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

INTRODUCTION

1. Draw a number line on the board.

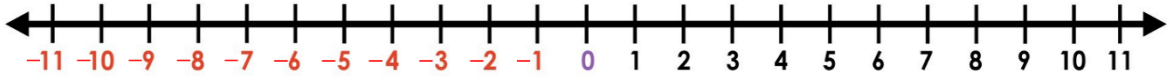


2. Write the following integers on the board: 7, -4, +3, -5, 0.
3. Ask a few volunteers to circle the given numbers on the number line.
4. Elicit from the students that positive integers are on the right side of 0, negative integers are on the left side 0 and 0 is neither positive nor negative.

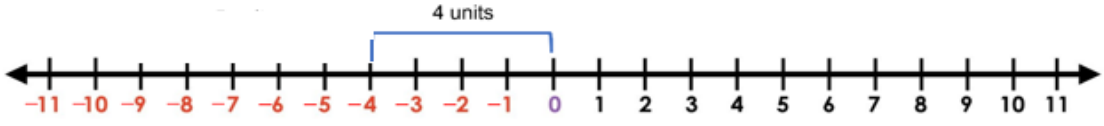
DEVELOPMENT

Activity 1:

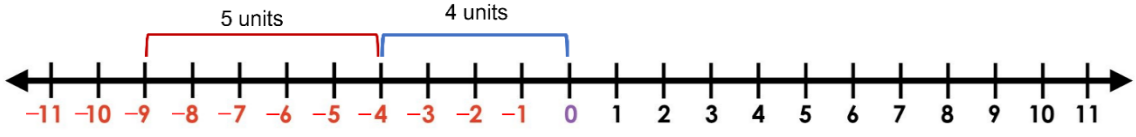
1. Ask students about like integers and unlike integers.
2. Elicit few examples and write on the board.
3. Tell the students that a number line can also be used to find the sum of integers.
4. Highlight that on the number line, when we add the positive integers, we move towards the right and for the negative integers we move towards the left.
5. Write the following question on the board using like integers (-4, -5).
6. Use the number line to find the sum of -4 and -5.
7. Draw the following number line on the board.



8. Consider “0” as starting point and move 4 steps towards left reaching at -4.



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



10. Deduce and share the result that the sum of two like integers is always addition with same sign. Hence, (-4) + (-5) = -9
11. Ask a few students to come up to the board and solve the like integers sums (-4, -7), (8, 6) using the number line method.
12. Encourage the class to provide feedback and corrections as needed.

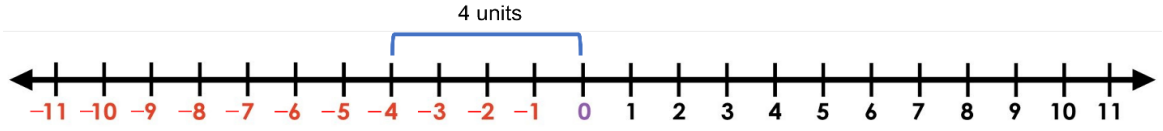
13. Ensure that enough practice is provided for the students to understand the concept.

Activity 2:

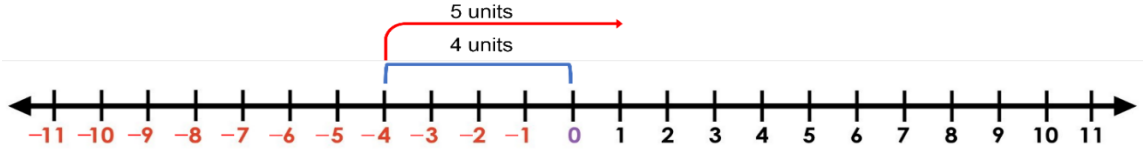
1. Use the same number line drawn on the board in the previous activity.
2. Write the following question on the board using unlike integers.

Use the number line to find the sum of – 4 and + 5.

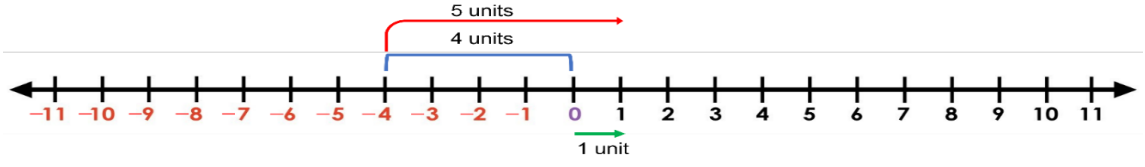
3. Consider "0" as a starting point and move 4 steps towards left on the number line.



4. Then, starting from -4, move 5 steps towards right till you have reached at point 1.



5. Explain that now the remaining units are the required answer.



6. Deduce and share the result that for unlike integers we always subtract and put the sign of the greater value. Hence, **(– 4) + (+5) = +1**
7. Ask a few students to come up to the board and solve the unlike integers sums using the number line method. **(16, – 11), (– 10, + 6).**
8. Encourage the class to provide feedback and corrections as needed.

Activity 3:

1. Divide the students into pairs and distribute the worksheet to each pair.
2. Instruct each pair to work together and solve the sums given on the worksheet using the number line method.
3. Once the pairs have completed the worksheet, encourage them to compare their answers with another pair.
4. Take random responses and check the answers.

Activity 3:

1. Divide the students into pairs and distribute the worksheet to each pair.
2. Instruct each pair to work together and solve the sums given on the worksheet using the number line method.
3. Once the pairs have completed the worksheet, encourage them to compare their answers with another pair.
4. Take random responses and check the answers.

CONCLUSION / SUM UP/ WRAP UP:

1. Sum up the lesson by consolidating the following points.

- On the number line, when we add the positive integers, we move towards the right and for the negative integers we move towards the left.
- The sum of two like integers is always addition with same sign.
- The sum of unlike integers is always subtraction with sign of the integer with the greater value.

ASSESSMENT

1. Ask the students to solve the following questions in their notebooks.
   - Use the number line to find the sum of -7 and -5.
   - Use the number line to find the sum of -9 and 5.

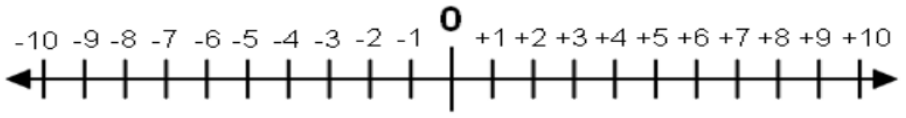
FOLLOW UP

1. Use the number line to simplify the given sums. Ex 3.1, Q1, pg.33, Textbook Grade 6

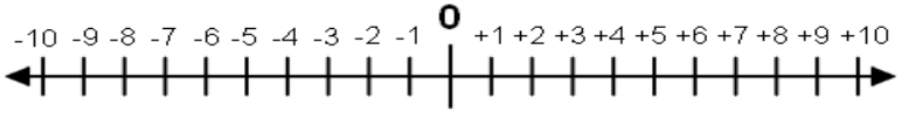
HANDOUT 1: WORKSHEET

Q. Use number line to simplify the following:

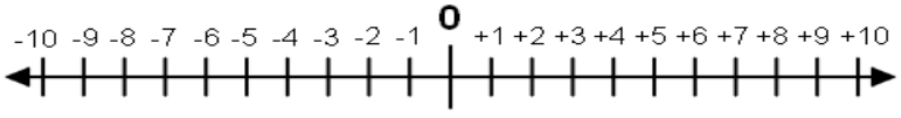
1. **4 + 3 = _____**



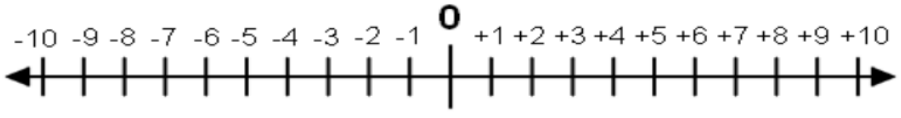
2. **7 + (-3) = _____**



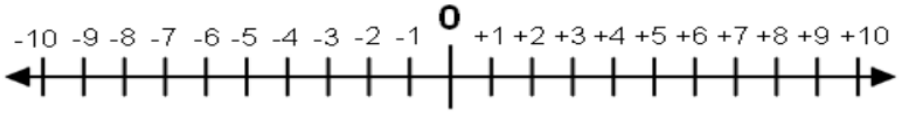
3. **-6 + (-3) = _____**



4. **-10 + 2 = _____**



5. **-2 + (-6)= _____**



Grade – 7	Lesson Plan 3: Ratio, Rate & Percentage	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. calculate increase and decrease in a ratio based on change in quantities

MATERIALS

- Textbook Grade 7
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- This lesson is in continuation of the Ratio, Rate and Percentage.
- It is expected that the students understand what is meant by ratio and percentage.
- It is important to note that ratios are always expressed in their simplest form.
- A ratio is a comparison of two or more quantities or values. They 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, for example: If there are 3 boys and 5 girls in a class, the ratio of boys to girls is 3:5.
- Equivalent ratios are ratios that have the same relative comparison but with different values. Two ratios are equivalent if they simplify to the same value when reduced to the simplest form, for example: The ratios 2:3 and 4:6 are equivalent because both simplify to 2:3.
- Steps for solving word problems/real life situations:
    1. **Read the word problem/real-life situation:** This step involves carefully reading and understanding the problem or situation presented. Take note of any important details, relationships, and specific requirements mentioned.
    2. **Identify the key information:** In this step, identify the relevant information needed to solve the problem. Determine the given values, variables, and any other relevant data mentioned in the problem.
    3. **Highlight the word which shows operation:** This step helps in identifying the mathematical operation or operations needed to solve the problem. Look for keywords or phrases that indicate addition, subtraction, multiplication, division, or other mathematical operations.
    4. **Change words into mathematical statements:** Convert the information and relationships described in the problem into mathematical equations or statements. This step involves translating the problem into a mathematical representation, using variables to represent unknown quantities, and clearly labeling known values.
    5. **Find the solution:** Apply the appropriate mathematical operations to the equations or statements you set up in step 4. Perform the necessary calculations and solve for the unknown quantity or quantities. Make sure to consider units, decimal places, or any specific conditions mentioned in the problem.

INTRODUCTION

1. Divide students into pairs.
2. Inform them that the teacher will ask a series of questions very quickly.
3. In pairs, write down the answers to these questions.
4. Read out all the questions one by one from the first column of the table given below.
5. After reading each question, give students 30 – 60 seconds to write down their answers.

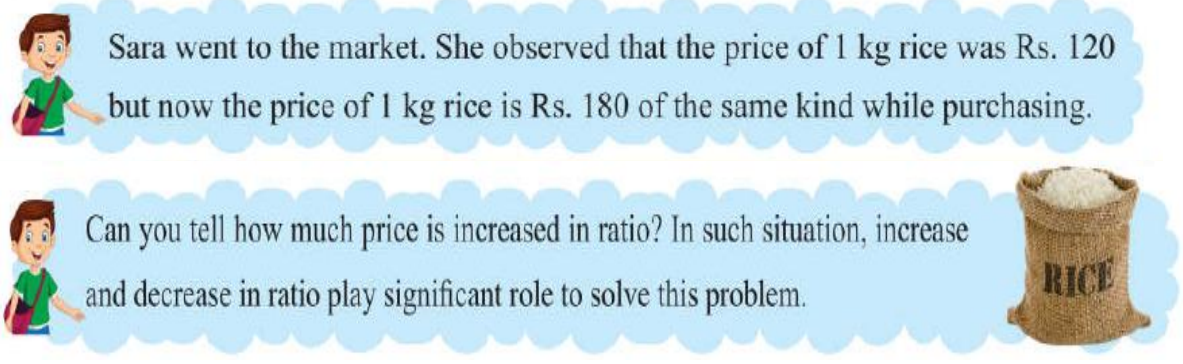
Questions	Answers
In the ratio $4:7$, which term is antecedent?	4
In the ratio $4:7$, which term is consequent?	7
Simplify the ratio $210:630$	1 : 3
12 is to **120**	1 : 10

6. Take a whole class feedback.

DEVELOPMENT

Activity 1:

1. Elicit the definitions of ratio and equivalent ratio.
2. Write the steps of solving word problems/real life situations on the board/chart paper.
   - 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.
3. Divide the students into groups.
4. Write the following situation on the board.



5. Ask the students to read the statement and note down important information in their notebooks.
6. Remind the students to use the problem-solving strategy written on the board.
7. Allow a few minutes for the groups to brainstorm the solution of the given word problem. answers.

8. After the brainstorming is complete, invite one student from each group to share their ideas with the rest of the class.
9. When all groups have shared their ideas, write the solution on the board.

Activity 2:

1. Ask students to open pg. 46 of the Textbook Grade 7 and tell them we will be doing some exercise questions.
2. Write down Question 2 (ii) and Question 3 (iii) on the board.
3. Solve each question on the board with the help of the students.
4. Clarify any misconceptions.
5. Now divide students into groups of 4.
6. In each group, two students will work on Q.2 and two students will work on Q.3
7. Allocate 5 minutes to the groups to complete the questions.
8. Now instruct the first pair of students to explain their working to the second pair in one minute and vice versa for the second pair.
9. Take responses randomly for answer to each question and use these to allow students to check their work.

CONCLUSION / SUM UP/ WRAP UP:

1. Ask students to think about the main points covered in the lesson.
2. Tell them that they will have to explain them within a minute.
3. Ask any two or three students to volunteer to recap the main points covered in the lesson in one minute only.

∃ ASSESSMENT

1. Exercise 1.11, Page 46: Q4 and Q5. Textbook Grade 7

% FOLLOW UP

1. Review Exercise 1(b), Page 79: Q2, Q3 and Q4, Textbook Grade 7.

Grade – 8	Lesson Plan 4: Financial Arithmetic	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. Convert Pakistani currency to well-known international currencies and vice versa.

MATERIALS

- Textbook Grade 8
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- A foreign currency exchange rate is a price that represents how much it costs to buy the currency of one country using the currency of another country.
- Using the exchange rate, we can convert between Rupees (Pakistani currency) and foreign currencies.

INTRODUCTION

1. Begin the lesson by asking the following questions:
   - What is meant by currency?
   - What is the currency of Pakistan?
   - How many international currencies do you know?
   - Do you know the current rate of any currency?
2. Take their responses and appreciate their participation.

DEVELOPMENT

Activity 1:

1. Begin by asking the students if you are going to Saudi Arabia to perform Umrah, which currency will you take along with you? (Answer: Riyal)
2. Explain to them that if you have Pakistani Rupees and you want to exchange them for Riyal, you will bring your Pakistani Rupees to the currency exchange store and buy Riyal with them.
3. Elicit that the exchange rate between two currencies is the price of one currency in terms of the other.
4. Take a real life object in hand Tell them that currency conversion rates are not permanent, they vary day by day.
5. We use these currency rates to convert Pakistani currency to different international

currencies.

6. Discuss the table of current exchange rates of some international currencies given in Textbook Grade 8 on pg. 63.

Country	Currency	Symbol	Buying (PKR)	Selling (PKR)
US	Dollar ($)	$	181.70	183
UK	Pound (£)	£	237.5	240
Saudi Arabia	Riyal (SR)	SAR	48	48.75
India	Rupee	₹	2.03	2.10

7. Write the following example on the board:

   Saud wants to exchange Pakistani rupees (PKR) 50,000 to US Dollars. How many US Dollars will he receive?

8. Write the given information on the board.
   Amount to be converted = 50,000
   Rate of one Dollar = 181.70
9. Explain to them that to convert Pakistani rupees into dollar, divide Pakistani rupees with the current exchange rate.

   Number of Us Dollars = $\frac{50,000}{181.70}$ = US $ 275.2

10. Repeat the same process with Example 2.
11. Encourage students to provide solutions.
12. Take random feedback and clarify any misconceptions.

Activity 2:

1. Divide the students into 4 groups.
2. Assign any one question from Ex- 1.19, Q.1- 4, and Textbook Grade 8 pg.63 to each group.
3. Ask them to discuss within their group and solve the question.
4. Ask one of the group members to solve the question on the board.
5. Take random feedback to clarify any misconceptions.

Activity 3:

1. Divide students into pairs.
6. Ask each pair to solve Q.5 & 6 from Ex- 1.19, Textbook Grade 8 pg. 63 in their notebooks.
7. The students solve their individual questions and then share their notebooks with their paired students.
8. Ask any volunteer pairs to share their solutions with the class.
9. Appreciate their work.

CONCLUSION / SUM UP/ WRAP UP:

1. Sum up the lesson by asking students to recall the steps of conversion of currencies.

∃ ASSESSMENT

1. Assign Q.7 & 8 from Ex- 1.19, Textbook Grade 8 pg. 63 on their notebooks.

% FOLLOW UP

1. Ask students to find more information on conversion of currencies and make an informative booklet.

Grade – 8	Lesson Plan 5: Insurance	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. solve real life problems involving insurance

MATERIALS

- Textbook Grade 8
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- Insurance is a system of protecting or safeguarding against risk or injuries. It provides financial protection for property life health etc., against specified contingencies such as death loss or damage and involving payment of regular premium in return for a policy guarantee.
- The written contract is called the insurance policy.
- The party bearing the risk is the insurer or assurer and the party whose risk is covered is known as insured or assured.
- There are many different types of insurance including health, life, vehicle, property etc.
- Depreciation refers to the gradual decrease in the value of an asset over time due to factors such as wear and tear, obsolescence, or age. It is a common concept in accounting and finance used to allocate the cost of an asset over its useful life.
- Life insurance guarantees a specific sum of money to the nominated person authorized by the insured to receive this sum upon his death. Life insurance sometimes includes financial coverage in case of disability or long-term nursing.
- Vehicle insurance covers the risk of accidents, fire, or any kind of damage to the vehicles or property. In vehicle insurance the premium is some percentage of the actual value of the vehicle.
- For solving word problems/real life situations:
  1. **Read the word problem/real-life situation:** This step involves carefully reading and understanding the problem or situation presented. Take note of any important details, relationships, and specific requirements mentioned.
  2. **Identify the key information:** In this step, identify the relevant information needed to solve the problem. Determine the given values, variables, and any other relevant data mentioned in the problem.
  3. **Highlight the word which shows operation:** This step helps in identifying the mathematical operation or operations needed to solve the problem. Look for keywords or phrases that indicate addition, subtraction, multiplication, division, or other mathematical operations.
  4. **Change words into mathematical statements:** Convert the information and

relationships described in the problem into mathematical equations or statements. This step involves translating the problem into a mathematical representation, using variables to represent unknown quantities, and clearly labeling known values.

5. **Find the solution:** Apply the appropriate mathematical operations to the equations or statements you set up in step 4. Perform the necessary calculations and solve for the unknown quantity or quantities. Make sure to consider units, decimal places, or any specific conditions mentioned in the problem.

INTRODUCTION

1. Begin the lesson by asking students if they are familiar with the concept of insurance.
2. After taking random responses, provide a brief explanation of insurance, highlighting its purpose and the types of risks it covers.
3. Emphasize that insurance is an essential financial tool that helps individuals, families, and businesses protect themselves from unforeseen events and financial losses.

DEVELOPMENT

Activity 1:

1. Explain to the students that in today's lesson they will learn how to solve real life situations involving life insurance and vehicle insurance.
2. Briefly review the definition of life insurance and vehicle insurance, and depreciation.
3. Write the steps of solving word problems/real life situations on the board/chart paper.
   - 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.
4. Write the following Real-life situation (Example 15, pg.72 Textbook Grade 8).

   Saud got a life insurance policy of rupees 500 000. Rate of annual premium is 4.5% of the total amount of the policy whereas the policy fees is at the rate of 0.25%. Find the annual premium of the policy.

5. Model the process of solving the real-life situation step by step on the board.

   Key information:

   Policy amount (Principal amount) = Rs. 500,000

   Policy fees @ 0.25 %

   First premium @ 4.5 %

   Annually (once yearly)

   Words that show operation: Find the annual premium (refers to after a specific time)

   Mathematical form:

   Policy fees @ 0.25 % = $\frac{25}{100}$ x $\frac{1}{100}$ x principal amount

First premium @ 4.5 % = $\frac{45}{100}$ x $\frac{1}{100}$ x principal amount

Annual Premium = First premium + policy fee

Solution:

Policy fees @ 0.25 % = $\frac{25}{100}$ x 500000 x $\frac{1}{100}$ = Rs. 1250

First premium @ 4.5 % = $\frac{45}{100}$ x $\frac{1}{100}$ x 500000 = Rs. 22, 500

Annual Premium = First premium + policy fee

= Rs. 22,500 + Rs. 1250 = Rs. 23,750

Repeat the same process with another real-life situation.

6. Write the following real-life situation related to vehicle insurance on the board. (Example 17, pg.72 Textbook Grade 8)

   Khalid purchased an insurance policy for his car. The cost of the car is Rs.750 000. The rate of annual premium is 3% for two years and depreciation rate is 10%. Find the total amount he paid as premium.

7. With the help of students' input solve the real-life situation/ word problem.
8. Encourage students to use the problem-solving strategy written on the board.
9. Take random feedback and clarify any misconceptions.

Activity 2:

1. Divide students into pairs.
2. Ask each pair to solve Q.1 & Q.5 from Ex- 1.22, Textbook 8 pg. 73 in their notebooks.
3. The students solve their individual questions and then share their notebooks with their paired students.
4. Ask any volunteer pairs to share their solutions with the class.
5. Appreciate their work

CONCLUSION / SUM UP/ WRAP UP:

1. Sum up the lesson by asking students to recall the steps of solving real-life situations.

∃ ASSESSMENT

1. Ask the following questions?
   - How many types of insurances are there?
   - Differentiate between Life insurance and Vehicle insurance?
   - What is the formula to calculate annual premium?
2. What do we mean by depreciation?

% FOLLOW UP

1. Ask students to complete Ex. 1.22, Q. 2- 4, 6, 7 Textbook Grade 8 pg.73- 74

Grade – 8	Lesson Plan 6: Algebraic Expression	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. add and subtract two or more polynomials

MATERIALS

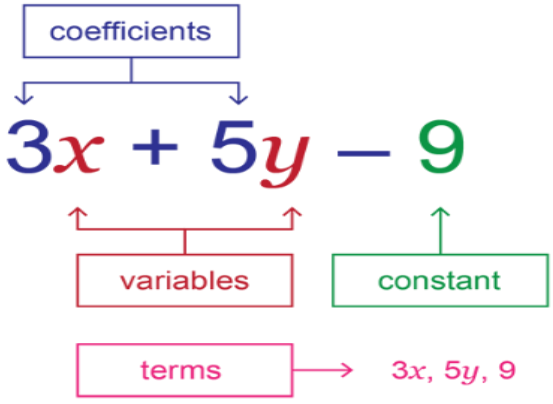
- Textbook Grade 8
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- A polynomial is an algebraic expression comprising of the whole number as an exponent of the variable. For example: $3x^2 + 2x + 4$
- A polynomial's degree is the highest or the greatest power of a variable in a polynomial equation. The degree indicates the highest exponential power in the polynomial (ignoring the coefficients). For example: 6x4 + 2x3+ 3 is a polynomial with degree 4.
- Monomials: It is a type of polynomial having a single term. $3x^2, 4xy^2$ etc.
- Binomials: A binomial is a polynomial having two terms. For example, $2y^2 + 7, 2xy + 4x$ etc.
- Trinomial: It is a type of polynomial that consists of three terms. For example, $7x^2 + 2x + 5$
- Rules for addition of polynomials:
  - **Rule 1:** Always take like terms together while performing addition.
  - **Rule 2:** Signs of all the polynomials remain the same.
- Methods to add or subtract the polynomials:
  - **Horizontal method:** In this method, all expressions are written in a row and then add the like terms.
  - **Vertical method:** In this method, each expression is written in a separate row. Such that the like terms are written below the like terms.

INTRODUCTION

1. Begin the lesson by reviewing the concept of polynomials and the terminology associated with them (coefficients, variables, exponents).
2. Write an algebraic expression $3x + 5y - 9$ on the board.
3. Elicit variables, constant, terms and co-efficient in the given expression.
4. Take random responses from the students and clarify any misconceptions.



DEVELOPMENT

Activity 1:

1. Begin by defining 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.
2. Remind students of the importance of combining like terms when adding polynomials.
3. Write two or three monomials on the board (e.g., $2x^2, 3xy^2, 7x^2$)and ask students to identify the like terms.
4. Elicit more examples of like and unlike terms and write on the board with students' input.
5. Explain that when adding polynomials, we combine like terms.
6. Tell the students to add polynomials, keep two rules in mind.
   - **Rule 1:** Always take like terms together.
   - **Rule 2:** Signs of all the polynomials remain the same.
7. Write the following question on the board:

   Add $4x^2 + 3x + 1$ and $5x^2 - x - 7$
8. Start by separating the like the terms 4x2 and 5x2,3x and –x, 1 and 7.
9. By arranging the terms in horizontal row, weget:

   $4x^2 + 5x^2 + 3x – x + 1 – 7$

   $= 9x^2 + 2x - 6$
10. Remind them that the addition of polynomials always results in a polynomial of the same degree.

Activity 2:

1. Write the following example on the board.

   Subtract $2x^2 + 5x + 4$ from $5x^2 + 8x + 12$
2. Explain the Horizontal method with the help of following steps:
   - **Step 1:** Arranging the like terms in descending order.
   - **Step 2:** Enclose the part of the polynomial which to be deducted in parentheses with a negative (-) sign prefixed. Then, remove the parentheses by changing the sign of each term of the polynomial expression.
   - **Step 3:** Subtract the like terms to obtain the solution.

3. For the Vertical method, solve the same question on the board using the students' input.

Horizontal Method	Vertical Method
$5x^2 + 8x + 12$ - ($2x^2 + 5x + 4$) =$5x^2 + 8x + 12 - 2x^2 - 5x - 4$ = $5x^2 - 2x^2 + 8x - 5x + 12 - 4$ = $3x^2 + 3x + 8$	$5x^2 + 8x + 12$ $+ 2x^2 + 5x + 4$ $3x^2 + 3x + 8$

Activity 3:

1. Divide students into pairs.
2. Allocate Horizontal Method to Student A and Vertical Method to Student B.
3. Each pair to do the following questions in their notebooks:
   - **Add $5x^2 + 15x + 7$, $x^2 + 8x - 12$**
   - **Subtract $y^2 - 2q^2 + 3r$ from$8y^2 + 6q^2 + 7r$**
4. The students solve their individual questions and then share their notebooks with their paired students.
5. Student B will have to check Student A's work, by solving the question and vice versa.
6. Ask any volunteer pairs to share their solutions with the class.

CONCLUSION / SUM UP/ WRAP UP:

Conclude the lesson by consolidating the following:

1. Combine the like terms to add or subtract the polynomials.
2. If a term is missing, we can write '0' instead to avoid confusion while arranging terms for addition or subtraction.
3. In subtraction, the signs of the subtrahend will change.
4. While adding or subtracting the polynomials, the power of the variables remains the same.

∃ ASSESSMENT

1. Formative assessment has been carried out via Development: Activity 3.

% FOLLOW UP

1. Ask the students to solve Q.3 & 4 from Ex-2.3, Textbook Grade 8 pg.90.

Grade – 6	Lesson Plan 7: Volume and Surface area of Cube	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. Calculate the surface area and volume of any simple 3D shape

MATERIALS

- Textbook Grade 6
- Writing board
- Marker/chalk

INFORMATION FOR TEACHERS

- A cube is a three dimensional solid formed by 6 identical square surfaces.
- It has 6 surfaces, 8 vertices and 12 edges.
- All its surfaces are equal in area and all its edges equal in length.
- Area of surface = 6 × Area of one square
- The amount of the space which any object occupies in the three dimensions is called "volume".

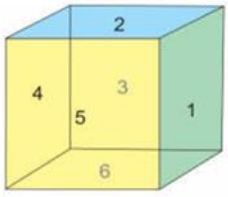
INTRODUCTION

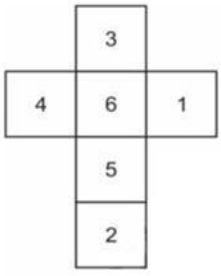
1. Ask students to identify 2-D shapes and 3-D shapes around them, e.g., duster, books, dice, rubber, etc.
2. Elicit the formula to calculate the area of a square. (Area = l x l)
3. Divide the class into pairs.
4. Ask them to calculate the area of a square with different lengths. (l=5, l=9, l= 15)
5. Take random responses to clarify any misconceptions.

DEVELOPMENT

Activity 1:

1. Ask students to give some examples of a cube. (dice, ice cube, room, etc.)
2. Draw the net of a cube on the board.





3. With the students' input, count the faces of a cube, emphasizing on the shape of each face as an identical square.
4. State that a cube is a 3-dimensional solid formed by 6 identical square surfaces.
5. Tell students if each side of every face of a cube the length has "a", then we find the area of the cube by adding areas of all its faces.

   = $\mathbf{a^2 + a^2 + a^2 + a^2 + a^2 + a^2}$

   = $\mathbf{6\ a^2}$
6. Tell them this is called the surface area of a cube.

   Area of surface of a cube = 6 a^2
7. To calculate the volume of the cube, we will use the base area and the height of the cube.

   Base area of cube = **length × breadth**

   = $\boldsymbol{a \times a = a^2}$

   Height of cube= **a**

   Volume of cube = Base area of cube × height of cube

   = $\boldsymbol{a^2 \times a = a^3}$
8. Provide ample examples on the board and solve them together as a class.
9. Encourage the class to provide step by step solution to the questions.

Activity 2:

1. Divide students into pairs.
2. Write the following questions on the board.

   Q1. A room is shaped like a cube. Its measurement is 9m on each edge. What is the total surface area of 5 such room?

   Q2. A cubicle box measures 15 centimeters on each edge. What is the total surface area of 3 such boxes.
3. Each pair to do the following questions in their notebooks:

   Student A: Q1 **Student B: Q2**
4. The students solve their individual questions and then share their notebooks with their paired students.
5. Student B will have to check Student A's work, by solving the question and vice versa.
6. Ask any volunteer pairs to share their solutions with the class.

CONCLUSION / SUM UP/ WRAP UP:

5. Ask students to think about the main points covered in the lesson.
6. Tell them that they will have to explain them within a minute.
7. Ask any two or three students to volunteer to recap the main points covered in the lesson in one minute only.

∃ ASSESSMENT

1. Formative assessment has been carried out via Development: Activity 2.

% FOLLOW UP

1. Ask students to do Q.1(ii), 4 & 5, Ex 18.3, pg.121, Textbook Grade 6

Grade – 7	Lesson Plan 8: Measurement of Distance, Time and Speed	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. Differentiate between uniform and average speed.

MATERIALS

- Textbook Grade 7
- Writing board
- Marker/chalk
- Traffic cones/markers
- ball
- measuring tape
- stopwatches

INFORMATION FOR TEACHERS

- This lesson reviews the concept of speed and allows students to understand how average speed differs from uniform speed.
- For this lesson, the class should be scheduled in an open space such as ground or courtyard.
- Traffic cones will be used as markers. In case of unavailability, you can use large rocks, filled bottles, chairs, lines drawn with chalk etc.
- It is expected that the students understand the concept of ratio and rate.
- Speed is the distance traveled per unit of time. It is how fast an object moves.
- The average speed of a body is the total distance traveled divided by the total time taken to cover this distance.
- Uniform Speed: A body has a uniform speed if it travels equal distances in equal intervals of time.

INTRODUCTION

1. Begin by informing the students that they will be doing a practical mathematics lesson today.
2. Take the students to the designated space and ask them to stand in a circle.
3. Pick up the ball in your hand and give the students the following instructions:
   - I will be throwing this ball to you randomly and you catch it.
   - The student who catches the ball will have to answer a question.
   - The students that answer correctly will get to throw the ball to the next student.
   - Any student who gives an incorrect answer will move to stand at the center of the circle.

4. Once the students are clear about the instructions, ask them a series of questions to review the previous lesson, revise definition of ratio and rate, units used for distance and time, and converting between units of distance as well as time.
5. Spend no more than 5 minutes on this activity.
6. Once completed ask all students to stand together in a group on one side to begin with instruction for the next activity.

DEVELOPMENT

Activity 1:

1. Divide students into groups of 4.
2. Provide each group with the following: one stopwatch, one measuring tape, 5 Traffic cones.
3. Each group should have their notebooks and pens with them also.
4. Give the following instructions to the students:
   - 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 notebook and pen and will be noting down the measurements in table given below.
   - 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.
5. Before beginning, ask recorders of each group to make a table as follows, in their notebook:

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

6. Allow 10 minutes for this activity. Some groups will finish early, and some will finish later, depending on the speed of the "runner".
7. For the next 5 minutes, each group should calculate speed and complete the table.
8. Now ask all groups to calculate the average speed by using total distance over total time.
9. Allow students to discuss their results with other groups.
10. Elicit few examples of uniform speed like movement of clock hand, motion of earth around the sun, etc.
11. Now ask them to differentiate between uniform and average speed.
12. Carry out a whole-class discussion on it.
13. Take random feedback and clarify any misconceptions.

Activity 2:

1. Divide students into pairs.
2. Ask each pair to solve Q.2 from Ex- 3.4, Textbook Grade 7 pg. 124in their notebooks.
3. The students solve their individual question and then share their notebooks with their paired students.
4. Ask any volunteer pairs to share their solution with the class.
5. Appreciate their work.

CONCLUSION / SUM UP/ WRAP UP:

1. Ask students to think about the main points covered in the lesson.
2. Tell them that they will have to explain them within a minute.
3. Ask any two or three students to volunteer to recap the main points covered in the lesson in one minute only.

∃ ASSESSMENT

1. Formative assessment has been carried out via Development: Activity 2.

% FOLLOW UP

1. Ask the students to find information about Average speed and Uniform speed.

Grade – 8	Lesson Plan 9: Postulates for congruency between triangles	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. apply the following postulates for congruency between triangles:
   - $SAS \cong SAS$
   - $SSS \cong SSS$
   - $ASA \cong ASA$
   - $HS \cong HS$

MATERIALS

- Textbook Grade 8
- marker / chalk
- worksheet (SSS postulate)
- handouts (reading materials for activity 2)
- rulers
- Triangle cut-outs

INFORMATION FOR TEACHERS

- This lesson is a continuation of practical geometry.
- It is expected that the students understand the different types of triangles, are aware of construction methods and can measure their sides and angles.
- It is expected that the students understand the terms congruence and similarity.
- For the lesson, you will need chart paper triangle cut-outs of various sizes. Ensure you have:
  - Two pairs of similar triangles, each pair a different size.
  - Two pairs of congruent triangles, each pair a different size.
  - Triangles made of different colors.

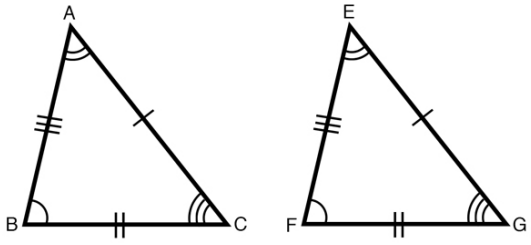
INTRODUCTION

1. Begin the lesson by reviewing “congruency and similarity”.
2. Hold up a pair of cut-outs of triangles and as a whole class, ask students to determine whether these are congruent or similar.
3. Repeat with the rest of the cut-outs. Where needed, guide the students to the correct answer, by placing the two cut-outs on top of each other.
4. Use the discussion to write the statement on the board:
   Two figures are congruent if these figures have exactly the same shapes and sizes.
5. Remind students that measurements tell us whether triangles are congruent. Their color and texture do not matter.

∀ DEVELOPMENT

Activity 1:

1. Begin the lesson by pasting two cutouts of identical triangles on the board and label them as shown in the figure below:



2. Ask one student to volunteer to come to the board and measure side AB and EF of each triangle respectively.
3. Note the measurement next to the side.
4. Repeat the same with sides AC / EG and BC / FG by calling two other students to the board.
5. Allow the students to reach the conclusion that since all three sides are equal of both triangles, the two triangles are congruent.
6. Now distribute worksheet 1 and allow students 3 minutes, to individually identify pairs of congruent triangles.
7. Circulate around the class, facilitating where required.
8. Take 2-3 random responses to allow for identification of all congruent pairs of triangles.
9. Summarize that one of the ways to determine congruency is to ensure all three sides are identical on both the triangles.
10. State that this is one of the postulates that can be used to determine congruency.
11. On the board write down:

    Postulate 1: All three sides of one triangle are equal to all three corresponding sides of the other triangles, i.e., $SSS \cong SSS$
12. Announce that there is a total of four such postulates that can be used.

Activity 2:

1. Divide the class into groups of three students each.
2. Assign numbers such as 1, 2 and 3.
3. Ask all students tagged “1” to get together to form a team on one side, those tagged “2” on one side and the ones tagged “3” on another side.
4. Ask each group to read the information given on pg. 158-159, Textbook Grade 8.
   - Team 1 - $SAS \cong SAS$
   - Team 2 - $RHS \cong RHS$
   - Team 3 - $ASA \cong ASA$
5. Allow 5 minutes for each team to go through their reading material, discuss with each other.
6. After the time is up, ask students to go back to their original groups.
7. Instruct each student to explain their learning to their group members, turn by turn.

8. Allow 6 minutes for this discussion.
9. While the students are working, circulate amongst the groups and help where the students are challenged.
10. By taking random responses, write down the remaining postulates on the board.

    Postulate 2: Two sides of one triangle and their included angle are equal to the two corresponding sides and included angle of the other triangle, i.e., $SAS \cong SAS$

    Postulate 3: Two angles of a triangle their included side are equal to the two corresponding angles and included side of the other triangle, i.e., $ASA \cong ASA$

    Postulate 4: The hypotenuse and one side (base or altitude) of a triangle are equal to the corresponding hypotenuse and one side of the other triangle, i.e., $RHS \cong RHS$

11. Discuss any misconceptions that students may have.
12. Ask students to remain in their groups and solve the following questions from their book:

    Q.2 & 3, Ex- 4.1, pg. 160, Textbook Grade 8

13. Take random feedback and clarify any misconceptions.

CONCLUSION / SUM UP/ WRAP UP:

1. Ask students to think about the main points covered in the lesson.
2. Tell them that they will have to explain them within a minute.
3. Ask any two or three students to volunteer to recap the main points covered in the lesson in one minute only.

∃ ASSESSMENT

1. Assign Q.4 from Ex- 4.1, pg.160, Textbook Grade 8

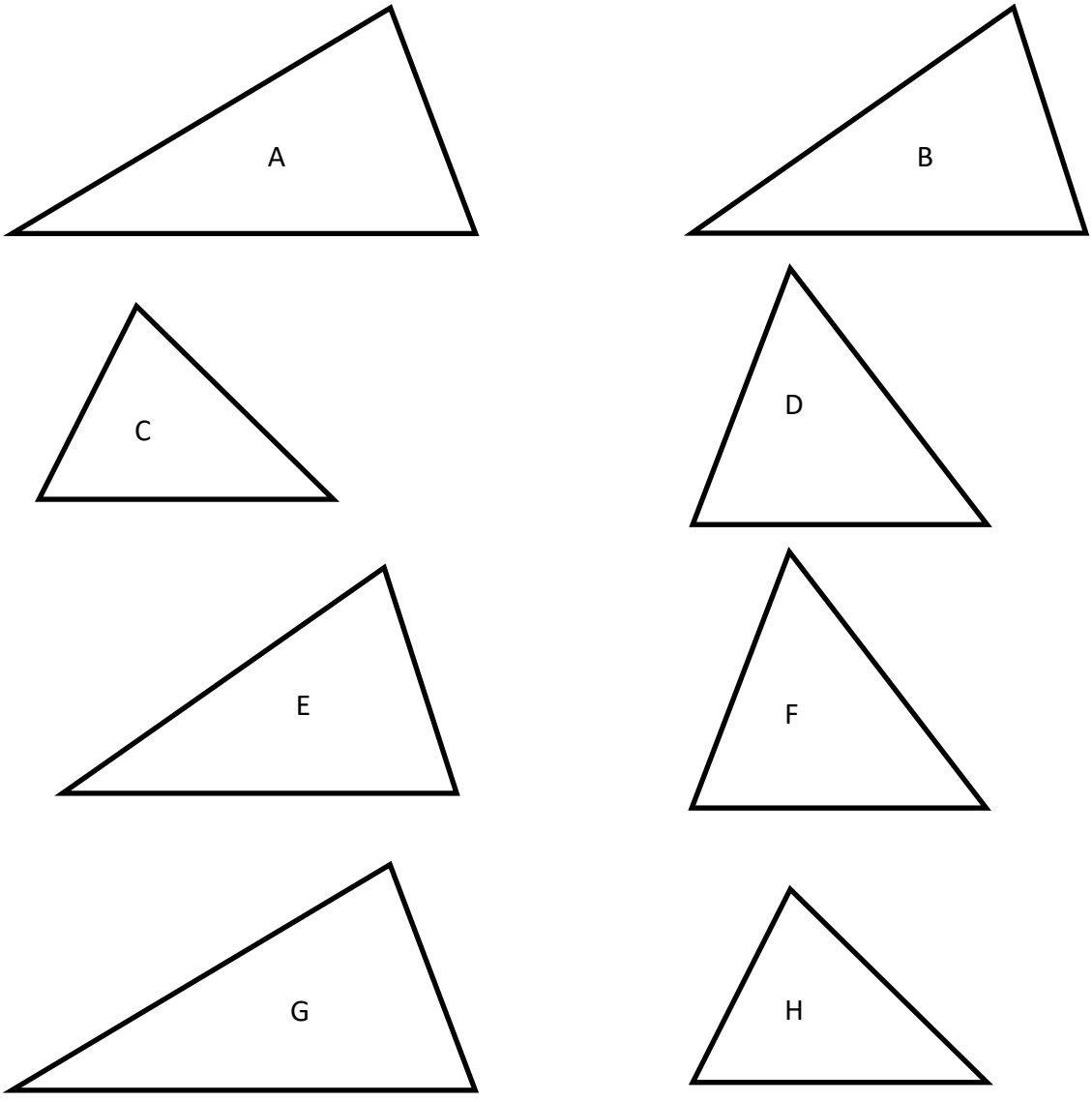
% FOLLOW UP

1. Ask students to make a booklet about the four postulates for congruency between triangles.

Handout 9: Worksheet

Instructions:

Identify all pairs of congruent triangles below, by making measurements using your rulers.



Grade – 8	Lesson Plan 10: Different types of quadrilaterals	Time: 40 Minutes

STUDENT LEARNING OUTCOMES

By the end of the lesson students will be able to:

1. construct different types of quadrilaterals (square, rectangle, parallelogram, trapezium, rhombus, and kite)

MATERIALS

- Textbook Grade 8
- marker / chalk
- handouts for construction of shapes
- geometry box for students

INFORMATION FOR TEACHERS

- This lesson is in continuation of practical geometry and will come towards the end of the unit.
- It is expected that the students understand congruency and similar triangles.
- Similar triangles are triangles that have the same shape, but their sizes may vary.
- Two triangles are said to be congruent if all three corresponding sides are equal and all the three corresponding angles are equal in measure.
- Teacher to make shape construction cards in advance using the information given onpg.161-166, Textbook Grade 8.

INTRODUCTION

1. Begin the lesson by asking the following questions:
   - What is meant by similar triangles?
   - What is meant by congruent triangles?
   - How many sides does a quadrilateral have?
   - What examples do you have for a rhombus?
   - What examples do you have for a parallelogram?
2. Take their responses and appreciate their participation.

DEVELOPMENT

Activity 1:

1. Arrange six stations in the classroom.
2. Stations are tables joined together with supplies for group work.

3. On each station, place a name tag saying one of the following:
   Square, rectangle, parallelogram, trapezium, rhombus, kite
4. On each station, place the relevant handout (describing the steps for construction of the shape, information given on pg.161-166, Textbook Grade 8), corresponding to the name tag.
5. Divide students into six groups.
6. Give the following instructions:
   - Keep your notebooks, geometry boxes and pencils with you during the entire activity.
   - Each group starts with one station.
   - Each station has a shape assigned.
   - When I say start, construct the shape assigned.
   - Use the handout available at your table.
   - You will have 4minutes to complete the task.
   - Once the time is up, I will say “Stop and Move”. Pick up your notebook, geometry and pencils and move clockwise to the next station.
   - Continue until you have completed all five stations.
7. While the students are working, circulate amongst the stations and help where the students are challenged.
8. Once the activity is completed, take random feedback.

CONCLUSION / SUM UP/ WRAP UP:

1. Ask students to think about the main points covered in the lesson.
2. Tell them that they will have to explain them within a minute.
3. Ask any two or three students to volunteer to recap the main points covered in the lesson in one minute only.

∃ ASSESSMENT

1. Ask students to attempt anyone questions from Ex. 4.2, Q. 1-12, Textbook Grade 8 pg.166

% FOLLOW UP

1. Ask students to complete Ex. 4.2, Q. 1-12, Textbook Grade 8 pg.166