MATHEMATICS

Grade 7

Teacher Guide

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Foreword

Education and development are closely related endeavours. This is the main reason why it is said that education is the key instrument in Ethiopia's development. The fast and globalised world we now live in requires new knowledge, skills, attitudes and values on the part of each individual. It is with this objective that the curriculum, which is a reflection of a country's education system, must be responsive to changing conditions.

It is more than fifteen years since Ethiopia launched and implemented the *Education and Training Policy*. Since then our country has made remarkable progress in terms of access, equity and relevance. Vigorous efforts also have been made, and continue to be made, to improve the quality of education.

To continue this progress, the Ministry of Education has developed a Framework for Curriculum Development. The Framework covers all pre-primary, primary, general secondary and preparatory subjects and grades. It aims to reinforce the basic tenets and principles outlined in the *Education and Training Policy*, and provides guidance on the preparation of all subsequent curriculum materials – including this teacher guide and the student textbooks that come with it – to be based on active-learning methods and a competency-based approach.

Publication of a new Framework and revised textbooks and teacher guides are not the sole solution to improving the quality of education in any country. Continued improvement calls for the efforts of all stakeholders. The teacher's role must become more flexible ranging from lecturer to motivator, guide and facilitator. To assist this, teachers have been given, and will continue to receive, training on the strategies suggested in the Framework and in this teacher guide.

Teachers are urged read this guide carefully and to support their students by putting into action the strategies and activities suggested in it. The guide includes possible answers for the review questions at the end of each unit in the student textbook, but these answers should not bar the students from looking for alternative answers. What is required is that the students are able to come up with, and explain knowledgeably, their own possible answers to the questions in the textbook.

Introduction

Mathematics is one of the school disciplines that focus on the enhancement of student's mathematical power and proficiency that lead to purposeful and worthwhile mathematical work. As a science of patterns and relationships, mathematics relies on **logic**, **reasoning, problem solving** and **creativity**. It is characterized by a cycle of learning that includes representation, manipulation and validation.

Nowadays learning mathematics is becoming helpful in almost every kind of human endeavor. It serves as a basic precise language for the other field of studies such as **science** and **technology.** All sciences use the language of mathematics to describe objects and events, to characterize relationships between variables, and to argue logically. It can be said that learning mathematics is essential in everyday life.
Mathematics involves certain interrelated learning elements such as:-

- Comprehension of mathematical terms, concepts, operations and relationships.
- Skill in carrying our procedures flexibly, accurately, efficiently and appropriately.
- Ability to formulate, represent and solve mathematical problems.
- Logical thought, reflection, explanation and justification.

The need to develop continuous assessment implementation teacher guide arise from the following basic assumptions:-

- Effective mathematics instruction requires periodic and constant flow of information about students learning progress or learning deficiencies.
- Repeated and regular assessment of students provides better picture of the instructional process for mathematics teacher.
- A system of continuous assessment in mathematics teacher helps to measure a wide range of mathematical skills (such as problem solving and critical thinking) that cannot easily be assesses by time-limit terminal examinations.
- Implementation of continuous assessment improves the motivation of students to work hard and helps to get involved in learning mathematics.

- The other support systems such as teacher's resource materials (Syllabus, text books, teachers guides) and refreshment courses should be in place to effectively implement.
- Finally it is possible to implement a system of continuous assessment in mathematics in spite of the increased effort time and energy it demands form both teachers and students.

Organization of this teachers Guide

This teacher guide is organized unit by unit. It contains the following major themes:

i. **Introduction**: **-** includes the role and rational and special Characteristics of learning the subject matter, guidelines on how to use the teacher guide and the nature of continuous assessment.
ii. **Competencies of each unit**: **-** drawn from mathematics syllabus of grade 7.
iii. Suggested teaching aids.
iv. Sub-unit competencies of each unit.
v. Sub-unit introduction of each unit.
vi. Teaching notes of each unit.
vii. Answers to Activities and Exercises.
viii. Continuous assessment.
ix. Answers to Miscellaneous Exercises for unit by unit.
x. Topics, period allotment and location chart.
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The Concept of Active learning and Continuous Assessment

What is Active Learning?

***Active learning*:-** as the name suggests, is a process where by students are actively engaged in the learning process, rather than "Passively" absorbing lectures. Students are rather encouraged to think, Solve problems, do activities carefully selected by the teacher, answer questions, formulate questions of their own, discuss, explain, debate or brain storm question , explore and disc over, work cooperatively in group to solve problems and work out project.

Teachers' are strongly advised to discuss and work out difficult questions. As far as possible the class should not be teacher centered. Attention should be given to the following points in motivating students to participate in the lesson through activities, class work, home work, Group work and reading the text book independently.

- Give students a chance to express theorems, definitions, properties and rules in their own for each unit.
- Make students work the activities in class either individually, in pair or in small groups:
- Make the lesson lively be relating it with real examples from the students' environment.
- Use order to methods in teaching i.e from simple to complex methods in teaching.
- In order to evaluate students and find out individual weakness and help them, regular tests should be prepared carefully by referring to the unit out comes in the syllabus.
- Use different types of teaching aids based on each unit.

What is Assessment?

***Assessment:* -** is a process by which information is obtained relative to some known objective or goal. The teachers assess at the end of a lesson or unit or the end of a school year through testing. Generally assessment is defined as collecting information on the progress of students learning using varieties of procedures (Example checklist, formal tests, self- assessment, creative writing, portfolios).

Purposes of Assessment

Teachers have many purposes for assessment of students. Some of the main reasons are:

1. **Improving instructional materials**: **-** Teachers need information regarding how effective teaching procedures, activities, the text book and other materials are in teaching.
2. **Improving students learning**: Both teachers and students need to know how students are doing.
3. **Determining content mastery**: Teachers evaluate students to determine if and when they have mastered the subject matter.
4. **Teaching: Evaluation activities**, if appropriately planned and used, can be powerful learning activities.
5. **Grading Students**:**-** Parents, administrators, and sometimes employees need evidence of pupil progress.

Forms of Assessment

There are two forms of assessment. These are continuous assessment and summative assessment.

Continuous Assessment:- of learners' progress could be defined as a mechanism whereby the final grading of learners in the **cognitive**, **affective and psychomotor** domains of learning systematically take account of all their performances during a given period of schooling. Continuous assessment is an assessment approach that involves the use of a variety of assessment so as the assess various components of learning:

- The thinking processes (cognitive skills),
- Behaviors, personality traits (affective characteristics) and
- Manual dexterity (psychomotor domain)

Summative Assessment

This is a summary assessment of the extent to which learners have mastered the intended objectives. It normally occurs at the end or the completion of a semester teaching.

The Need for Continuous Assessment

Continuous assessment as a method of evaluating the progress and achievement of students on a day – to – day basis is relevant to get a clear picture of every students' performance.

Most importantly, planning a continuous assessment system at school level is useful to gather adequate and reliable information about:-

- The present status of every students
- The students motivation to participate actively in the teaching – learning process;
- Students progress in his/her learning;
- Students learning difficulties for diagnosing problems and to take remedial measures;
- Students preferences, interests and attitudes; and
- The effectiveness of teaching methods, techniques, and learning material used by teachers.

Steps in the Continuous Assessment

The following are the major steps to follow in Continuous Assessment:-

Step i: - Overview the unit out comes, contents, methods and tools of the unit.

Step ii*:* - Produce a schedule of assessment for the unit.

Step iii. Determine the items for the suggested assessments of the unit.

Step iv: - Construct questions for the types of assessments suggested for the unit based on the determined items.

Step v:- Administer the suggested assessment tools constructed specifically on the bases of the schedule.

Step vi:- Grade or mark what was done by students.

Step vii:- Record the assessed results.

Teachers should have format (s) for recording the assessment results of students. The format (s) may be centrally or regionally designed or individually formulated by the teachers themselves. In any case, the recording format has to include at least, the names of students, grade level, subject type, and the marks allotted for each assessment task.

Step viii:- Report the recorded results.

Methods /Strategies of continuous Assessment

The methods of continuous assessment enables you to assess a wide range of learning competencies and behaviors using a variety of instruments some of which are:-

- Tests (quizzes)
- Classroom discussions, exercises, assignment or group works
- Project
- Observations

- Interview
- Group discussions
- Questionnaires

Different competencies may require different assessment techniques and instruments. For example, oral questions and interviews may serve to assess listening and speaking abilities.
Below are a descriptions of these methods of continuous assessment used in this assessment used in this assessment guide and their possible uses.

Tests

These usually consist of a range of questions covering almost all of the objectives of a unit. Students are required to respond to questions within a specified time, not more than half an hour. Tests could be phrased in different ways:

Close – ended (selection type such as true – false, multiple – choice, matching type) and open – ended (short – answer, essays, completion type).

Group Projects

A Project:- is an exercise on a single objective or topic that requires investigation in with the time constraints more investigation in with the time constraints more relaxed than assignments. More over, projects require much more information than assignments and require the involvement of a group of learners working together.

Marking

Marking or grading:- is the process of offering different types of symbols to academic progress or achievement of students. The marks given to students academic achievement are usually reported to the school administration in general and parents in particular. Designing a good marking scheme can help to be uniformly fair to all students.
The following are some suggestions on how to mark a semester's achievement.

1. One final semester examination 30%
2. Mid examination 20%
3. Tests 15%
4. Quizzed 10%
5. Home work 5%
6. Class activities, class work and presentation 10%
7. Project work, in groups or individually 10%

Recording and Reporting Students' progress and Achievement

Recording Students' achievement is an important aspect of continuous assessment. The reports on students' progress and performance may be miss- leading and incomprehensible unless records are properly kept.

The major records to be kept are teacher's records, student's cumulative report card and transcript.

a) **The teacher's record book: -** is a permanent record book which every teacher must keep in his/her class. The teacher's record book is expected to contain a detailed scheme of work, an accurate diary or daily record of work and progress report.

b) **The student's cumulative record card:-** this contains the most available information of students development through out the primary school course. The following main information should be including in the students cumulative record card.

- Personal information about the students
- Weekly or periodic report of academic performance.
- Report on his/her character.
- Report on the terminal tests
- Report on the summary of progress in all areas of the school curriculum.

c) The transcript:- This includes the results of continuous and Summative assessments add up to 100%. Below is a record format of transcript.

Students	Continuous Assessment									
	Weight	Class work, Class activities	Home Work	Quizzes	Project; Group Work	Test 1	Test 2	Mid Exam	Final Exam	Total
1		10%	5%	10%	10	5%	10%	20%	30%	100%
2										
3										
4										
.										
.										
N										

Reporting Makes educators more accountable to learners, parents, the education system and the border community.

N.B: This plan is more preferably during the beginning of the semester (year).

Topics, period allotment and location chart

Periods allotted for		*Topics*	*Page*	
Unit	*Sub-unit*		*S.T*	*T.G*
Unit1 32		**1. Rational numbers**		
	9	1.1 The concept of rational numbers	2	2
	7	1.2 Comparing and ordering rational numbers	19	12
	16	1.3 Operation of rational numbers	25	14
Unit2 25		**2. Linear equations and inequalities**		
	13	2.1 Solving linear equations	49	33
	22	2.2 Solving linear inequalities	66	41
Unit3 24		**3. Ratio, proportion and percentage**		
	6	3.1 Ratio and proportion	80	50
	7	3.2 Further on percentage	91	58
	11	3.3 Application of percentage in calculations	99	66
Unit4 20		**4. Data handling**		
	5	4.1 collecting data using Tally Mark	114	76
	10	4.2 Construction and interpretation of line graphs and pie charts.	120	78
	5	4.3 The mean, made, median and range of data	132	86
Unit5 40	12	**5. Geometric Figures and measurement**		
	11	5.1 Quadrilaterals, polygons and circles	144	99
	17	5.2 Theorems of triangles	166	116
		5.3 Measurement	182	129

UNIT 1

RATIONAL NUMBERS

Total allotted period: 32 Periods

Introduction

This unit requires affirm understanding of numbers. The unit gives much emphasis to the definition of Rational numbers, opposite of rational numbers, absolute value of rational numbers; comparing and ordering rational numbers and operations of rational numbers are discussed one after the other.

The activities, exercises and challenge problems given in each sub- unit are designed to encourage students to think critically about the lessons presented and to explore the key concept in more details.

Unit Outcomes:

After completing this unit, students should be able to:

- define and represent rational numbers as a fractions.
- show the relationship among $\mathbb{W}$, $\mathbb{Z}$ and $\mathbb{Q}$.
- order of rational numbers.
- operation with rational numbers.

Suggested teaching Aids in Unit 1

You can present different venn diagrams, number line thermometer and a model graph for fractions that demonstrate the behavior of Rational numbers. You can also encourage students to prepare different representative model graph for rational numbers.

1.1 The Concept of Rational Numbers

Period allotted: 9 periods

Competencies:

At the end of this sub unit, students should be able to:

- express rational numbers as fractions.
- represent rational number as a set of fractions on a number line.
- describe the relationship among the sets $\mathbb{W}$, $\mathbb{Z}$ and $\mathbb{Q}$.
- determine the absolute value of a rational number.
- solve simple equations containing absolute value.

Introduction

This sub-unit begins with discussing the concept of:

- revision of natural numbers, whole numbers and integers.
- revision of fractions.
- revision of equivalent fractions.
- rational numbers.
- representing rational numbers on a number line.
- relationship among $\mathbb{W}$, $\mathbb{Z}$ and $\mathbb{Q}$.
- opposite of rational numbers.
- the absolute value of rational number.

Teaching Notes

Students are expected to have some background on the concepts of Natural numbers, Whole numbers, Integers for lower grades. For the purpose of revision you can ask students questions like the following.

1. Group the following numbers are Natural numbers, Whole numbers, Integers or not. Let them give reasons.

   a) $2\frac{4}{2}$ b) $\frac{10}{3}$ c) $\frac{-100}{2}$ d) $\frac{0}{100}$

2. Consider the given fractions $\frac{12}{16}, \frac{24}{32}, \frac{48}{64}$ and $\frac{96}{128}$ are they equivalent fractions?

3. You may ask students to describe Natural numbers, Whole numbers, types of fractions and Equivalent fractions by your own word.

The purpose of Group work 1.1 Activity 1.1, 1.2, and 1.3 is to help students to revise terms related to Integers and check their level of understanding of Rational numbers.

Answers to Group work 1.1

1. a) The set of numbers such as {1, 2, 3, …} denoted by ℕ is called the set of **natural numbers**.
   b) The set of numbers such as {0, 1, 2, 3 . . . } denoted by 𝕎 is called the set of **whole numbers**.
   c) The set which contains the whole numbers and their additive inverse is the set of **integers** and is denoted by ℤ ={. . . , -3, -2, -1, 0, 1, 2, 3, . . }.

2. 1, 2, 3, 4, 5 and 6.
3. 0, 1, 2, 3, 4 and 5.
4. 1,2,3,4,5 and 6.
5. -1, -2, -3, -4, -5 and – 6.
6. a) whole number, integers and rational number.
   b) natural number, whole number, integers and rational number.
   c) integers and rational numbers.
   d) the same as b.

7. **a)** < **b)** < **c)** >

Answers to Activity 1.1

1. a) False b) True c) True d) True e) True
2. a) yes, yes b) yes, yes c) yes, yes

Answers to Activity 1.2

1. a) $\frac{5}{6}$ ← numerator, ← denominator

b) $\frac{12}{10}$ ← numerator, ← denominator

c) $3\frac{2}{5} = \frac{17}{5}$ ← numerator, ← denominator

d) $\frac{a}{b}$ ← numerator, ← denominator

2. Examples of:

Proper fractions, $\frac{1}{2}, \frac{6}{21}, \frac{7}{36}$ etc

Improper fractions, $\frac{7}{6}, \frac{9}{8}, \frac{10}{11}$ etc

Mixed numbers, $1\frac{2}{3}, 2\frac{5}{6}, 7\frac{9}{12}$ etc

3. a) $\frac{5}{2} = 2\frac{1}{2}$ c) $\frac{26}{9} = 2\frac{8}{9}$

b) $\frac{39}{4} = 9\frac{3}{4}$ d). $\frac{17}{10} = 1\frac{7}{10}$

4. a) $\frac{13}{4}$ b) $\frac{22}{5}$ c) $\frac{37}{10}$ d) $\frac{109}{100}$

Answers to Activity 1.3

1. a) $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16} = \frac{15}{20} = \frac{18}{24}$

b) $\frac{2}{7} = \frac{4}{14} = \frac{6}{21} = \frac{8}{28} = \frac{10}{35} = \frac{12}{42}$

c) $\frac{4}{5} = \frac{8}{10} = \frac{12}{15} = \frac{16}{20} = \frac{20}{25} = \frac{24}{30}$

2. Yes, because all fractions that represent the same rational number point on the number line i.e $\frac{3}{4}$

After completion of Exercise 1A, you should allow time for students to look at the problems of rational numbers. Start the new lesson by giving questions 1-6 of Group work 1.2 as **class work** and round to identify those who need further assistance and those who are fast enough to solve each question and puts on record.

Answers to Exercise 1A

1. a) 350

   b) 230

   c) 5.5

   d) 52.8

   e) -9.15

   f) $\frac{-1}{35}$

   g) $\frac{1}{2}$

   h) $\frac{-1}{2}$

   i) $\frac{21}{50}$

2. a) Yes, $\frac{5}{9} = \frac{5}{9} \times \frac{4}{4} = \frac{20}{36}$

   b) Yes, $\frac{1}{7} = \frac{1}{7} \times \frac{9}{9} = \frac{9}{63}$

   c) Yes, $\frac{625}{25} = 25$

   d) No

3. a) $\frac{8}{18} = \frac{8 \times 2}{18 \times 2} = \frac{16}{36}, \frac{8}{18} \times \frac{3}{3} = \frac{24}{54}$ and $\frac{8}{18} \times \frac{4}{4} = \frac{32}{72}$

   b) $\frac{30}{36} = \frac{30 \times 2}{36 \times 2} = \frac{60}{72}, \frac{30 \times 3}{36 \times 3} = \frac{90}{108}$ and $\frac{30}{36} \times \frac{4}{4} = \frac{120}{144}$

4. a) $\frac{13}{2}$ c) $\frac{-23}{1}$ e) $\frac{-83}{100}$ g) $\frac{39}{8}$

   b) $\frac{15}{8}$ d) $\frac{-433}{100}$ f) $\frac{87,632}{10}$ h) $\frac{207}{100}$

5.

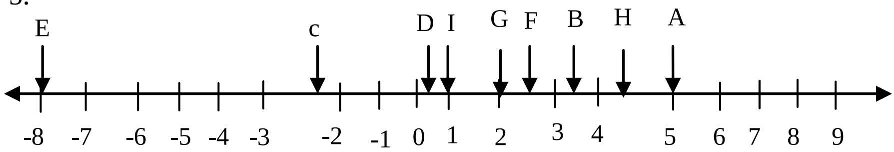


Figure 1.1

6. a) Male= $\frac{15}{28}$ b) Female= $\frac{13}{28}$

7. a) – signs   c) + signs   e) – signs
   b) + signs   d) – signs   f) + signs

Answer to Group Work 1.2

1. $\frac{1}{2}, \frac{3}{4}, \frac{5}{26}$.
2. -1, -2 and -3.
3. -1, -2 and -3.
4. $\mathbb{N} \subseteq \mathbb{W} \subseteq \mathbb{Z} \subseteq Q$.
5. {Integers ∩ rational numbers} = Integers.
6. {whole numbers ∪ rational numbers}= Rational numbers.

After completion of Exercise 1A and Group Work 1.2, you should allow time for students. You need to discuss and solve Activity 1.4 with active participation of students. The purpose of this activity is to help students to revise opposite of Integers and rational numbers. After the completion of Activity 1.4 you may solve Exercise 1B.

Answers to Activity 1.4

1. a) -70   b) 23   c) 170   d) 0
2. a) $\frac{1}{3}$ c) $\frac{-1}{20}$ e) -4.5   g) $-3\ \frac{2}{5}$
   b) $\frac{-45}{2}$ d) 4.5   f) 0.6

Exercise 1B might be useful as a stimulus in order to encourage students to reflect up on and engage in doing class work and **home work**.

Answers to Exercise 1B

1. a) False
   b) False
   c) True
   d) False
   e) False
   f) True
   g) True
   h) False
   i) False
   j) True
   k) True

2. a) True
   b) True
   c) True
   d) True
   e) False
   f) False
   g) False
   h) True
   i) True
   j) False
   k) True

3. a) -0.823
   b) 26.72
   c). 24.278
   d) $-3\frac{3}{39}$
   e) $\frac{8}{50}$
   f) $\frac{0}{10,000}$
   g) -8.797
   h) $-20\frac{5}{80}$
   i) $-36\frac{70}{80}$

4. a) x= 28
   b) $x = -3\frac{5}{9}$
   c) x = 0
   d) x = -70

5. a) Negative b) Positive c) zero

After conducting and doing Activity 1.5 with the active participation of students encourage students through questions and answer to absolute value geometrically or graphically.

Answers to Activity 1.5

1. a) 8 b) 8 c) 0 d) $\frac{1}{2}$

You can discuss absolute value examples similar to those given in the students text. Give questions form Exercise 1C question number 3 a, b and g and question number 4, all and challenge problems all for class work and homework finally give corrections for each questions.

Answers to Exercise 1C

1.

x	8	$\frac{-1}{2}$	$2\frac{2}{3}$	$-5\frac{6}{7}$	-9	0	5.6 or -5.6	0.92 or -0.92	11 or -11	$\frac{9}{2}$	2.6	-3.7
|x|	8	$\frac{1}{2}$	$2\frac{2}{3}$	$5\frac{6}{7}$	9	0	5.6	0.92	11	$\frac{9}{2}$	2.6	3.7

2. a) $8\frac{3}{5}$ and $-8\frac{3}{5}$
   b) 3.5 and -3.5
   c) $\frac{2}{5}$ and $\frac{2}{5}$
   d) $4\frac{1}{6}$ and $-4\frac{1}{6}$
   e) 3.8 and -3.8
   f) 0

3. a) $|-7| + |31-11|$
   $= 7 + |20|$
   $= 7+20$
   $= 27$

   b) $|-18| - |-7| + |5|$
   $= 18-7+5$
   $= 16$

   c) $|9+(-9)|$
   $= |9-9|$
   $= 0$

   d) $|4-5|$
   $= |-1|$
   $= 1$

   e) $|-3+10| = |7|$
   $= 7$

   f) $|3+30| = |33|$
   $= 33$

   g) $|4| + |-10| - |-3|$
   $= 4+10-3$
   $= 11$

   h) $|-3| + |25-21|$
   $= 3+|4|$
   $= 3+4 = 7$

4. a). -6x+2| x-3|, when x= -3

= 18+2| -6|

= -18 +12

= 18+12

= 30

d) | y| -| x| when y= -7 and x=3

= | -7| -| 3|

= 7-3

= 4

b) | m | $-$m+3 when m= $\frac{1}{2}$

$= \left|\frac{1}{2}\right| - \frac{1}{2}+3$

$=\frac{1}{2} - \frac{1}{2} + 3$ =3

e) ($|9-y|$)× (1) when y = -5

$= (|9-(-5)|)x(-1)$

= 14×-1⇒ -14

c) | x | + |y | when

x = -3 and y=-1

| -3 | + | -1 |

3+1 = 4

f) -2 (| x-7 |) when x= -3

= -2 | -3-7 |

= -2 | -10 |

= -2(10)

= -20

5. a) | x | = $2\frac{3}{2}$

If | x | = $2\frac{3}{5}$ then x= $2\frac{3}{5}$ or x = $-2\frac{3}{5}$.

∴Solution sets = $\{ 2\frac{3}{2}, -2\frac{3}{2} \}$

b) | x | = 2.35

If | x | = 2.35 then x= 2.35 or x= -2.35.

∴solution sets = {-2.35, 2.35}

c) 1-2|x+2| = 6

= -2|x+2| = 5

= |x+2| = $\frac{-5}{2}$

The absolute value of a number cannot be negative, since the solution set is empty.

d) 2 | x-5 | +7 = 14

2 | x-5 | = 7

| x-5 | = $\frac{7}{2}$

We write two equations using the definition of absolute value.

$|x-5| = \frac{7}{2}$ or $x-5 = \frac{-7}{2}$

$x-5 = \frac{7}{2}$ $\quad$ $x = \frac{-7}{2} + 5$

$x = \frac{7}{2} + 5$ $\quad$ $x = \frac{-7+10}{2}$

$x = \frac{17}{2}$ $\quad$ $x = \frac{3}{2}$

The solutions sets = $\left\{\frac{3}{2}, \frac{17}{2}\right\}$.

e) $|4x| = 32$

If $|4x| = 32$ then $4x=32$ or $4x= -32$.

$\Rightarrow x = \frac{32}{4}$ or $x = \frac{-32}{4}$

$\Rightarrow x = 8$ or $x = -8$

Therefore, the Solution sets = {-8, 8}.

f) $|x-4| = 7$

$|x-4| = 7$ is equivalent to $x-4 = 7$ or $x-4 = -7$

$\Rightarrow x = 11$ or $x = -3$

The only solution sets are x = 11 and x= -3.

6. a) $|8-12x| = 3\frac{2}{5}$

$|8-12x| = 3\frac{2}{5}$ is equivalent to $8-12x = 3\frac{2}{5}$ or 8-12x is x= $-3\frac{2}{5}$.

$\Rightarrow 8-12x = \frac{17}{5}$ or $8-12x= \frac{-13}{5}$

$\Rightarrow -12x= \frac{17}{5} - 8$ or $-12x= \frac{-13}{5} - 8$

$\Rightarrow -12x = \frac{-23}{5}$ or $-12x= \frac{-53}{5}$

$\Rightarrow x = \frac{23}{60}$ or $x = \frac{53}{60}$

Therefore, the only solution set is $x= \frac{23}{60}$.

b) $-3\,|\,2x+10\,|+2=27$

$$-3\,|\,2x+10\,| = 25$$

$$|\,2x+10\,| = \frac{-25}{3}$$

The absolute value of a number cannot be negative, since the solution set is empty.

Assessment

Dear teacher you are strongly advised to give tutorials to the students by dividing them in three groups such as slow learners, bright learners and fast learners. Difficult problems, medium problems and simple problems are respectively to be solved to fast learners, bright learners and slow learners. Using such a steep the slow learners and bright learners will be pushed up to fast learners. In addition to this, for fast learners or interested students, you can also give the following additional exercise problems.

1. Can you define a rational number precisely?
2. Show the location of -3, $\frac{7}{2}$, 0, 10 and $\frac{-1}{2}$ on a number line.
3. If the opposite of a certain number is a negative number, then the number must be ______ number.
4. If the opposite of a certain number is a positive number then the number must be ______ number.
5. If the opposite of a certain number is equal to that number, then the number must be ?_
6. If a number n is equal to 6 then the opposite of (n+1) is equal to____?
7. Solve the following absolute values equations:
   a) $|\,2-6x\,| = 2$ c) $|\,-5x-1\,| = 10$
   b) $|\,6x\,| - 16 = 38$ d) $6\,|\,2x\,| = 150$

1.2 Comparing and ordering Rational Numbers

Period allotted: 7 periods

Competencies:

At the end of this sub unit, students should be able to:

- compare rational number.
- order of rational numbers by representing them on number line.
- determine the absolute value of a rational number.

Introduction

This sub-unit begins with discussing the concept of comparing and ordering rational numbers on a number line with the students.

Teaching Notes

You can start this lesson by discussing the role of comparing and ordering Rational Numbers with the help of examples similar to the ones given in the student text.

Example1: Arrange the following integers in a descending order:

a) -20 , - 30 – 70, 0, 90, 700

b) $\frac{-50}{2}, \frac{-34}{2}$, 0 , 72 , 36 , 90

Example 2: List all integers which lie between:

a) -7 and 20 b) -3 and 7

Example 3: Compare the following pairs of numbers by using the symbols < , ≤, ≥ and =.

a) $\frac{-30}{2}$ ______ 7

b) $3\frac{2}{3}$ ________ $5\frac{2}{9}$

c) $1\frac{2}{3}$ ________ $2\frac{3}{4}$

d) 144 _________ 1444

Dear teacher, you can assign Group work 1.3 to individual students or small group of students. Finally proper feedback must be given. After completion of Group work 1.3 you should allow time for students to look at the meaning of comparing and ordering rational numbers.

Answers to Group work 1.3

1. There is no integers between n and n+1.
2. There is no whole numbers between n and n+1.
3. -70, -10, 0, 34, 43, 52 and 65
4. 100, 70, 16, 0, -5, -10
5. a) -4, -3, -2, -1, 0 and 1

   b) -1, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9

   c) 1 and 2

   d) 1, 2, 3 and 4

6. a) $<$ c) $>$ e) $<$

   b) $>$ d) $>$ f) $=$

After Completing the given examples and short note, you can solve Exercise 1 D. The given exercise can be assigned as a class work or home work. Finally proper feedback must be given for each exercise.

Answer to Exercise 1D

1. a) True   e) False   i) True

   b) False   f) True   j) False

   c) True   g) False   k) False

   d) True   h) False

2. a) $>$ d. $>$ g. $<$ j. $>$

   b) $=$ e. $=$ h. $=$ k. $<$

   c) $>$ f. $=$ i. $>$

3. a) 25 is to the right of 7

   b) $\frac{6}{8}$ is to the right of $\frac{3}{5}$

   c) $3\frac{2}{3}$ is to the right of $2\frac{1}{7}$

   d) $\frac{5}{8}$ is to the right of $\frac{-3}{5}$

e) $\frac{15}{2}$ is to the right of -5

f) $\frac{1}{2}$ is to the right of -1.2

4.

	First play	Second play	Final result
Abebe	Loss 5 basket balls	Won 7 basket balls	2
Almaz	Won 6 basket balls	Loss 6 basket balls	0
Hailu	Loss 3 basket balls	Loss 2 basket balls	5

Abebe won by 2 while Hailu lost by 5.

5. a) < b) < c) > d) <

6. a) < b) > c) > d) > e) > and >

7. a) 1, 2, 3, 4, 5, 6, 7, 8 and 9

b)

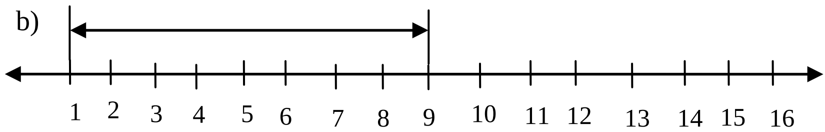


Figure 1.2

8. a) Ascending order: -9000, -2000, 7, 23, 56, 93, 234, 469 and 614.
   b) Descending order: 614, 469, 234, 93, 56, 23, 7, -2000 and -9000.

Assessment

Give students various exercise problems to compare rational numbers using the inequality signs < and > between given rational numbers and check their work.

1.3 Operation on rational numbers

Period allotted: 16 periods

Competencies:

At the end of this sub unit, students should be able to:

- add rational numbers.
- apply the commutative and associative properties of addition.

- subtract one rational numbers from another.
- find the product of two rational numbers.
- apply the rules of multiplication of rational numbers.
- use the commutative and associative properties of multiplication and distributive property of multiplication over addition of rational numbers.
- divide one rational number of another non-zero rational number.
- apply the rules for division of two rational numbers.

Introduction

This sub-unit begins with discussing the concept of

- Addition of rational numbers.
- Subtraction of rational numbers.
- Multiplication of rational numbers.
- Division of rational numbers one after the other.

Teaching Notes

You may wish to start this lesson by revising additions, subtraction, multiplication and division of Rational numbers by considering different examples such as the following. Perform the indicated operation

i. Add: 5 +10 +2

ii. Subtract: -10 -3 -5

iii. Multiply: $\frac{3}{2}\times\frac{5}{6}\times\frac{1}{2}$

iv. Divide : $\frac{12}{7}\div\frac{14}{3}$

It is easier for the students to follow, if the teacher first consider the case of adding, subtracting, multiplying and dividing rational numbers, on a number line or without a number line.

Example 1: Add a) 5+7 = 12

b) $\frac{1}{2}+\frac{3}{2}=\frac{1+3}{2}=\frac{4}{2}=2$

Example 2: Draw a number line and find the sum by arrow addition

a) 5+3 b) -4 + (-1)

a)

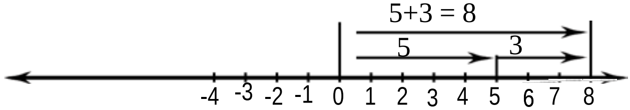


Figure 1.3

Note: the sum of two positive number is always a positive number.

b)

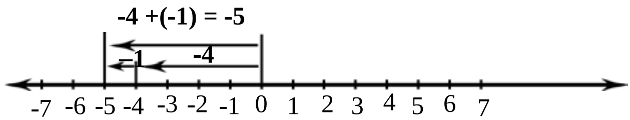


Figure 1.4

Note: The sum of two negative numbers is always a negative number. It is very important that the students be aware of the fact that when adding rational numbers on a number line.

Example 3: Draw a number line and find the sum by arrow addition

a) 6+ (-2) b) -5 +4

a)

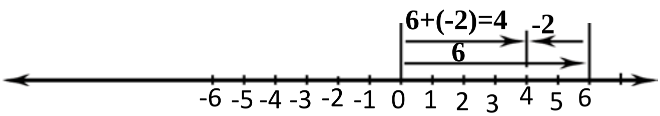


Figure 1.5

b)

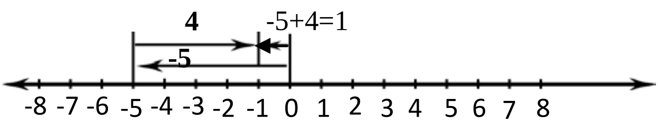
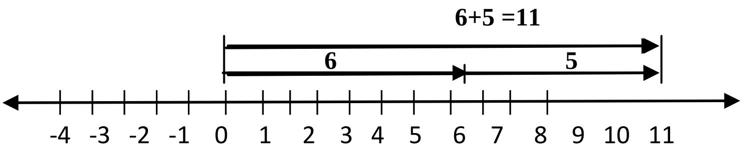


Figure 1.6

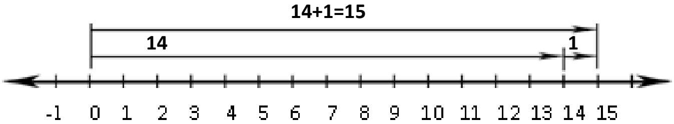
After completing the given example on student Textbook you can give Exercise 1E, 1F, 1G, 1H, 1I, 1J and 1K as class work, home work or Group work. Do not forget to entertain your students those achieving below and above the minimum learning competencies. You have to assess the progress of your students by encouraging answer the activities, exercises and challenge problems. Use word incentives and fractional marks so that they can find out their status in the learning.

Answers to Group work 1.4

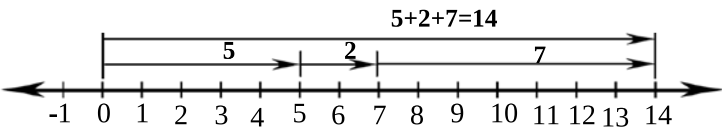
1. a)



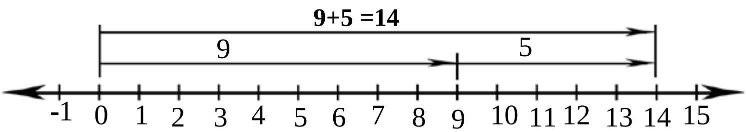
b)



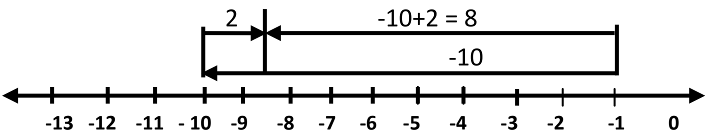
c)



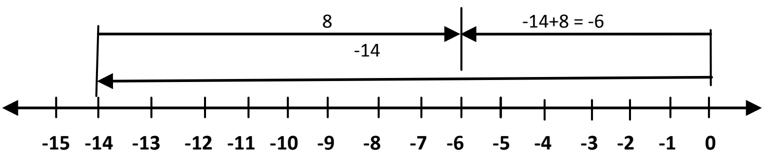
d)



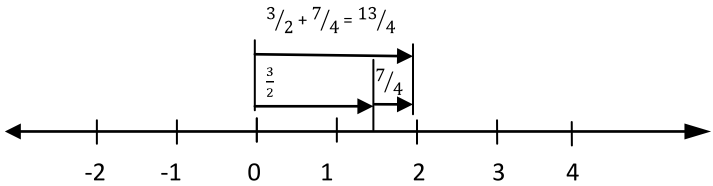
e)



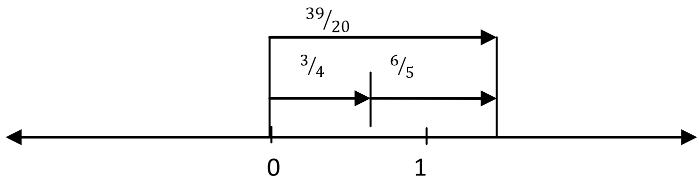
f)



g)



h)



i)

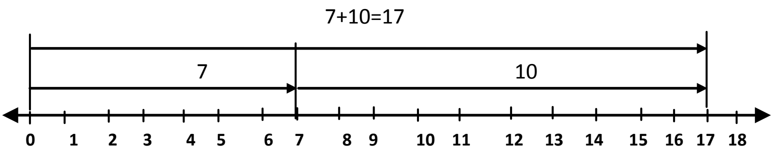


Figure 1.7

2. a) $\frac{7}{5}$ or $1\frac{2}{5}$ b) $\frac{8}{9}$ c) $\frac{7}{3}$ or $2\frac{1}{3}$

3. A = -4 D = 2 F =7
   B = -1 E = 4 G = -7
   C = 0.5

4.

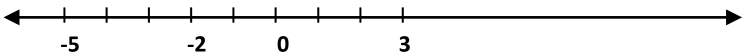


Figure 1.8

5. a) $\frac{13}{15}$ c) $\frac{31}{10}$ e) $\frac{15}{8}$
   b) $\frac{51}{45}$ d) $\frac{139}{42}$ f) $\frac{31}{6}$

Answers to Exercise 1E

1. a) 8.2+ (-3.2)= 5
   b) 28+(-36)= -8
   c) 7.4+(-2.8)= 4.6
   d) -248+236= -12
   e) 42+(-54) = -12
   f) 0 + (-9.6) = -9.6
   g) 8 + (-96)= -88
   h) -10.25+6.54=-3.71
   i) $6\frac{1}{2} + 5\frac{3}{2} + \left(-2\,\frac{1}{2}\right)$

   $= \frac{13}{2} + \frac{13}{2} - \frac{3}{2}$

   $= \frac{26}{2} - \frac{3}{2}$

   $= \frac{23}{2}$

   j) $3\frac{1}{5} + \left(\frac{-7}{8}\right) + 3\,\frac{6}{5}$

   $= \frac{16}{5} - \frac{7}{8} + \frac{21}{5}$

   $= \frac{37}{5} - \frac{7}{8}$

   $= \frac{296-35}{40} = \frac{261}{40}$

2. a) Some examples are: $\frac{-10}{2} + \left(\frac{-10}{2}\right) = -5 + (-5) = -10$

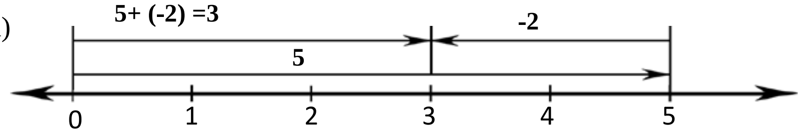
   -6+ (-4) =-10
   -6+6=0
   -7+7=0
   8 +7=15
   30+(-15)=15

   b) Some examples are: 40+(-10+) = 30, -30+2= -28
   32+ (-2) =30, -29+1=-28
   34+ (-4) =30, -30+2=-28
   36+ (-6) =30, -31+4=-28
   80+(-10)=70
   90+(-20 =70
   100+(-30)=70
   120+(-50)=70

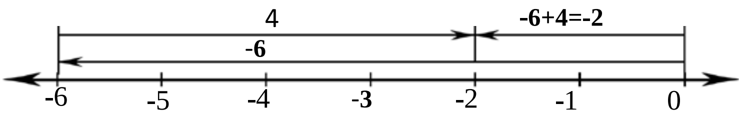
3. a) r
   b) –m
   c) 4m
   d) 0
   e) -70a+d
   f) -12x

4.

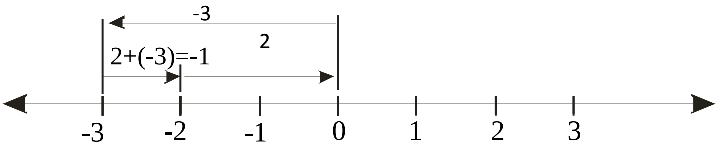
a)



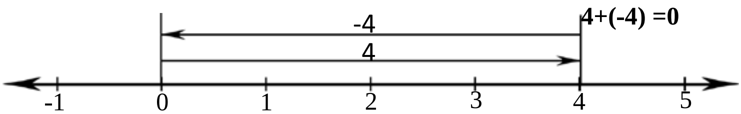
b)



c)



d)



e)

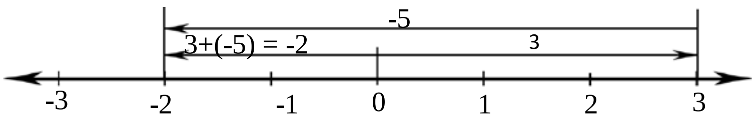


Figure 1.9

5. First addend= -5; second added= -4 and sum = -9
6. First addend= =12' second added= -8 and sum = -20
7. d= -5
8. -28+10=-18 (lost 18 points)
9. let x be the first anural number and y be the second natural number then

$x + y = 30$ ------------- Equation 1

$5y + y = 30$ ------------- Equation 2

$6y = 30$

$y = 5$

$x = 5y$

$x = 25$

Therefore, the first natural number is 25 and the second number is 5.

10. $4x + 8x+12x+16x = 5 + 10 + 30 +40$

$40x = 85$

$x = \frac{85}{40}$

Answers to exercise 1F

1. a) -17 c) $\frac{-83}{78}$ e) $\frac{-1}{8}$

   b) 147 d) 25.6 f) 50

2. a) $x = \frac{50}{13}$ c) $y =1$ e) $y = -301$

   b) $x = \frac{64}{5}$ d) $x = \frac{96}{14}$ f) $x = \frac{8}{3}$

3. a) 14 and $\frac{164}{6}$ b) $\frac{17}{24}$ and -3.225 c) $\frac{-15}{2}$ and -4.25

Answers to Exercise 1G

1.

a	b	C	a+ b	b + a	(a+ b)+c	a+(b+ c)
6	-8	14	-2	-2	12	12
-2.3	-5.6	9.6	-7.9	-7.9	1.7	1.7
$\frac{3}{4}$	$\frac{-5}{7}$	-2.5	$\frac{1}{28}$	$\frac{1}{28}$	$\frac{-69}{28}$	$\frac{-64}{28}$

2 a) 34+48+66

= (34+48) +66 ……….. Associative property

= (48+34) +66 ……….. Commutative property

= 48+ (34+66) ……….. Associative property

= 48+100=148 ……….. Addition operation

b) 218+125+782+375

= 218+ (125+782) +375 …... Associative property

= 218+ (782+125) +375 …... Commutative property

= (218+782) + (125+375) … Associative property

= 1000 + 500 = 1500 ……..... Addition operation

c) $59+42+41+36$

$= 59+ (42+41) +36$ ……..… Associative property

$= 59+ (41+42) +36$ …..…… Commutative property

$= (59+ 41)+(42 +36)$ ……… Associative property

$=100+78=178$ ……………… Addition operation

d) $572+324+176+447+428+253$

$=572+ (324+176) +447+ (428+253)$ … Associative property

$=572+(176+324)+447+(253+428)$……..Commutative property

$= (572+176) +324+ (447+253) +428$ …Associative property

$= (748+324) + (700+428)$ ……………..Associative property

$= 1072+ 1128 = 2200$ ……………….. Addition operation

e) $3.7+5.8+0.8+0.9$

$= 3.7+ (5.8+0.8) +0.9$ ……………..... Associative property

$= 3.7+ (0.8+5.8)+0.9$ ……………...... Commutative property

$= (3.7+0.8) + (5.8+0.9)$ …………….. Associative property

$= 4.5+6.7=11.2$ ………..…………..... Addition operation

f) $3.9+0.8+0.66+3\frac{5}{2}$

$= 3.9+ (0.8+0.66)+ 3\frac{5}{2}$ …………….. Associative property

$= (3.9+ 0.8)+(0.66+ 3\frac{5}{2})$ …………. Commutative property

$= 4.7 + 6.16 = 10.86$ ……………….. Addition operation

Answers to Activity 1.6

1. $\frac{-50}{3}$

2. a) $\frac{13}{4}$ c) $\frac{25}{7}$

   b) $\frac{17}{4}$ d) $\frac{-217}{16}$

Answers to Exercise 1H

1. a) $\frac{393}{20}$ b) $\frac{-99}{6}$ c) -0.3 d) -165 e) 3.5

   f) 2 g) 5 h) 12.6 i) $\frac{5}{2}$

2.

a	2	-10	0	14	28	2.8
b	-6	-8	-12	10	12	1.0
a+b	-4	-18	-12	24	40	3.8
a-b	8	-2	12	4	16	1.8

3. a). 12 c) -20 e) 5

b) . 19 d) -1 f) 11

4.

a)

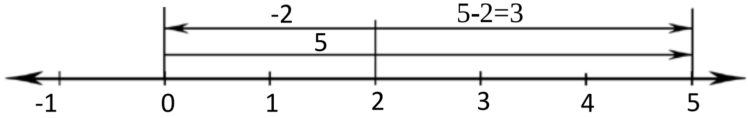


Figure 1.10

b)

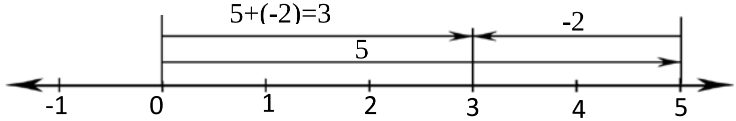


Figure 1.11

Answers to Activity 1.7

1. a) $\frac{8}{35}$ c) $\frac{7}{18}$ e) 92.261 g) $\frac{-1}{9}$

b) $\frac{15}{77}$ d) $\frac{930}{42}$ f) $\frac{1}{14}$

Answers to Exercise 1I

1. a) 3×0 b) 4×3 c) 4×5 d) 4×6 e) 4×8 f) 3×50
2. a) 1+1+1+1+1 c) 5+5+5+5+5

b) 0+0+0+0 d) 3+3+3

3. Let x be the number then

$\Rightarrow (x+5)4=32$

$\Rightarrow 4x+20=32$

$\Rightarrow 4x=12$

$\Rightarrow x=3$

Therefore, the original number is 3.

4. Let x be the number then

$\Rightarrow (x+12)5 = 105$

$\Rightarrow 5x+60 = 105$

$\Rightarrow 5x = 45$

$\Rightarrow x = 9$

Therefore, the original number is 9.

5. Let x be the number then

$\Rightarrow (x+6)7=56$

$\Rightarrow 7x+42=56$

$\Rightarrow 7x=14$

$x=2$

Therefore, the original number is 2.

6. Let x be the number then

$(x^2)\ 4=1$

$x^2 = \frac{1}{4}$

$x = \pm\sqrt{\frac{1}{4}}$

$x = \pm\frac{1}{2}$

Therefore, the required number is $\frac{1}{2}$ or $\frac{-1}{2}$.

7) a) $4\frac{3}{4} \times \left[\frac{-16}{15} \times (-3.25)\right]$

$= \frac{19}{4} \times \left[\frac{-16}{15} \times \frac{-325}{100}\right]$

$= \frac{98800}{6000}$

$= \frac{247}{15}$

b) $\left[4\frac{3}{4} - 1\frac{1}{2}\right] \times \left[-6\frac{1}{8} - 5\frac{3}{8}\right]$

$= \left[\frac{19}{4} - \frac{1}{2}\right] \times \left[\frac{-47}{8} - \frac{37}{8}\right]$

$= \left[\frac{19-2}{4}\right] \times \left[\frac{-84}{8}\right]$

$= \frac{357}{8}$

Answers to Activity 1.8

a) True b) True c) True d) True e) False

Answers to Exercise 1J

1. a) $6x+75$ d) $8x+52$ g) x^2+10

   b) $11x+8y$ e) $3y^2$

   c) $12x+14y$ f) $-\frac{3}{2}x-2y$

2. a) $7x+5x=(7+5)x$ ………………Distributive property

   $= 12x$ ………………… Computation

   b) $20x+6x=(20+6)x$ ………….. Distributive property

   $= 26x$ ……………… Computation

   c) $5a + 3b+ 2a = 5a+ (3b+2a)$ ……. Associative property of addition

   $=5a+ (2a+3b)$ ……. Commutative property of addition

   $=(5a+2a) +3b$ …… Associative property of addition

   $= 7a+3b$ ……….... Computation

   d) $4 [3+2(x+5)] =12+8 (x+5)$ …….. Distributive property

   $=12+ (8x+40)$ ……. Distributive property

   $=12+ (40+8x)$ ……..Commutative property of addition

   $=(12+40) +8x$……. Associative property of addition

   $= 52 + 8x$ ……… Computation

   e) $x (x+3)+2 (x+5) = x^2+x.3+(2x+10)$ …….. Distributive property

   $= (x^2+3x)+(2x+10)$ ……. Commutative property

   $= [(x^2+(3x+2x)]+10$ …... Associative property

   $= x^2+(3+2)x+10$ ………. Distributive property

   $= x^2+5x+10$ …………… Computation

   f) $-5+2 (3x+4) = -5 [2(3x)+2(4)]$ ……. Distributive property

   $= -5+ [6x+8]$ ………... Computation

   $= 6x+[-5+8]$ ……….. Associative property

   $= 6x+3$ ……………… Computation

Answers to Activity 1.9

1 a) $\frac{24}{35}$ b) 11 c) $\frac{9}{40}$ d) $\frac{45}{4}$

e) $\frac{9}{4}$ f) $\frac{16}{9}$

Answers to Exercise 1K

1. a) $\frac{-3}{2}$ b) $\frac{-8}{3}$ c) 1 d) $\frac{-40}{176}$

   e) $\frac{21}{2}$ f) $\frac{2}{15}$ g) 0 h) undefined

2. a) $\frac{-23}{30}$ b) -1 c) $\frac{1}{2}$ d) -722 e) -0.5

3. a) $\frac{-3}{4}$ c) $\frac{2}{5}$ e) $\frac{49}{2}$

   b) $\frac{-5}{8}$ d) $-2a^2b$ f) $\frac{198}{25}$

4. a) y= $\frac{-6}{7}$ c) y= -16 e) x= 0

   b) y= -16 d) x= -8 f) x= $\frac{-1}{9}$

5. a) $\left[\frac{-18}{5} \div \frac{9}{35}\right] \times \left(\frac{-3}{7}\right)$

$$= \left(\frac{-18}{5} \times \frac{35}{9}\right) \times \frac{-3}{7}$$

$$= 14 \times \frac{3}{7}$$

$$= 6$$

b) $\left[\frac{-12}{25} \times \left(\frac{-5}{7}\right)\right] \div \left(\frac{-9}{14}\right)$

$$= \frac{60}{175} \times \frac{-14}{9}$$

$$= \frac{-280}{525}$$

c) $\left[1\frac{2}{3} \times 4\frac{2}{3}\right] \div 6\frac{1}{9}$

$$= \left[\frac{5}{3} \times \frac{14}{3}\right] \times \frac{9}{55}$$

$$= \frac{70}{9} \times \frac{9}{55} = \frac{14}{11}$$

d) $\left(5\frac{1}{16} \div 6\frac{3}{4}\right) \times \left(7\frac{5}{9}\right)$

$$= \left(\frac{81}{16} \div \frac{27}{4}\right) \times \frac{68}{9}$$

$$= \left(\frac{81}{16} \times \frac{4}{27}\right) \times \frac{68}{9}$$

6. $\frac{1}{2} \div \frac{1}{2} \div \frac{1}{2} \div \frac{1}{2} \div \frac{1}{2} \div \frac{1}{2} \div \frac{1}{2}$

$\Rightarrow \frac{1}{2} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1} \times \frac{2}{1}$

= 32

7. $(56 \div 8) \div 2$

$\left(\frac{56}{8}\right) \div 2$

$\Rightarrow \frac{56}{8} \times \frac{1}{2} \Rightarrow \frac{28}{8} = \frac{14}{4}$

and 56 ÷ (8 ÷ 2)

$\Rightarrow 56 \div 4$

$\Rightarrow \frac{56}{4} \Rightarrow \frac{28}{2} = 14$

$= \frac{612}{108}$

$= \frac{34}{6}$

$= \frac{17}{3}$

8. $\frac{8x^2}{4x} + \frac{20xy}{4x}$

$= 2x + 5y$

Assessment

Dear teacher asses your students' based on the following sub-topics:

- Give different exercise problems on addition of rational numbers and check their progress based on their feedback.
- Give different exercise problems on the use of the commutative associative and distributive properties and follow up the performance of your students.
- Give exercise problems on subtraction of rational numbers and check also their performance of your students.
- Give exercise problems on multiplication of rational numbers and check also their performance and to take remedial measures based on their feedback.
- Give exercise problems on division of rational numbers and check also their performance and to take remedial measures based on their feedback.
- Finally based on the performance of your students
  - Asking oral questions.
  - Giving class work.
  - Giving your own assignment.
  - Giving quiz, test and project work.

Give comments on their attempts. Generally give the following exercise problems for fast learners or interested students.

1. Perform the indicated operations.
   a) (5×8)+9
   b) (7-11)+(11-7)
   c) (10×12) + (7×9)
   d) (7×13)+(-4)
2. Tell which property of rational numbers is illustrated by each sentence.
   a) 8+ (2+5)= (8+2)+5
   b) (2.6+5.2)+3.4=2.6+(5.2+3.4)
   c) 1.23+3.21= 3.21+1.23
   d) 14+(9+16)=(14+9)+16
3. Simplify
   a) $\left[\frac{9-(-3)}{8-6}\right]\left[\frac{3+(-8)}{7-2}\right]$
   b) $\frac{3-5\left[\frac{4+2}{2+1}\right]-2}{-4+3\left[\frac{4-2}{4-6}\right]-2}$
   c) $\left[\frac{6+(-2)}{3+(-7)}\right]\left[\frac{8+(-12}{2-4}\right]$
   d) $\frac{8+2\left(\frac{9-15}{3-1}\right)-2}{-4+8\left(\frac{6-3}{1-4}\right)+12}$
4. For any even and odd integers then
   i. Even + odd = ________
   ii. Even × odd = ________
   iii. even + even = _______
   iv. even × even = _______
   v. odd + odd = _________
   vi. odd × odd = ________
5. The smallest of three consecutive natural numbers is X. What are the other two numbers?
6. The greatest of four consecutive odd natural numbers is n. Find the other three numbers.
7. The sum of three consecutive natural numbers is 27. If the smaller one is x, find the value of x.
8. The sum of two natural number is 25 and their difference is 5. Find the number.

Answers to Miscellaneous Exercise 1

1. a) True c) False e) True
   b) False d) False f) True

2. a) 16 b) 3 c) $\frac{93}{40}$ d) $\frac{-29}{36}$

3. a) K c) m-7n e) 4x+4y
   b) $-(3x^2+9x)$ d) $-3x^2+6x$ f) 6x+30

4. a) 17x+10 c) 4 e) $9x^2+10x$
   b) 6x+3 d) 42x-5 f) $\frac{y}{8}+\frac{5}{4}$

5. $$\left[\left(\frac{1}{2}+\frac{1}{3}\right)\times\frac{1}{4}\right]\div\left[\left(\frac{2}{5}+\frac{3}{4}\right)\div\frac{6}{12}\right]$$
$$=\left[\left(\frac{3+2}{6}\right)\times\frac{1}{4}\right]\div\left[\left(\frac{8+15}{20}\right)\div\frac{6}{12}\right]$$
$$=\left[\frac{5}{6}\times\frac{1}{4}\right]\div\left[\frac{23}{20}\times\frac{12}{6}\right]$$
$$=\left[\frac{5}{24}\right]\div\left[\frac{23}{10}\right]$$
$$=\frac{5}{24}\times\frac{10}{23}$$
$$=\frac{25}{270}$$

6. $$\left[\frac{-24}{5}\times\frac{15}{16}\right]\div\left[\frac{6}{4}\times\frac{-12}{8}\right]$$
$$=\frac{-9}{2}\div\frac{-9}{4}$$
$$=\frac{-9}{2}\times\frac{4}{-9}$$
$$=2$$

7.

a) $$\frac{\frac{1}{8}\div\left(\frac{1}{4}-\frac{1}{3}\right)}{\frac{4}{3}+\frac{1}{2}\left[\frac{1}{2}\div\frac{3}{2}\right]}$$

$$=\frac{\frac{1}{8}\div\left(\frac{3-4}{12}\right)}{\frac{4}{3}+\frac{1}{2}\left(\frac{1}{2}\times\frac{2}{3}\right)}$$

$$=\frac{\frac{1}{8}\div\left(-\frac{1}{12}\right)}{\frac{4}{3}+\frac{1}{6}}$$

$$=\frac{-3}{2}\times\frac{18}{27}$$

$$= -1$$

b) $$\frac{\frac{15}{37}\left[\frac{4}{15}+\frac{23}{30}-\frac{5}{12}\right]}{\frac{1}{7}\left[\frac{14}{3}\div\frac{1}{3}\right]}$$

$$=\frac{\frac{15}{37}\left[\frac{16+46-25}{60}\right]}{\frac{1}{7}\left[\frac{14}{3}\times\frac{3}{1}\right]}$$

$$=\frac{\frac{15}{37}\left(\frac{37}{60}\right)}{2}$$

$$=\frac{1}{8}$$

c) $$\left[2\frac{3}{4}+4\frac{1}{8}\times1\frac{5}{11}\right]\div\left[7\frac{7}{8}\div10\frac{7}{20}\right]$$

$$=\left(\frac{11}{4}+\frac{33}{8}\times\frac{16}{11}\right)\div\left(\frac{63}{8}\div\frac{207}{20}\right)$$

$$=\left(\frac{11}{4}+\frac{48}{8}\right)\div\left(\frac{63}{8}\times\frac{20}{207}\right)$$

$$=\left(\frac{11}{4}+6\right)\div\left(\frac{63}{8}\times\frac{20}{207}\right)$$

$$=\frac{35}{4}\div\frac{1260}{1656}$$

$$=\frac{35}{4}\times\frac{1656}{1260}$$

$$=\frac{57960}{5040}$$

$$= 11.5$$

d) $$\frac{\frac{5}{11}\left[\frac{2}{3}-\frac{1}{5}\right]}{\frac{7}{2}+\left[1+\frac{5}{6}\right]}=\frac{\frac{5}{11}\left[\frac{10-3}{15}\right]}{\frac{7}{2}+\left[\frac{6+5}{6}\right]}$$

$$=\frac{\frac{5}{11}\left(\frac{7}{15}\right)}{\frac{7}{2}+\frac{11}{6}}$$

$$=\frac{\frac{7}{33}}{\frac{32}{6}}=\frac{7}{176}$$

8. a) $|2y-4|=12$

$2y - 4 \pm 12$

$2y - 4 = 12$ or $2y - 4 = -12$

$2y = 16$ $\quad$ $2y = -8$

$y = 8$ $\quad$ $y = -4$

Therefore, the solution set = {-4,8}

b) $|3x+2| = 7$

$3x + 2 = \pm 7$

$3x + 2 = 7$ or $3x + 2 = -7$

$3x = 5$ or $3x = -9$

$x = \frac{5}{3}$ $\quad$ $x = -3$

Therefore, the solution

set = $\left\{-3, \frac{5}{3}\right\}$

c) $3|4x-1|-5=10$

$3|4x-1|=15$

$|4x-1| = 5$

$4x - 1 = 5$ or $4x - 1 = -5$

$4x = 6$ or $4x = -4$

$x = \frac{3}{2}$ or $x = -1$

Therefore, the solution set

$= \left\{-1, \frac{3}{2}\right\}$

d) No solution

9. $\frac{|x|-|3y|}{xy} \Rightarrow \frac{|-6|-|3\times10|}{|60|}$

$= \frac{6-30}{60}$

$= \frac{-24}{60} = \frac{-2}{5}$

10. a) $\frac{x}{2}+11$ when x = 10

$= \frac{10}{2}+11$

$= 16$

b) $7x - 4y$ when x = 10 and y = $\frac{1}{2}$

$= 7\times10-4\times\frac{1}{2}$

$= 70 - 2$

$= 68$

c) $3x^2 + 6^2$ when x =0 and y = 2

$= 3(0)^2 + 6(2)^2$

$= 0 + 6(2)^2$

$= 0 + 6(4)$

$= 24$

11. $\dfrac{n}{18} = \dfrac{7}{9}$

$\Rightarrow 9n = 7 \times 18$

$\Rightarrow n = 14$

12. Dividend is 8, the divisor is 2 and the quotient is 4.

13.

a) $\left[4\frac{3}{4} + \left(1\frac{1}{2}\right)\right] \times \left[6\frac{1}{8} + \left(5\frac{3}{8}\right)\right]$

$= \left(\frac{19}{4} + \frac{3}{2}\right)\left(\frac{49}{8} + \frac{43}{8}\right)$

$= \left(\frac{25}{4} \times \frac{92}{8}\right)$

$= \dfrac{23 \times 25}{8}$

$= \dfrac{575}{8}$

b) (2.01 + (-3.17)) × (-4.2 + 17.8)

= -1.16 × 13.6

= -15.776

c) $4\frac{3}{4} \times \left[\frac{-16}{15} \times (-3.25)\right]$

$= \frac{19}{4} \times \left(\frac{52}{15}\right)$

$= \dfrac{988}{60}$

$= \dfrac{247}{15}$

d) $\frac{5}{16} \times \left[\frac{4}{15} \times \left(\frac{-4}{3}\right)\right]$

$= \frac{5}{6} \times \left(\frac{-16}{45}\right)$

$= \dfrac{-1}{9}$

14. Let x be some number then

7(x + 3) = 28

x + 3 = 4

x = 1

Therefore, the original number is 1.

15. Let x be some number then

5(x+ x) = 15

2x = 3

$x = \dfrac{3}{2}$

Therefore, the original number is $\dfrac{3}{2}$

UNIT 2

LINEAR EQUATIONS AND INEQUALITIES

Total allotted period: 25 periods

Introduction

This unit is designed to linear equations and inequalities. The unit gives more emphasis (focused) to solving linear equations and solving linear inequalities. It presents methods of solving linear equations and inequalities. In general, the concepts discussed in this unit enable students to solve linear equations and inequalities and to perform some of their application.

Unit Outcomes:

After completing this unit, students should be able to:

- solve linear equations using transformation rules.
- solve linear inequalities using transformation rules.

Suggested Teaching Aids in Unit 2

Although Suggested teaching aids not be excessively exploited for this unit, you can present different simple balance and model of thermometer.

2.1 Solving Linear equations

Competencies

Period allotted: 13 periods

At the end of this sub-unit, students should be able to:

- solve linear equation by using rules of equivalent transformation (with positive coefficient of the variable).

Introduction

This Sub – Unit with revising the basic concepts term, like terms or similar terms, coefficient of a term algebraic expressions, equation and equivalent equation. Related to these basic concepts, you discussed about rules of transformation for equation, linear equation in one variable, some word problems, Rules of Transformation for Inequalities and solutions.

Teaching Notes

So as begin, it is better to motivate the students by giving or asking the following questions.

1. Identify each of the following are algebraic expressions or mathematical equations.

   a) $2x + 10 = 5$

   b) $\frac{1}{2}x + 5 = -10$

   c) $2r + 10$

   d) $\frac{3}{2}x - 15$

2. Identify whether each pair of the following algebraic expressions are like terms or unlike terms.

   a) $\frac{3}{5}a^2b^3$ and a^2b^3

   b) $3\frac{2}{3}a^4b^5$ and $\frac{1}{2}a^5b^4$

   c) $\frac{3}{5}$ ab and ab

   d) a^2b^3 and - b^3a^2

Finally, group your students and let them to discuss Group Work 2.1. After they discuss in group, let some of the groups present their discussion to the whole class.

Answers to Group Work 2.1

1 a) Like terms or similar terms are terms whose variables and exponents are exactly the same but only differ in their numerical coefficients.

b) The factor which is a numerical constant of an expression is called **a numerical coefficient**.

c) Algebraic expressions have only one side.

Examples, $2x+10$, $\frac{9}{2}x + \frac{5}{2}$, $7x + 10$ etc

d) An equation is a mathematical statement that two algebraic expressions are equal (=).

e) Equivalent equations are equations that have the same value (the same solution) set.

2. a) 59 a^2b^2 and $\frac{59}{3}a^2b^2$, x^2y^2 and $2x^2y^2$ etc are examples of like terms or similar terms.

   b) 60ab and -70 a^2b^2, $\frac{-3}{2}$ a^2b^2 and $\frac{3}{2}a^4b^4$ are examples of unlike terms.

   c) $4x+\frac{1}{2} = 0$, 2x-6=-10, $\frac{3x}{2}+\frac{1}{2} = \frac{1}{2}$ etc are examples of equations.

   d) $5x+\frac{1}{2}$, $\frac{3}{2}$ $x + 10$, $\frac{-1}{2}x - \frac{1}{2}, \frac{3}{2}x + \frac{1}{2}$ etc are examples of algebraic expressions.

3. The numerical coefficients of x^3 is 1 and $-y^3$ is -1.

   A variety of problems are offered on Exercise 2A. This does not mean, however, that all these problems have to be solved by each student. The teacher should be selective according to the unit out comes.

Answers to Exercise 2A

1 a) equation
  b) Algebraic expression
  c) equation
  d) equation

2. a) $\frac{3}{2}$ b) $-3\frac{1}{2}$ c) $\frac{-2}{3}$ d) $\frac{-2}{7}$

3. a) like terms c) like terms
   b) unlike terms d) Unlike terms

4. $0.0056x+26=100x+3\frac{1}{2}$

   $0.0056x-100x+26-3.5 = 0$

   $-99.9944x+22.5 = 0$

   $-99.9944x=-22.5$

$x = \frac{22.5}{99.9944}$

$0.0056x+26=100x+3\frac{1}{2}$ is a linear equation because the value of x is exactly one solution set.

5. $a^5b^5c^5d^5$ and $-2(a^5b^5c^5d^5)$ are like terms. Because they have the same variables and exponents but only differ in the numerical coefficients.

Group your students and let them to discuss Activity 2.1, Exercise 2B and Activity 2.2. After they discuss in group or individual, let some of the group or individual present their discussion to the whole class.

Answer to Activity 2.1

1. a) $.0.8 + 2x = 3.5 - 0.5x$

$\Rightarrow 5(14-2x)=4(4+10x)$

$\Rightarrow 70-10x=16+40x$

$\Rightarrow 54=50x$

$\Rightarrow x=\frac{54}{50}$

b) $8x-(3x-5) =40$

$\Rightarrow 8x-3x+5=40$

$\Rightarrow 5x = 35 \Rightarrow x= 7$

c) $(2x + 8) - 20 =-(3x - 18)$

$\Rightarrow 2x+8-20=-3x+18$

$\Rightarrow 2x-12=-3x+18$

$\Rightarrow 5x = 30 \Rightarrow x = 6$

d) $5x-17-2x= 6x-1-x$

$\Rightarrow 3x-17=5x-1$

$\Rightarrow -2x=16$

$\Rightarrow x = -8$

2. $ax^2+bx+c=0$ it is a quadratic or second degree equation.

Answers to Exercise 2B

1. a) not equivalent
b) not equivalent
c) not equivalent
d) equivalent
e) not equivalent
f) equivalent

2. $4(2x-1) = 3(x+1)-2$ and $8x = 3x + 5$

$8x-4=3x+3-2$ $\quad$ $5x = 5$

$x= 1$ $\quad$ $x = 1$

Therefore, $4 (2x-1) =3(x+1) -2$ and $8x=3x+5$ are equivalent equations.

3. a) $x = -14$ d) $\{\ \}$

b) $x = \frac{3}{8}$ e) $x = \frac{1}{2}$

c) $x = -1$ f) $x = -2$

4. $\frac{2}{3}(x+4) + \frac{3}{5}(2x+1) = 0$; $4(x+4) - 3(2-x) = 17$

$$\frac{2}{3}x + \frac{8}{3} + \frac{6}{5}x + \frac{3}{5} = 0 \text{ and } 4x+16-6+3x=17$$

$$\frac{10x+40+18x+9}{15} = \text{ and } 7x+10=17$$

$$28x+49 = 0 \text{ and } 7x=7$$

$$28x=-49 \text{ and } x=1$$

$$x = \frac{-7}{4}$$

Therefore, $\frac{2}{3}(x+4) + \frac{3}{5}(2x+1) = 0$ and $4(x+4)-3(2-x) = 17$ are not equivalent equation ….Why?

5. a). $ax+b=cx+d$; $a \neq c$

$ax-cx+b-d=0$

$x(a-c)=d-b$

$x = \frac{d-b}{a-c}$

b) $m(x-n)=3(r-x)$; $m \neq 3$

$mx-mn=3r-3x$

$mx+3x=3r+mn$

$a_1 \neq a_2$

$x(m+3)=3r+mn$

$x = \frac{3r+mn}{m+3}$

c) $ax+b=c$; $a \neq 0$

$ax=c-b$

$x = \frac{c-b}{a}$

d) $x+y=b(y-x)$; $b \neq -1$

$x+y=by-bx$

$x+bx=by-y$

$x(1+b)=by-y$

$x = \frac{by-y}{1+b}$

e) $a_1x+b_1y=a_2x+b_2y$;

$a_1x-a_2x=b_2y - -b_1y$

$x(a_1-a_2) = b_2y-b_1y$

$x = \frac{b_2y-b_1y}{a_1-a_2}$

Answers to Group Work 2.2

1. a) A number plus twelve.
   b) The sum of a number and twelve.
   c) Twelve added to a number.
   d) A number increased by twelve.
   e) Twelve more than a number.
2. a) A number minus seven.
   b) The difference between a number and seven.
   c) Seven subtracted from a number.
   d) Sven less than a number.
   e) Seven fewer than a number.
   f) A number decreased by seven.
3. a) Four times a number.
   b) product of four and a number.
   c) Four multiplied by a number.
   d) Four ways a number.
4. a) A number divided by six.
   b) The quotient of a number and six.
   c) The ratio of a number and six.
   d) one-sixth of a number.

The main objective of this topic us to stabilize the method of solving equation by applying it to solving word problems. To avoid weaknesses on solving formal problems, students should further be made to practice on solving problems during the daily exercises, depending on the actual situation in the class. Some exercises, for 2c like problem number 5,6 and 7 could be performed to gain further practice.

Answers to Exercise 2C

1. Let x be a number then

$$\frac{3}{4}x = \frac{1}{10}$$

$$x = \frac{1}{10} \times \frac{4}{3}$$

$$x = \frac{4}{30}$$

2. Let x be the first integer and x+1 be the second integer then

$$x+x+1 = 3(x+1-x)$$
$$2x+1=3$$
$$2x=2$$
$$\Rightarrow x= 1$$

Therefore, the larger number will be 2.

3. a) Let x be a number then

$$2x+4= 3x-7$$
$$x=11$$

b) Let x be a number then

$$2(x+4) =4x-6$$
$$2x+ 8=4x-6$$
$$x =7$$

4. Let the number of boys in the class be "B" and the number of girls be G then

B+G=48 …………… Equation 1

G=3B ……………… Equation 2

Substituting equation (2) in equation (1) we get

$$B+3B= 48$$
$$4B= 48$$
$$B=12$$

Implies G=3(12) = 36

Therefore, there are 12 boys and 36 girls in the class.

5. Let S= sheep and h= hen

$$\left.\begin{array}{l} s+h=100 \\ 4s+2h=356 \end{array}\right\} \text{from } s+h=100 \Rightarrow s=100-h$$

$$4(100-h)+2h=356$$
$$400-4h+2h=356$$
$$400-2h=356$$
$$44=2h$$
$$\Rightarrow h=22$$

Thus s= 100-h

$$\Rightarrow s= 100-22 = 78$$

Therefore, the farmer have 22 hens and 78 sheep.

6. Let x be the first number and y also the second number then

$$\begin{cases} 8x+5y=184 \ldots\ldots\ldots\ldots \quad \text{Equation (1)} \\ x - y = -3 \ldots\ldots\ldots\ldots\ldots \quad \text{Equation (2)} \end{cases}$$

$\Rightarrow x - y = -3$

$\Rightarrow x = -3+y \ldots\ldots\ldots\ldots$ Equation (3)

Substituting equation 3 in equation (1) we get

$8(-3+y) + 5y = 184$

$-24+8y+5y = 184$

$-24+13y = 184$

$13y = 208$

$\Rightarrow y = \frac{208}{13} = 16$

Thus $x = -3+\frac{208}{13}$

$x=13$

Therefore, the first number is 13 and the second number will be 16.

7. Let p= perimeter, ℓ length and w= width then

$p = 2(\ell+w)$

$628=2(w+6+w)$

$628=2(2w+6)$

$314=2w+6$

$308=2w$

$w=154m$

$\ell= w+6$

$\ell= 154+6$

$\ell= 160m$

The dimensions of the rectangular field 2 = 154m and ℓ=160m

Assessment

Dear teachers give different activities to your students on solving simple linear equations and check their work. Finally give oral questions, quiz, Test and various exercise problems can be given as a class work, a project work, a group work and home works. For fast learners or interested students, you can also give the following additional exercise problems.

Find the value of the unknown quantity which satisfies each of the following equations, and in each case verify the solution.

1. $\frac{x}{2}+\frac{x}{3}=5$

2. $\frac{x}{9}+2\frac{2}{9}=6-\frac{3x}{7}$

3. $\frac{3}{8x}=\frac{15}{7}\ (x\neq 0)$

4. $\frac{x}{3}+1\frac{1}{2}=\frac{2x}{9}-\frac{x}{6}+4$

5. $5x-11x+29=2x-11$

6. $9x-41-13x=24-17x$

7. $\frac{7x+2}{5}=\frac{4x-1}{2}$

8. $\frac{3x-13}{7}+\frac{11-4x}{3}=0$

9. $\frac{2x-1}{3}-\frac{3x-2}{4}=\frac{5x-4}{6}-\frac{7x+6}{12}$

10. $\frac{2x-7}{11}-\frac{x-2}{7}=\frac{5x-3}{7}-6$

2.2 Solving Linear inequalities

Period allotted: 12 periods

Competencies

At the end of this sub-unit, students should be able to:

- solving linear inequalities with positive coefficients using the rule of equivalent transformation.

Introduction:

You may start the revision work by asking your students and clarifying the important notations such as:

- The rules of transformation of inequalities using examples.
- Assist students to demonstrate how to solve a linear inequality that requires one or more equivalent transformations; based on each activities.

Teaching Notes

The purposes of this topic is to establish, step by step, a system of rules for transforming inequalities through " equivalent inequalities"

Example 1: $x < 20$

Example 2 $3x < 9$

On the chalk board and ask the students to give the solution in W.

The discussion should lead to the following conclusions

- Inequality (1), the solution can be read directly.
- Inequality (2) the solution is obtained by rearranging the inequality, i.e by dividing both sides of the inequality by 3.

For fast learner students, you might give additional questions such as the following. Find the value of x satisfying the following inequalities.

a) $5x + 10 > 10$; $x \in \mathbb{N}$

b) $\frac{2x}{3} - \frac{3}{5} < \frac{5}{6}; x \in \mathbb{W}$

c) $3x+10 \leq 3x + 2x + 20$; $x \in \mathbb{Q}$

d) $\frac{1}{2}x + \frac{3}{2}x > 5x + 50; x \in \mathbb{Z}$

You may now ask students to do Activity 2.2 in the student text book on their own independently so that they can practice to solve.

By rounding you need to see their work and give extra help to students who are lagging behind.

Answers to Activity 2.2

1. a) $x \leq \frac{-3}{4}$ c) $x \geq \frac{-42}{12}$ e) $x < -3$

   b) $x \geq 3.8$ d) $x \geq \frac{10}{3}$

The purpose of Group work 2.3 is to enable the students realize how to use inequalities by using the addition rule and multiplication rule to find the solution set.

Answers to Group work 2.3

1. a) $x > -5$ c) $x \leq 0.6$

   b) $x > -12.4$ d) $x \geq -0.41$

2. a) $x \leq \frac{-5}{3}$ c) $x > 6$

   b) $x \geq \frac{-3}{81}$ d) $x \geq 2$

After Completing and understanding example 21 and 22 try to solve exercise 2D individual.

Answers to Exercise 2D

1. a) equivalent d) equivalent

   b) not equivalent e) equivalent

   c) equivalent

2. a) linear d) linear

   b) linear e) not linear

   c) linear f) not linear

3. a) $32-14x \geq 20x-8$

$40 \geq 34x$

$34x \leq 40$

$x \leq \frac{20}{17}$

b) $5x+5x+2x \leq -24$

$12x \leq -24$

$x \leq -2$

c) $7(x-2)<4x-8$

$7x-14<4x-8$

$3x< 6$

$x < 2$

d) $5(x-3)< 7(x+6)$

$-2x < 57$

$x > \frac{-57}{2}$

e) $\frac{3x+4}{2} \geq 10$

$3x+4 \geq 20$

$3x \geq 16$

$x \geq \frac{16}{3}$

f) $\frac{2-3x}{4} x+4$

$2-3x > 4x+16$

$-14 > 7x$

$7x < -14$

$x< -2$

g) $\frac{3}{4}x + \frac{2}{3} < \frac{5}{6}x + \frac{4}{5}$

$\frac{3}{4}x - \frac{5}{6}x < \frac{4}{5} - \frac{2}{3}$

$\frac{9x-10x}{12} < \frac{12-10}{15}$

$\frac{-x}{12} < \frac{2}{15}$

$-15x < 24$

$x > \frac{-24}{15}$ or

$x > \frac{-8}{5}$

h) $-5x+7 \leq 1.4x-17$

$-5x-1.4x \leq -24$

$-6.4x \leq -24$

$x \geq \frac{240}{64}$ or

$x \geq 3.75$

i) $\frac{2}{3}x+\frac{3}{4}<\frac{4}{5}x+\frac{5}{6}$

$$\frac{2}{3}x-\frac{4}{5}x<\frac{5}{6}-\frac{3}{4}$$

$$\frac{10x-12x}{15}<\frac{10-9}{12}$$

$$\frac{-2x}{15}<\frac{1}{12}$$

$$x>\frac{-15}{24}$$

4. $x+0.000894 \leq -0.009764$

$x \leq -0.009764-0.000894$

$x \leq -0.010658$

5. $8x-0.00962 \leq 7x+0.00843$

$x \leq 0.01805$

6. $x+0.001096 \geq -0.005792$

$x \geq -0.005792-0.001096$

$x \geq -0.006888$

7. $6x-0.000834 < 5x-0.000948$

$6x-5x < 0.000948-0.00834$

$x <- 0.000114$

Answers to Activity 2.3

1. a) $10x+14 < 25$ ($x \in \mathbb{N}$)

$10x < 11$

$x < \frac{11}{10}$

Therefore, the only solution set is {1}

b) $5(2+x)>18+6x$ ($x \in \mathbb{W}$)

$10+5x>18+6x$

$-x>8$

$x<-8$

Solution set= { }

c) $2-3x \geq 10$ ($x \in \mathbb{Q}$)

$-3x \geq 8$

$x \leq \frac{-8}{3}$

Solution set $\{x : x \leq \frac{-8}{3}\}$

d) $10-2x \leq 4x-2$ ($x \in \mathbb{Z}$)

$12 \leq 6x$

$2 \leq x$

Solution set = $\{x: x \geq 2\}$

Finally, problem number 1-4 of Exercise 2E could be take for home work because this problems contains all types of inequalities dealt with in topic 2.2.3.

Answers to Exercise 2E

1. $x > \frac{9}{2}$
2. let x be a natural number then

$x < -x+8$

$2x < 8$

$x < 4$

Solution set= {1, 2,3}

3. Let (x+2) and (x+4) be the two consecutive even integers then

$x+2+x+4 > 51$

$2x > 45$

$x > 22.5$

Let 24 be the smallest integer >22.5 then 2+24>22.5

$\Rightarrow 26 > 22.5$

$\Rightarrow 4+24 > 22.5$

$\Rightarrow 28 > 22.5$

Therefore, 26 and 28 be the two consecutive integers

4. 35

Assessment

Dear teachers you need to assess your students in order to be informed about their progress. Making assessment will enable you to find out what aspect of the lesson is difficult. Assessment will also give a clear picture of the knowledge and skill of the students. At the end of the lesson to give additional class activities or group discussion or assignment and quiz or test. You can give them the following questions as additional exercise problems.

Solve the following inequalities

1. $\frac{1}{2}(x + 6) > \frac{3}{4}(x - 4)$
2. $6x + 10 < 10x - 14$
3. $\frac{5}{8}x \le \frac{3}{4}x - 10$
4. $\frac{3}{4}(x-3) < \frac{1}{2}(x+8)$
5. $\frac{1}{2}(x+6)+\frac{1}{4}(x-2)<\frac{1}{6}(x+2)$
6. $15(3-4x)-2(3x+4) < 0$
7. $\frac{1}{5}(x+4)-\frac{1}{4}(4-x)\ge\frac{1}{3}(x+4)-\frac{1}{2}(5-x)$
8. $\frac{2}{3}(x-4)-\frac{3}{4}(x+4)\ge\frac{1}{2}(2x-3)$
9. $12(x+2) -12(x+12) \le 10$
10. $\frac{1}{2}(2x-1)+\frac{1}{2}(2x+3)<3(x+4)$

Answers to Miscellaneous Exercise 2

1. a) $x= 1$
   b) $y= \frac{-1}{2}$
   c) $x= \frac{21}{8}$
   d) $x= -2$
   e) $y = \frac{3}{7}$
   f) $x = 16$
   g) $y = \frac{-8}{7}$
   h) $x= \frac{1}{5}$
   i) $x= -1$

2. a) $x = -10$ d) $x = 0$ g) $y = \frac{3}{7}$

   b) $y = \frac{1}{4}$ e) $y = 1$ h) $y = \frac{-240}{156}$

   c) $x = 8$ f) $p = \frac{10}{3}$

3. To **simplify an expression**, clear parentheses and combine like terms. To **solve an equation**, use addition, subtraction, multiplication, and division properties of equality to isolate the variable.
4. First use the subtraction property, then the division property.
5. First use the addition property, then the division property.
6. Let x and x+1 be the two consecutive integers then

$$x+x+1 = -67$$
$$2x = -68$$
$$x = -34$$
$$\Rightarrow x+1 = -33$$

Therefore, the integers are -34 and -33.

7. $x+x+1=941$

$$2x = 940$$
$$x = 470$$
$$\Rightarrow x+1 = 471$$

Therefore, the page numbers are 470 and 471.

8. y+2, y+4
9. The numbers are 17, 19 and 21
10. a) 2x+26

    b) – (14x+31)

11. a) $x \geq -7.5$ d) $x < 7$

    b) $y \geq -0.3$ e) $y > -5$

    c) $x > -3$ f) $x \leq \frac{15}{4}$

12. a) $\varnothing$

 b) $\varnothing$

 c) solution set= $\{x:x<-3\}$.

 d) solution sets are $=\{x:x\geq13\}= \{13,14,15 \ldots\}$.

 e) solution set = $(y:y <-6\}$.

13. Solution set = $\{x:6 < x \leq 11\}$.

14. $x+x+20=86$

$$2x= 66$$

$$\Rightarrow x= 33$$

and $x+20 =33+20$

$$= 53$$

Therefore, the length of the pieces are 33cm and 53cm.

15. Solution set = $\{x:x \leq\frac{9}{14}\}$

UNIT 3

RATIO, PROPORTION AND PERCENTAGE

Total allotted period: 24 periods

Introduction

This unit requires a firm understanding of ratio, proportion and percentage. The concept of correspondence is developed by matching the elements of two sets. The pupils learn that numbers associated with the matching form a ratio and that the fractions may be used to name the **ratio.**

Proportionality (direct and inverse) are given by Group work 3.3 and 3.4 on student textbook. Finally the students are in a position to apply what they have studied about percentages in problems solutions.

Unit outcomes:

After completing this unit, students should be able to:

- understand the notations of ratio and proportions.
- solve problems related to percentage.
- make use of the concept of percentage to solve problems of profit, loss and simple interest.

Suggested Teaching Aids in Unit 3

You can present different figures, and different squres model that demonstrate (Show) the characterstics of ratio.

3.1 Ratio and Proportion

Period allotted: 6 periods

Competencies

All the end of this sub – unit, students should be able to:

- explain the notion of ratio.
- Solve simple problems on ratio.
- Solve problems on proportion.

Introduction

This Sub – Unit deals with ratio and proportion. To do this you may use Group work 3.1 and Group work 3.2 . For the main purpose of the Activities to understand the concept of ratio and proportion.

Teaching Notes

Dear teachers you are always present simple fact (known facts) to the more general facts. More over to show the importance of this sub – unit to discussed about ratio and proportion.

***Example1*:-** Write down the ratio of the first number to the second one, in the simplest form:

a) 6 kg to 200 gram

b) 100m to 200 cm

Solution:

a) 6 kg to 200 gram

But 1kg = 1000 gram

6kg = x

$x \times 1\text{kg} = 6\text{kg} \times 1000$ gram

$x = 6{,}000$ gram

Therefore, The ratio of 6,000 gram to 200 gram = $\frac{6{,}000\text{gram}}{200\text{gram}}$

$= \frac{30}{1} = 30:1$

b) 100m to 200 cm

But 1m = 100 cm

100m = x

$x \times 1\text{m} = 100\text{m} \times 100\text{cm}$

$x = 10{,}000$ cm

Therefore, the ratio of 10, 000 cm to 200 cm = $\frac{10{,}000\text{cm}}{200\text{cm}}$

$= \frac{50}{1} = 50:1$

***Example 2*: Find the unknown value in the proportion:**

$$\frac{2x+10}{3} = \frac{x+8}{5}$$

***Solution*:-** $3(x+8) = 5(2x+10)$

$3x+24 = 10x+50$

$-7x = 26$

$$x = \frac{-26}{7}$$

Therefore; the value of the unknown is $\frac{-26}{7}$

You can use the practical activities to the students do for the purpose of give Group work 3.1 and 3.2 as a group work so that students can present their work.

Answers to Group Work 3.1

1. a) $\frac{3}{2}$ b) $\frac{1}{2}$

2. $\frac{3}{2}$

Finally, problem number 1-13 of Exercise 3A could be take for home work, class work and assignments because this problems contains all types of ratio dealt with in topic 3.1.

Answers to Exercise 3A

1. a) $\frac{3}{5}$ c) $\frac{3}{4}$ e) $\frac{1}{1}$

   b) $\frac{1}{2}$ d) $\frac{4}{3}$ f) $\frac{7}{4}$

2. a) $\frac{25}{1}$ c) $\frac{7}{13}$ e) $\frac{13}{7}$

b) $\frac{6}{5}$ d) $\frac{8}{9}$ f) 600

3. The ratio of the two numbers is $\frac{3}{5}$.

It means that the numbers are some common multiples of 3 and 5.
Let this common multiple be x.
Then, the given numbers are 3x and 5x.
The sum of the numbers is given to be 88
Therefore, $3x + 5x = 88$

$\Rightarrow 8x = 88$

$\Rightarrow x = 11$

Therefore, the first number $= 3x \Rightarrow x = 33$ and
the second number $= 5x \Rightarrow 5 \times 11 = 55$.

4. 35 and 15
5. 30^o, 60^o, 90^o
6. Birr 80 (1: 3: 5: 7) (5) = (5: 15: 25: 35) ⇒5 + 15 + 25 + 35 = 80.
7. $\frac{2A}{3B} = \frac{5}{6}$ and $\frac{3B}{2C} = \frac{36}{15}$

$$\frac{2A}{3B} \times \frac{3B}{2C} = \frac{5}{6} \times \frac{36}{15}$$

$$\Rightarrow \frac{A}{C} = \frac{2}{1}$$

8. $\frac{5}{1}$
9. let x be a number then

$12x - 5x = 49$

$7x = 49$

$\Rightarrow x = 7$

Therefore, the first number = 84 and the second number = 35.

10. 60cm and 100cm
11. 120; 150
12. $\frac{4}{7}$
13. $\frac{81}{25}$

Answers to Group Work 3.2

1. 6.8
2. 5.5

Dear teachers, as far as possible, the teaching and learning process should not be teacher centered. Attention should be given to Exercise 3B to motivating students to participate in the lessons through class activities, class work, home work and doing the given exercise independently.

Answers to Exercise 3B

1. P = x y
2. a) x = 15 d) k = 378 g) x = 255
   b) y = 18 e) x = 206.4 h) x = 96.5
   c) y = 57 f) x = 48
3. a) let x be the fourth proportional to 15, 12, 35

   Then $\frac{15}{12} = \frac{35}{x}$

   $\Rightarrow x = 28$

   Therefore, the fourth proportional is 28.

   b) let x be the fourth proportional to a^2, ab and b^2

   Then $\frac{a^2}{ab} = \frac{b^2}{x}$

   $x = \frac{b^3}{a}$

   Therefore, the fourth proportional is $\frac{b^3}{a}$.

4. The number 14, 21, 4, and 6 are in proportion

$$\frac{14}{21} = \frac{4}{6}$$

$\Rightarrow 84 = 84$

Therefore, 14, 21, 4 and 6 are in proportion.

5. a) let x be the mean proportion between 20 and 45.

Then $\frac{20}{x} = \frac{x}{45}$

$\Rightarrow x^2 = 900$

$\Rightarrow x = 30$

Therefore, the mean proportion between 20 and 45 is 30.

b) let x be the mean proportion between 25 and 16.

Then $\frac{25}{x} = \frac{x}{16}$

$\Rightarrow x^2 = 25 \times 16$

$\Rightarrow x^2 = 400$

$\Rightarrow x^2 = (20)^2$

$\Rightarrow x = 20$

Therefore, the mean proportional between 25 and 16 is 20.

6. $48x^2$, $64x^4$, x and $36x^2$ are in proportion

$$\frac{48x^2}{64x^4} = \frac{x}{36x^2}$$

$$\Rightarrow \frac{48}{64x^2} = \frac{x}{36x^2}$$

$$\Rightarrow \frac{48}{64} = \frac{x}{36}$$

$$\Rightarrow 64x = 1728$$

$$\Rightarrow x = \frac{1728}{64}$$

$$\Rightarrow x = 27$$

7. a) 53 c) 73

b) 630 d) 630

Group your students and let them to discuss Group work 3.3 and Group work 3.4 . After the discussion encourage your students to respond to each questions posed in the student textbook. You have to give fairly equal chance to your students and motivating equally. Don't forget to entertain your students those achieving below and above the minimum learning Competencies.

Answers to Group work 3.3

1. The answer is different.
2. a) $y = 18$ b) $x = 35$
3. $k = 4$
4. $q = \frac{15}{2}$
5. $\frac{1}{3}$
6. $K = 8$
7. $E = 96$

Answers to Group work 3.4

1. The answers is different.
2. $y = 7.5$
3. $m = 10$
4. a) 45 days b) $\frac{45}{2}$ days
5. $a \; \alpha \; y^2$

$\Rightarrow a = ky^2$ ………. k is a constant

$b \; \alpha \; \frac{1}{y}$

$\Rightarrow b = \frac{n}{y}$ …………. n is α constant

$\Rightarrow x = a + b + 4$

$$x = ky^2 + \frac{n}{y} + 4$$

Substituting y = 2 and x = 18

$$18 = 4k + \frac{n}{2} + 4$$

$\Rightarrow 8k + n = 28$ ………… Equation 1

Substituting y = 1 and x = -3

$$-3 = m + n + 4$$

$\Rightarrow m + n = -7$ ………… Equation 2

Solving equation (1) and (2),

k = 5 and n = -12

$$\Rightarrow x = 5y^2 - \frac{12}{y} + 4$$

Substituting y = 4

$$x = 5(4)^2 - \frac{12}{4} + 4$$

$= 80 – 3 + 4$

$= 81$

Assessment

Remember the minimum learning competencies of the students. As part of the assessment technique, let your students define ratio and proportions: Ask them to identify direct and inverse proportions. Always check their answers and give immediate feedback.

Finally; Depending on their level of understanding you may also give additional exercises of the following type:

For slow learners

Write the following ratio in their simplest form:

1. The ratio of the radius of a circle to its diameter.
2. The ratio of the circumference of a circle to its diameter.

For Fast learners

Answer the following questions.

1. Calculate the ratio of the side with the diagonal of the same square of side 50 cm.
2. If $6a^3b$, $12a^2b^2$,k and $48ab^3$ are in proportion, express k in terms of a and b.

3.2 Further on percentage

Period allotted: 7 periods

Introduction

Percentages are comparison of a given quantity (or part) with the whole amount (which you call 100). Emphasize that percent means per hundred. Call the pupils' attention to % (percent sign).

Teaching Notes

The teacher should emphasize to the students that there are four basic types of Guidelines of percentage, decimal and fraction.

1. **Guidelines for Converting a percentage to a decimal**

   To convert a percentage to a decimal, remove the % symbol and multiply by 0.01.

***Example1*:** Convert the percentage to decimals.

a) 72% b) 0.046%

***Solution*:-**

a) $72\% = 72\times0.01$
$= 0.72$

b) $0.046\% = 0.046 \times0.01$
$= 0.00046$

2. **Guidelines for converting a percentage to a fraction**

   To convert a percentage to a fraction, remove the % symbol and multiply by $\frac{1}{100}$. Reduce the resulting fraction to lowest terms if necessary.

Example2**:** Convert the percentage to fraction.

a) $23\frac{1}{3}\%$ b) 99%

Solution:

a) $23\frac{1}{3}\% = \frac{70}{3} \times \frac{1}{100}$

$= \frac{70}{300}$

$= \frac{7}{30}$

b) $99\% = 99\times \frac{1}{100}$

$\frac{= 99}{100}$

3. **Guidelines for converting a decimal to a percentage**

   To convert a decimal to a percentage, multiply by 100% which is 1 (and attach the % symbol on the result).

Exam le3**:** convert the decimal to percentage.

a) 0.245   b) 0.567

Solution:

a. $0.245 = 0.245 \times 100\%$

$= 24.5\%$

b) $0.567 = 0.567 \times 100\%$

$= 56.7\ \%$

4. **Guidelines for converting a fraction to a percentage.**

   To convert a fraction to a percentage, multiply by 100% which is 1 (or $\frac{100}{100}$ but attach the symbol % on the result).

Example4**:** Convert the fractions to percentages.

a) $3\frac{5}{4}$ b) $\frac{3}{5}$

Solution:

a) $3\frac{5}{4} = 3\frac{5}{4} \times 100\%$

$= \frac{17}{4} \times 100\%$

$= 425\%$

b) $\frac{3}{5} = \frac{3}{5} \times 100\%$

$= 60\%$

The teacher should emphasize to the student that are three basic types of percent problems by taking other additional and simple examples; for example,

i) What number is 5% of 60? Asking (Percentage).
ii) 5% of what number is 2? Asking (base).
iii) What percent of 60 is 3? Asking (rate).

Group work 3.5

1. a) 0.93 b) $\frac{93}{100}$
2. a) 0.88 b) 4.14 c) 0.00047
3. a) $\frac{53}{100}$ b) $\frac{100}{300} = \frac{1}{3}$ c) $\frac{76}{1000} = \frac{19}{250}$ d) $\frac{22}{25}$
4. a) 93 % b) 1082% c) 0.6% d) 88%

The main purpose of Exercise 3c is to understand students convert percentage to decimal, convert decimal to percentage, convert percentage to fraction or convert fraction to percentage.

Answer to Activity 3.1

1. The answer is different
2. a) 0.86 c) 0.00045

   b) 2.42 d) 2.46
3. The answer is different.

4. a) $\frac{19}{25}$ c) $\frac{113}{50}$

b) $\frac{5}{2}$ c) $\frac{49}{50}$

5. The answer is different.

6. a) 13.5% c) 53.6%

b) 0.35% d) 0.2%

7. The answer is different.

8. a) 325% c) 35%

b) 60% d) 20%

Answers to Exercise 3c

1. a) 1.98 b) 6.28 c) 7.77 d) 0.00045

2. a) $\frac{29}{50}$ b) $\frac{133}{300}$ c) $\frac{39}{500}$ d) $\frac{9}{250}$

3. a) 96% b) 2080% c) 0.88% d) 2800.8%

4. a) $\frac{4}{15}\%$ b) $\frac{5}{18}\%$ c) $\frac{14}{25}\%$ d) $\frac{5}{16}\%$

5.

Percentage	Decimal	Fraction
61%	0.61	$\frac{61}{100}$
760%	7.6	$\frac{76}{10}$
135%	1.35	$\frac{27}{20}$
$8\frac{1}{2}\%$	0.085	$\frac{17}{200}$
67%	0.67	$\frac{67}{100}$

92%	0.92	$\frac{23}{25}$
8.9%	0.089	$\frac{89}{1000}$
$76\frac{1}{4}\%$	0.7625	$\frac{61}{80}$
1980%	19.8	$\frac{99}{5}$
96%	0.96	$\frac{24}{25}$

6. a) 5% b) $\frac{1}{3}\%$ c) 15% d) 50%
7. 40%
8. 512.5%

Answers to Class Activity 3.2

1. a) Birr 99 d) 3.8 km g) Birr 1562
   b) 225 tones e) 0.1728litres h) Birr 1.68
   c) 30720m f) Birr 669.12

Answers to Class Activity 3.3

1. a) Birr $\frac{3600}{29}$ c) 120 min
   b) 300 cents d) $\frac{100}{3}$ cm

Answers to Activity 3.4

1. a) 20% b) 0.15% c) 50% d) 12000%

Answers to Exercise 3D

1. Given:
   34 came from USA
   44 came from Japan
   64 came from Germany

18 came from South Africa

Total sum = 160

Percentage of Japan = $\frac{44}{160} \times 100 \times \frac{1}{100}$

$= 27.5\%$

2. We notice that 16 is the percentage and 25 is the base so the required quantity is the rate percent

Thus $\frac{r}{100} = \frac{p}{b}$

$\Rightarrow \frac{r}{100} = \frac{16}{25}$

$\Rightarrow r = 64\%$

Thus, 64% is the student's mark in percent.

3. Let x = the unknown quantity, then

$\frac{25}{100} = \frac{135.75}{x}$

x = Birr 543

Hence 25% of Birr 543 is Birr 135.75

4. Using the basic formula:

$\frac{r}{100} = \frac{18}{B}$

$\Rightarrow \frac{12}{100} = \frac{18}{B}$

$\Rightarrow 12B = 1800$

$\Rightarrow B \quad = 150$ oranges

Total oranges

150 = unsold oranges + sold oranges

150 = unsold oranges + 18

$\Rightarrow$ 132 oranges are not sold.

5. $25\% + 20\% + 6\% = 51\% = 0.51$

Now $0.45 = 36{,}000$

$0.51 = x$

$0.45x = 36{,}000 \times 0.51$

$x = 40800$

Therefore, the electorate voted $= 40{,}800 + 36{,}000$

$= 76{,}800$

6. First find the percent of the girls

$$\Rightarrow \frac{r}{100} = \frac{20}{80}$$

$$\Rightarrow 4r = 100$$

$$\Rightarrow r = 25\%$$

$\therefore$ The number of girls in the class is 25% while the number of boys in the class is 75%.

7. Given

$R = 36\%$ so $r = 5$

$P = 48$

$B = ?$

Thus $R = 100\% - 36\% = 64\%$

Using the basic formula: $\frac{r}{100} = \frac{P}{B}$

$$\frac{64}{100} = \frac{48}{B}$$

$$\Rightarrow B = 75$$

$\therefore$ There are 75 students in the class.

8. a) children $= 26\frac{2}{3}\%$

b) Women $= 56\frac{2}{3}\%$

c) men $= 16\ \frac{2}{3}\%$

9. Given: $B = A + 1$

Using the basic formula

$$\frac{A}{B} = \frac{P}{100}$$

$$\frac{A}{A+1} = \frac{93.75}{100}$$

$$93.75A + 93.75 = 100A$$

$$6.25A = 93.75$$

$$A = 15$$

$$\text{and } B = A + 1$$

$$= 15 + 1$$

$$= 16$$

Therefore the amount = 15 and the base = 16

10. $I = PRT$

$$= \text{Birr } 46{,}000 \times \frac{26}{100} \times 1\text{year}$$

= Birr 11960

Thus $A = P + I$

= Birr 11960 + Birr 46,000

Birr 57,960

Assessment

Dear teachers Give different activities to your students on the basic concepts and terms such as, base, amount, percent and percentage of a given base using the concept of proportion.

Finally give oral questions, quiz, Test and various exercise problems can be given as a class work, a project work, a group work and home works. For slow learners and fast learners students, you can also give the following additional exercise problems.

For Slow learners

Work out the following questions

1. In an examination, out of 80 marks, Abebe scored 70 marks. What percent of marks did he score?
2. In a school, two – thirds of the students are boys. What percentage of the students are boys?

For Fast learners

Work out the following questions

1. A basket contains 120 mangoes, 15% of the mangoes are damaged. Find the number of mangoes which are good enough to eat.
2. 60% of the students of a school are boys. Find the number of boys in the school if the total number of students in the school is 1,440.

3.3 Application of percentage in calculations

Period allotted: 11 periods

Competencies

At the end of this sub – unit, students should be able to:

- apply the concepts of percentage to solve problems on profit and loss.
- apply the concept of percentage to solve problems on simple interest.

Introduction

In this sub – topic, students should be able to calculate or compare quantities interms of percentage loss or percentage profit. The calculation of profit and loss and interest are among the various application of percentages. At this stage the students are in a position to apply what they have studied about percentages in problems solutions.

The teacher should first give a formal definition of profit and loss and write the formulae used to calculate profit and percent loss and show their applications by using different examples as those given in the text.

Teaching Note

The teacher should first give a formal definition of profit and loss and write the formulae used to calculate profit and percent loss and show their applications by using different examples similar to student, Textbooks. The main aim of Activity 3.5 and Activity 3.6 the students will be easily to compare quantities by means of percentage change, i.e by percentage increase or percentage decrease. Finally after solving Activity 3.5 and Activity 3.6 give comments for your students.

Answers to Activity 3.5

1. a) Actual change = 600 – 400

$= 200$

$$\text{Percentage increase} = \frac{\text{Actualchange}}{\text{Originalchange}} \times 100\%$$

$$= \frac{200}{400} \times 100\%$$

$$= 50\%$$

b) Actual change = 500 – 300

$= 200$

$$\text{Percentage increase} = \frac{\text{Actual change}}{\text{Original change}} \times 100\%$$

$$= \frac{200}{300} \times 100\%$$

$$= \frac{200}{3}\%$$

2. Actual change = 60 – 20

$= 40$

$$\text{Percentage increase} = \frac{\text{actual change}}{\text{aoriginal change}} \times 100\%$$

$$= \frac{40}{20} \times 100\%$$

$$= 200\%$$

Answers to Activity 3.6

1. a) Actual change = 600 – 400

$$= 200$$

Percentage decrease = $\frac{\text{actualchange}}{\text{originalchange}} \times 100\%$

$$= \frac{200}{600} \times 100\%$$

$$= \frac{100}{3}\%$$

b) Actual change = 500 – 300

$$= 200$$

Percentage decrease = $\frac{\text{actual change}}{\text{original change}} \times 100\%$

$$= \frac{200}{500} \times 100\%$$

$$= 40\%$$

2. Actual change = 80 – 30

$$= 50$$

Percentage decrease = $\frac{\text{actual change}}{\text{Originalchange}} \times 100\%$

$$= \frac{50}{80} \times 100\%$$

$$= 62.5\%$$

Answers to Exercise 3E

1. The VAT is 15%

It is Birr 175 $\times \frac{15}{100}$ = Birr 26.25

Therefore, the VAT is Birr 26.25

The man actually Pay = Birr 175 + Birr 26.25

= Birr 201.25

2. 25 kg
3. 12%
4. First 10% of 500 = $\frac{10}{100}$ × Birr 500 = Birr 50

   ∴ The new salary = original salary + Increment

   = Birr 500 + Birr 50

   = Birr 550 Birr
5. Sales tax = $\frac{6}{100} \times 60{,}00$

   = 3600

   Total cost = 60,00 + 3600

   = Birr 63,600

Answers to Activity 3.7

1. $\% \text{ profit} = \dfrac{\text{selling price - cost price}}{\text{Cost price}} \times 100\%$

   $= \dfrac{225-180}{180} \times 100\%$

   $= \dfrac{4500}{180}\%$

   = 25%
2. Birr 29 × $\frac{15}{100}$ + Birr 29 = Birr 4.35 + Birr 29

   = Birr 33.35
3. $\% \text{ loss} = \dfrac{\text{Cost Price - selling price}}{\text{Cost price}} \times 100\%$

   $5\% = \dfrac{150 \text{ - selling price}}{150} \times 100\%$

   150 × 5% = 150 – selling price × 100%

   $150 \times \frac{5}{100} = (15000 \text{ -100 selling price}) \times \frac{1}{100}$

$750 = 15000 – 100$ selling price

$- 14250 = -100$ selling price

$\Rightarrow$ selling price = Birr 142.50

Answers to Exercise 3F

1. % profit $= \frac{\text{Selling price - cost price}}{\text{cost price}} \times 100\%$

$\frac{17}{100}$ cost price = (17550 – 100 cost price) $\times \frac{1}{100}$

$\Rightarrow$ 17 cost price = 17550 – 100 cost price

$\Rightarrow$ 117 cost price = 17550

$\Rightarrow$ cos price = Birr 150

Therefore, the good cost Birr 150

2. % profit $= \frac{\text{selling price - cost price}}{\text{cost price}} \times 100\%$

$10\% = \frac{\text{330.00 - cost price}}{\text{cost price}} \times 100\%$

$\frac{10}{100}$ cost price = (33000.00 – 100 cost price) $\times \frac{1}{100}$

$\Rightarrow$ 110 cost price = 33000.00

Cost price = 300

Therefore, the original price of the article Birr 300.00

3. % loss $= \frac{\text{cost price –selling price}}{\text{cost price}} \times 100 \times \frac{1}{100}$

$\frac{11}{200} = \frac{\text{2000-selling price}}{2000} \times 100 \times \frac{1}{100}$

$\Rightarrow \frac{11}{200} \times 2000 = 200{,}000$ - 100 selling price

$\Rightarrow$ 110 = 200, 000 – 100 selling price

$\Rightarrow$ - 199890 = - 100 selling price

$\Rightarrow$ selling price Birr 1998.90

4. 1 egg $\longrightarrow$ Birr 0.30

   200 eggs $\longrightarrow$ x

   1 egg × x = 200 eggs × Birr 0.30

   x = Birr 60

   Thus % profit = $\frac{\text{Selling price - cost price}}{\text{cost price}} \times 100 \times \frac{1}{100}$

   $= \frac{\text{Birr 60 - Birr 50}}{\text{Birr 50}} \times 100\%$

   $= \frac{10}{50} \times 100\%$

   = 20%

   Therefore, the profit percentage is 20%

5. $10\frac{5}{22}\%$

6. Selling price of 40 shirts

   = 220 × 27

   = 5940

   % profit = $\frac{\text{selling price - cost price}}{\text{cost price}} \times 100\%$

   $= \frac{5940 - 220}{220} \times 100\%$

   $= \frac{5720}{220} \times 100\%$

   = 2600%

7. Let CP_M = Cost price that shopkeeper M pays for the good

   SP_M = Selling price which M receives

   CP_N = Cost price that N pays for the same good

   SP_N = Selling price that N receives

   CP_P = cost price that p pays for the same good

Given M makes profit of 15% by selling to N

N Sells(with loss of 5%) to P with 13.11 birr

Asked How much does M pay for the good(i.e, CP_M =?)

Solution: $SP_M = CP_M + 15\%$ of CP_M

but $SP_M = CP_N$

$SP_N = CP_N - 5\%$ of CP_N

$\therefore SP_N = 13.11 = CP_N - \frac{5}{100} CP_N$

$CP_N (1-0.05)\ \ 13.11 = CP_N \times 0.95$

$\Rightarrow CP_N = \frac{13.11}{0.95} = 13.80$

Since $SP_M = CP_{N,}$

$SP_M = 13.80$

but $SP_M = CP_M + 15\% CPm$

$13.80 = CP_M (1+0.15)$

$13.80 = 1.15\ CP_M$

$CP_M = \frac{13.80}{1.15}$

$CP_M = 12$ birr

$\therefore$ Shop keeper M pays 12 birr to buy the good

8. **Given**_Selling price(Sp)= 34.10 birr

Profit = 24% of cp(cost price)

Asked SP to given 28%profit

Solution:

34.10=CP+ 24% of CP

34.10=CP(0.24) CP

=(1+0.24)CP

= 1.24 CP

Thus, $CP = \frac{34.10}{1.24} = 27.50$ birr

To gain 28% Profit

$SP = CP + 28\% \text{ of } CP$

$SP = CP + (0.28)CP$

$= (1+0.28)CP$

$SP = 1.28CP$

$SP = 1.28 \times 27.50$.......$CP = 27.50$ birr

$SP = 35.20$

$\therefore$ To gain 28% profit the book must be sold for Birr 35.20

Group work 3.6

1. a) Birr 45 c) Birr 262.50
   b) Birr 73.50 d) Birr 236.25
2. Birr 300

Answers to Exercise 3G

1. $I = \frac{PRT}{100}$

$PRT = 100I$

$\Rightarrow R = \frac{I \times 100}{PT}$

$= \frac{\text{Birr } 59.61 \times 100}{\text{Birr } 142 \times 12}$

$= \frac{5961}{1704}\%$

$= 3.498\%$

2. Given: $P = \text{Birr } 1200$; $T = 5$ Years

$R = 10\%$

$A = P + I$ ….. Original formula

But $I = PRT$

$= \text{Birr } 1200 \times \frac{10}{100} \times 5$

$= \text{Birr } 600$

Thus $A = \text{Birr } 1200 + \text{Birr } 600$

$= \text{Birr } 1800$

3. Birr 26.55
4. $3\frac{1}{3}$ year
5. Birr 320.50
6. Birr 124.20
7. $R = 4\frac{1}{2}\%$
8. Given P = Birr 500

   A = Birr 900

   R = 8%

   But A = P + I ….. Original formula

   Birr 900 = Birr 500 + I … Substitution

   I = Birr 400

   Therefore, the simple interest is Birr 400

   Thus I = PRT …. Original formula

   $$T = \frac{I}{PR}$$

   $$T = \frac{\text{Birr } 400 \times 100}{\text{Birr } 500 \times 8}$$

   T = 10 years

   Therefore, the period of time is 10 years.

9. I = PRT … Original formula

   $= \text{Birr } 800 \times \frac{20}{100} \times 2$

   = Birr 320

The borrowers has to pay Birr 320 interest on the loan.

Thus, the total amount that must be repaid is

A = P + I

= Birr 800 + Birr 320

= Birr 1120

Assessment

Dear teachers the concept of this unit is a bit hard to grasp at first time, we suggest you give enough time for the students to forward their question and Activities.

Finally give different application problems to the students and check their performance and based on the performance to take remedial measures. Depending on the level of understanding you may also give additional exercises of the following type:

For Slow learners

Answer the following questions.

1. Find the number such that 182 is the difference between increasing it by 12% and decreasing it by 16%
2. A dining room suite is sold for Birr 1762.50 including VAT at 15%. How much is the cost without VAT?

For Fast learners

Answer the following questions

1. When the mass of a pile of soil is increased by 16% it becomes 1102kg. Find the original mass.
2. At what rate percent per annum simple interest will be a sum of money double itself in 25 years?
3. Birr 50,000 is invested at a simple interest rate 4%. How long will it take for the amount to become Birr 60, 000.

Answers to Miscellaneous exercise

1. False
2. False
3. True
4. True
5. True
6. False
7. a
8. b
9. a
10. d
11. d
12. b
13. b
14. d
15. c
16. d
17. c
18. d
19. c

20. Given a:b:c=5:2:3

Asked:- To evaluate

a) a-2b:3b-c   b) a + b + c: 5a   c) a-b:b+c

Solution:

a:b:c=5:2:3

$\Rightarrow$ a:b=5:2 $\Rightarrow \frac{a}{b} = \frac{5}{2} \Rightarrow a = \frac{5}{2}b$

and b:c=2:3 $\Rightarrow \frac{b}{c} = \frac{2}{3} \Rightarrow b = \frac{2}{3}c$

also a:c=5:3 $\Rightarrow \frac{a}{c} = \frac{5}{3} \Rightarrow a = \frac{5}{3}c$

a) $a-2b = \frac{5}{2}b - 2b = \frac{b}{2} = \frac{1}{2}(\frac{2}{3}) = \frac{1}{3}c$

and $3b-c = 3(\frac{2}{3}c) - c = 2c = c = c$

Thus $a-2b:3b-c = \frac{1}{3}c:c = 1:3$

a-2b:3b-c=1:3

b) $A + b + c = a + \frac{2}{5}a + \frac{3}{5}a = 2a$

Thus a+b+c:5a

= 2a:5a

= 2:5

$\therefore$ **a+b+c:5a=2:5**

c) a-b= $\frac{5}{2}$ b-b= $\frac{3}{2}$ b

and a+b= $\frac{5}{2}$ b+b= $\frac{7}{2}$ b

$\Rightarrow \frac{a-b}{a+b}=\frac{3}{2}b \div \frac{7}{2}b=\frac{3}{7}$

$\therefore$ **a-b:a+b =3:7**

21. Let x= previous income

and y= present income

Note that the income is increased, thus y>x $\Rightarrow \frac{y}{x}>1$

Given y:x =47:40 $\Rightarrow \frac{y}{x}=\frac{47}{40}>1$

but y= $\frac{47}{40}$ x

The difference in the income= y-x

$\therefore$ y-x = $\frac{47}{40}$ x-x

y-x= $\frac{7}{40}$ x $\Rightarrow \frac{y-x}{x}=\frac{7}{40}$

To find the percentage increment you can do as follows

$\frac{y-x}{x}\times 100=\frac{7}{40}\times 100=17.5\%$

$\therefore$ The required percentage = 17.5%

22. Given h:k =2:5

x:y = 3:4

2h+ x:k+2y+1:2

Asked h- x: k-y=?___

Solution:

$$h:k=2:5 \Rightarrow \frac{h}{k}=\frac{2}{5} \Rightarrow h=\frac{2}{5}k \text{ or } K=\frac{5}{2}h$$

$$x:y=3:4 \Rightarrow \frac{x}{y}=\frac{3}{4} \Rightarrow x=\frac{3}{4}y$$

$$2h+x:k+2y=1:2 \Rightarrow \frac{2h+x}{k+2y}=\frac{1}{2} \Rightarrow 4h+2x=k+2y$$

$$\Rightarrow 4(\frac{2}{5}k)+2(\frac{3}{4}y)=k+2y\text{.....substitution and}$$

$$\Rightarrow \frac{8}{5}k+\frac{3}{2}y=k+2y$$

$$\Rightarrow \frac{3}{5}k=\frac{1}{2}y \Rightarrow k=\frac{5}{6}y$$

Hence $k=\frac{5}{2}h$

$$\frac{5}{6}y=\frac{5}{2}h \Rightarrow h=\frac{1}{3}y$$

$$\frac{h-x}{k-y}=\frac{\frac{1}{3}y-\frac{3}{4}y}{\frac{5}{6}y-y}=\frac{\frac{3}{4}y-\frac{1}{3}y}{y-\frac{5}{6}y}$$

$$=\frac{\frac{5}{12}}{\frac{1}{6}}=\frac{5}{2}$$

$\therefore$ h-x:k-y=5:2

23. Let G=the number of girls

and B= the number of boys

Given

G=B+15%of G   Asked B:G= ?__

***Solution*:** G-15%of G=B

$$\Rightarrow G-\frac{15}{100}G=B$$

$$\frac{85}{100}G = B \Rightarrow \frac{17}{20}G = B \Rightarrow \frac{B}{G} = \frac{17}{20}$$

24. Let G= the number of girls

and B= the number of boys

Given G-10=B

and G: B=7:5

Asked G =? B= ? and B+G=?

Solution: (a) G:B=7:5$\Rightarrow \frac{G}{B} = \frac{7}{5}$

$$\Rightarrow \frac{G}{G-10} = \frac{7}{5}$$

$$\Rightarrow G= 35$$

$\therefore$ The number of girls =35

(b) Since G-10=B.......given

35-10=B

B= 25

$\therefore$ The number of boys = 25

(c) Total number of students=35+25=60

25. **Given** Total workers= 1200

Male workers= 720

Asked percent of workers that are female

Solution:- No of female worker= 1200-720=480

Females in %= $\frac{480}{1200} \times 100 = 40\%$

$\therefore$ 40% of the workers are female

26. **Given**

Cost price(CP)=2000 Birr

Selling price(SP)= with $5\frac{1}{2}$ % loss

Asked selling price(SP)

Solution: $SP = CP - \frac{15.5}{100} CP(\text{loss})$

$$= 2000 - \frac{55}{1000} \times 2000$$

$$SP = 2000 - 110$$

$\therefore$ The selling = 1890 Birr

27. **Given**= SP= 150 Birr

gain(profit)=15%

Asked Selling price to double the profit

Solution: selling price= cost price + profit(gain)

$$SP = CP + \frac{15}{100} CP$$

$$150 = (1+0.15)CP$$

$$150 = 1.15CP$$

$$CP = 130.43 \text{ birr}$$

$\Rightarrow$ Profit = 150-130.43=19.57Birr

Double of the profit = 2× 19.57= 39.14 Birr

Selling price to double= CP+ twice the profit

= 130.43+39.14

= 169.57 Birr

To double his profit the merchants should sell the article by 169.57 birr

UNIT 4

DATA HANDLING

Total allotted period: 20 periods

Introduction

In this unit, students will be familiarized with the basic ideas of data handling and mean, mode, median and range, which have not been discussed up to now. In data handling, the students will be introduced to very many new terminologies like interpret simple pie charts and line graphs etc.

Under this topic measures of central tendency, they will be introduced to different measures of central tendencies (averages) such as the mean, mode and media. Students will also be made familiar with the measures of dispersions like the range.

Unit outcomes:

After completing this unit, students should be able to:

- collect data and construct simple line graph, piecharts for a given data.
- calculate the mean, mode and median of a given data.
- find the range of a given data.

Suggested Teaching Aida in Unit 4

It is expected that all students are aware of data handling in its meaning from daily life. So as to be able to make their understanding up to standard, enabling students to participate in conception of data handling.

Therefore, constituting different groups, students can develop local examples which will help as an additional teaching aids for a better and easy understanding of data handling. You can also use foot ball field, Television, hand-span, line graphs and pic chart (circle graphs) etc.

4.1 Collecting Data Using Tally Marks

period allotted: 5 periods

Competencies

At the end of this sub- unit, students should be able to:

- Collect simple data from their environment using tally mark.

Introduction

Students are expected to have some of the basic about data handling from lower grades mathematics. In this sub-unit, they will get more familiarized with basic ideas of collecting data using Tally. i.e ways of collecting data

- By using a questionnaire
- By carrying out an experiment.
- From records or data base.
- From the internet.

Teaching Notes

You may start the lesson by giving chance to the students to explain there understanding about data handing from the daily life. For his purpose, you can let the students perform Activity 4.1, Exercise 4A and exercise 4B, so that they can

1. Give some examples of collecting data using Tally marks from their daily life.
2. Discuss the ways of collecting data in mathematical language.
   You can also let them do Activity 4.1, Exercise 4A and Exercise 4B. Encourage them to give as many examples of collecting data

using Tally marks from their daily life and guide their view of how collecting data.

The answer of Group work 4.1 are and Exercise 4A different

Answer to Exercise 4B

1.

Age of students	*Tally marks*	*Frequency*
13	~~////~~ /	6
14	~~////~~ ~~////~~ ~~////~~ ///	18
15	~~////~~ ~~////~~ /	11
16	~~////~~ ////	9
17	////	4

2. a)

Addis ababa weather station	*Tally marks*	*Frequency*
0	//	2
1	////	4
2	//	2
3	~~////~~	5
4	~~////~~	5
5	////	4
6	~~////~~ ///	8
7	~~////~~ ///	8
8	////	4
9	~~////~~ /	6
10	~~////~~ /	6
11	////	4
12	//	2

b)

Maximum temperature	*Tally marks*	*Frequency*
16	///	3
17	~~/N/~~ //	7
18	~~/N/~~ ////	9
19	~~/N/~~ ~~/N/~~ //	12
20	~~/N/~~	5
21	~~/N/~~ ~~/N/~~ ////	14
22	~~/N/~~ //	7
23	///	3

3. The answer is different.

Assessment

Continuous assessment addresses various strategies that teachers can use in order to ensure that all students in their class can fully participate in meaningful discussion.

Dear teachers you can also give class activities, group discussion, assignments, exercise problem and quiz or test for assessing students learning. Finally for gifted students, you can give your own question

4.2 Construction and interpretation of line graphs and pie charts

Period allotted: 10 periods

Competencies:

At the end of this sub-unit, students should be able to:

- Construct line graphs using the given data.
- Construct line graphs by collecting data from their environment.
- Interpret simple line graphs.
- Construct pie charts using the given data.
- Construct pie charts by collecting data from their environment.
- Interpret simple pie charts.

Introduction

The line graphs which are considered in this section are two dimensional that is they represent the correspondence between the elements of two sets, by showing how the elements of one set may be paired with the elements of a second.

Next, the procedure to draw circle graphs (pie chart) is listed in the students textbook are expected to study this procedure and exercise it by drawing various pie chart, using pair of compasses, protractor and rule.

Teaching Notes

This sub-unit seeks further on construction and interpretation of line graphs and pie chars.

At the end of our discussion on line graphs the teacher should summarize in a form of questions and answers as follows.

1. Graphs of direct proportional relations are straight lines passing through the origin,
2. Graphs of inverse proportional relations are smooth curves that move down wards as X increases (y-decreases as X-increases). It is also straight line.
3. Straight lines graphs parallel to the X-axis, represent constant values of y-as x-varies.
4. Graphs constantly rising as we move to the right represent values of y constantly increasing as x increases.

The procedure to draw circle graphs is listed in the, students text book are expected to study this procedure and exercise it by drawing various circle graphs, using pair of compasses, protractor and ruler.

It is important that the students be convinced that the circle graph is especially useful for showing the relation of one item to another and of one item to the whole number of items as shown in example 5,6 and 7, of sub unit 4.2.2.

First dear teacher encourage your students to respond to each questions possed in the textbook. Dear teacher give fairly equal chance to your students and motivating equally. You have to assess the progress of your students by encouraging answer to activity 4.1, Exercise 4C, Activity 4.3 ,2and Exercise 4D. Finally at the end of each activities and exercise give remedial measures based on their feedback.

Answer to Activity 4.1

There are many answer depends on the student measures.

Answers to Exercise 4C

1. a)

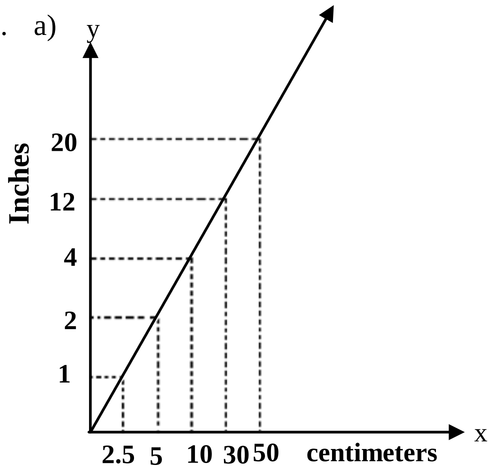


Figure 4.1

b) i) 1 inches = 2.5 centimeters

6 inches = x

x= 15 centimeters

ii) 1 inches = 2.5 centimeters

10 inches = x

x= 25 centimeters

c) Similarly

i) 10 inches

ii) 16 inches

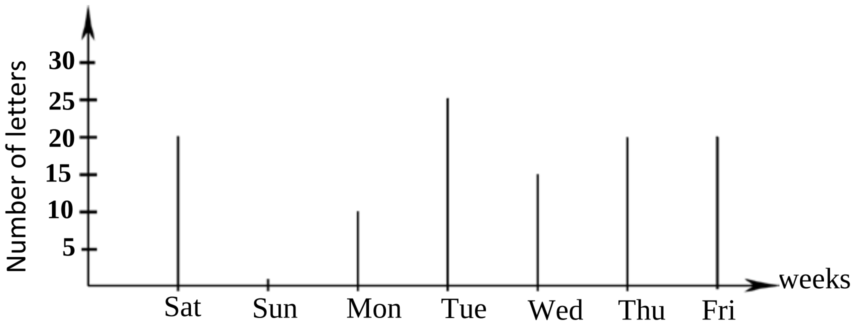
2. a) 9:00 am

b) petrol put in the storage tank

c) sales gradually increased

d) line gets steeper

3. a)



b)

Figure 4.2

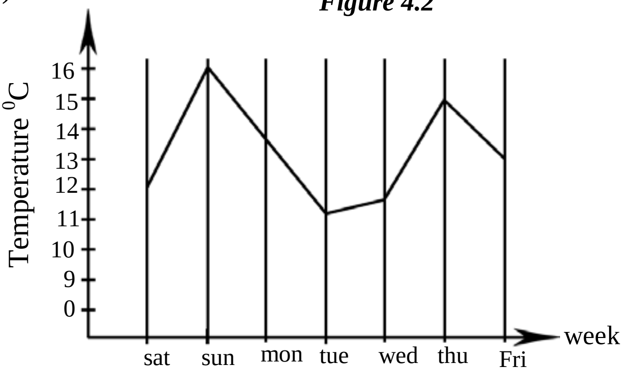


Figure 4.3

Answers to Activity 4.3

Similar to Activity 4.1

Answers to Exercise 4D

1 a) All their choices

b) Chocolate

c) orange

d) number of students used to strawberry ice-cream =

$$\frac{\text{Measure of the arc}(\theta)\text{of the sector} \times 30}{360^{o}}$$

$= \frac{36^0 \times 30}{360^0}$

$= 3$

2. a) The bus sector is 56^0 and the whole pie chart is 360^0, so the fraction traveling by bus $\frac{56}{360}$. There are 720 students so the number of students travelling by bus is: $\frac{56}{360} \times 720 = 112$

b) First, find the angle of the foot sector:

$$360^0 - (20^0 + 56^0 + 48^0 + 32^0) = 204^0$$

$$\frac{204^0}{360^0} \times 720$$

$\Rightarrow$ 408udents

4. a) let x be the items of food then

$$\frac{x \times 360^0}{12{,}000} = 80^0$$

$\Rightarrow 360^0 \times x = 80^0 \times 12{,}000$

$\Rightarrow x = 2666\frac{2}{3}$

Therefore, w/ro Eleni's spend on food Birr $2666\frac{2}{3}$

b) Let x be the number of items of saving then

$$= \frac{x \times 360^0}{12,000} = 40^0$$

$$= 360^0 \times x = 40^0 \times 12,000$$

$$\Rightarrow x = \frac{40^0 \times 12,000}{360^0}$$

$$\Rightarrow x = 1333^{\frac{1}{3}}$$

Therefore, W/ro Eleni's spend on saving Birr $1333\frac{1}{3}$.

c) Let x be the number of items of travel then

$$\frac{x \times 360^0}{12,000} = 72^0$$

$$= 360^0 \times x = 72^0 \times 12,000$$

$$\Rightarrow x = \frac{72^0 \times 12,000}{360^0}$$

$$\Rightarrow x = 2400$$

Therefore, W/ro Elen's Spend on travel Birr 2400.

d) Let x be the number of items of rent then

$$= \frac{x \times 360^0}{12,000} = 90^0$$

$$= 360^0 \times x = 90^0 \times 12, 000$$

$$\Rightarrow x = \frac{90^0 \times 12,000}{360^0}$$

$$\Rightarrow x = 3000$$

Therefore, W/ro Elen's Spend on rent Birr 3000.

e) Let x be the number of items of entertainment then

$$\frac{x \times 360^0}{12,000} = 60^0$$

$$x \times 360^0 = 60^0 \times 12,000$$

$$\Rightarrow x = \frac{60^0 \times 12,000}{360^0}$$

$$\Rightarrow x = 2000$$

Therefore, We/ro Elen's Spend on entertainment birr 2000.

5. The total budge = Birr 100,000

First calculate each budget in percent

Education= $\frac{75,000}{100,000} \times \frac{100}{100}$

$= \frac{75,000}{100,000} x100 \times \frac{1}{100}$

$= 75\%$

Public health= $\frac{20,000}{100,000} \times \frac{100}{100}$

$= \frac{20,000}{100,000} \times 100 \times \frac{1}{100}$

$= 20\%$

Community development= $\frac{5,000}{100,000} \times \frac{100}{100}$

$= \frac{5,000}{100,000} \times 100 \times \frac{1}{100}$

$= 5\%$

To draw a circle graph first multiply by 360^0 and to the percent of their share:

Education; $\frac{75}{100} \times 360^0 = 270^0$

Public health, $\frac{20}{100} \times 360^0 = 72^0$

Community development; $\frac{5}{100} \times 360^0 = 18^0$

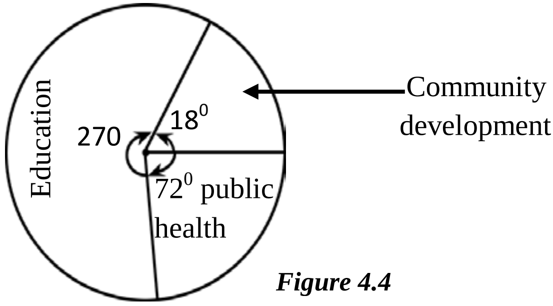


Figure 4.4

6. First added the total measure of the arc (θ) of the sector:

Thus $216^0 + 80^0 + 24^0 + 30^0 + x = 360^0$

$$350^0 + x = 360^0$$

$$x = 10^0$$

Hence, the number of expenditure from each center

$$= \frac{\text{Measure of the arc } (\theta) \text{ of the sector} \times 36{,}000{,}000}{360^0}$$

$$= \frac{10^0 \times 36{,}000{,}000}{360^0}$$

= Birr 1,000,000

7. Grade 5: $\frac{10}{100} \times 1200 = 120$

Grade 6: $\frac{30}{100} \times 1200 = 360$

Grade 7: $\frac{25}{100} \times 1200 = 300$

Grade 8: X

Grade 5+ Grade 6+ Grade 7+ Grade 8= 1200

120 + 360 + 300+ x= 1200

780+ x= 1200

$\Rightarrow$x= 1200-780

$\Rightarrow$ x= 420

Therefore, the number of students in grade 8= 420

Assessment

At the end of this lesson, a part from Exercises 4D, you can give class activities, assignments and quiz or test, to assess, their level of understanding. For fast learners or interested students you can also give the following additional exercise problems.

1. The given pie chart shows the students who passed in English, Maths, science and social studies:
   If the total number of students in the class is 60, find the number of students passing in each subject.

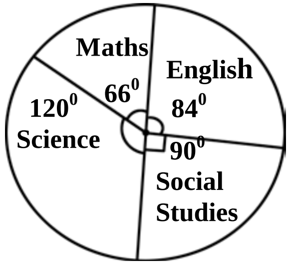


Figure 4.5

2. The pie chart indicates the number of Students in different School types

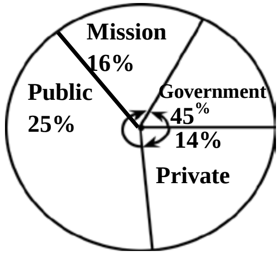


Figure 4.6

If the total numbers of Students 1200. How many students are there in private schools?

4.3 The Mean, Mode, Median and Range of data

Period allotted: 5 periods

Competencies:

At the end of this sub-unit, students should be able to:

- describe the terms mean, mode, median and range of data.
- calculate the mean of data.
- Calculate the median of data.
- Calculate the range of data.

Introduction

Under this topic measures of central tendency, they will be introduced to different measures of central tendencies (averages) such as the mean, mode and median. Students will also be made familiar with measures of dispersions like the range.

Teaching Notes

The three measures of central tendency are called mean, mode and median while the range is called measure of dispersion.

A. The Mean

In discussing this topic, first we will deal with mean from row data.

Example1:

Consider the following data: 20,40,60,80,100,120

a) To find the mean from the raw data here, let the students add the 6 values and divide the sum by 6 to get:

Solution

$$\text{mean} = \frac{20+40+60+80+100+120}{6} = \frac{420}{6} = 70$$

b) Mode

The students can easily find mode from raw data here you can discuss the unimodal, bimodal, Trimodal and no mode at all.

Example2: Find the mode of these sets of data:

a) 18 20 38 40 50 38
b) 92 300 400 500 600 700

Solution:

a) The mode is 38.
b) Each value occurs only once, so there is no mode for the given data.

c) Median

In treating this part, the discussion will focus on the number of observation being odd or even.

So as to attempt to deal with median, first give chance for the students to do Group work 4.1 and allow them to narrate their observation.

When you ensure that students can be calculate the mean, you can then encourage students to do Group work 4.2, Exercise 4E, Activity 4.3, Exercise 4F, Group work 4.3, Activity 4.4 and Exercise 4G individually.

Answers to Group work 4.2

1. a) Mean $\left(\bar{X}\right) = \dfrac{132+148+141+136+134+129}{6}$

$$= \frac{820}{6}$$

   b) Mean $\left(\bar{X}\right) = \dfrac{146+132+137+118+150+141}{6}$

$$= \frac{824}{6}$$

2. Mean $\left(\bar{X}\right) = \dfrac{15+17+x+28+19}{5}$

$$16 = \frac{79+x}{5}$$

$$80 = 79 + x$$

$$x = 1$$

Answers to Exercise 4E

1. a) $\dfrac{68}{6}$ b) 24.25 c) 22.5 d) $\dfrac{174}{7}$ e) 102
2. a) 162 b) 181.67
3. Sum of the four numbers is 376

   Thus mean= $\dfrac{\text{Sum of the values}}{\text{Number of values}}$

   = 376

Sum of the nine number is $17 \times 9 = 153$

Thus mean = $\dfrac{\text{Sum of the values}}{\text{Number of values}}$

$$= \frac{153}{9}$$

$$= 17$$

Therefore, mean of all thirteen number = $\dfrac{\text{total sum}}{13}$

$$= \frac{376 + 153}{13} = \frac{529}{13}$$

$$= 40.7$$

4. Mean $\left(\bar{X}\right) = \dfrac{14 + 6 + 2x + 8 + 10 + 4}{6}$

$$8 = \frac{42 + 2x}{6}$$

$42 + 2x = 48$

$2x = 6$

$x = 3$

5. Let x be the include data, then

Mean $\left(\bar{X}\right) = \dfrac{2 + 8 + 7 + 4 + 9 + x}{6}$

$$6 = \frac{30 + x}{6}$$

$36 = 30 + x$

$x = 6$

6. Mean of (A and B) = 20

$$\frac{A + B}{2} = 20$$

$A + B = 40$ …. Equation 1

Mean of (B and C) = 24

$$\frac{B+C}{2} = 24$$

$B + C = 48$ …. Equation 2

Mean of (A,, B and C) = 18

$$\frac{A+B+C}{3} = 18$$

$A+B+C= 54$

Mean of (A and C) =?

$40+ C= 54$

$C= 14$ and

$A+ 48 = 54$

$A=6$

Therefore, Mean of A and C = $\frac{A+C}{2}$

$$= \frac{6+14}{2}$$

$$= 10$$

7. $144= 2(x^4+y^4+Z^4)$

$72= x^4+y^4+z^4$

$$\text{Mean}\left(\bar{X}\right) = \frac{x^4 + y^4 + z^4}{3}$$

$$= \frac{72}{3}$$

$$= 24$$

Therefore, the mean of x^4, y^4 and z^4 = 24

8. Let x be the four tests then

$$\text{mean}\left(\bar{x}\right) = \frac{88+96+92+x}{4}$$

$$90 = \frac{276+x}{4}$$

$276+ x = 360$

$x = 84$

Therefore, the students score on the four tests is 84

9. let the five number a, b, c, d and e then

$$\frac{a+b+c+d+e}{5}=11$$

a+ b + c + d+ e = 55

Thus $\frac{a}{b}=\frac{1}{2}$ ....equation 1

$\Rightarrow$ 2a=b .... equation 2

$\frac{b}{c}=\frac{2}{3}$ .... equation 3

3b= 2c

b=$\frac{2}{3}$ c..................................... equation 4

$\frac{c}{d}=\frac{3}{4}$ .... equation 5

4c= 3d

d=$\frac{4}{3}$ c.. equation 6

$\frac{d}{e}=\frac{4}{5}$ .... equation 7

5d= 4e

d=$\frac{4}{5}$ e.. equation 8

Now 2a=b.. equation 9

$\Rightarrow$ 2a=$\frac{2}{3}$ c

$\Rightarrow$c=3a.. equation 10

d=$\frac{4}{3}$ c

$\Rightarrow$ d= $\frac{4}{3}$ (3a)

$\Rightarrow$ d= 4a .... equation 11

d= $\frac{4}{5}$ e

$\Rightarrow$ 4a = $\frac{4}{5}$ e$\Rightarrow$e=5a..................................... equation 12

Hence add equation 9,10,11,12 together

$\Rightarrow$ a+2a+3a+4a+5a= 55

$\Rightarrow$ 15a=55

$\Rightarrow$ a= $\frac{11}{3}$

b= $\frac{22}{3}$

c= $\frac{33}{3}$

d= $\frac{44}{3}$

e= $\frac{55}{3}$

The smallest number is $\frac{11}{3}=3\frac{2}{3}$

Cheeked

$$\frac{\frac{11}{3}+\frac{22}{3}+\frac{33}{3}+\frac{44}{3}+\frac{55}{3}=11}{5}$$

$$\Rightarrow \frac{165}{15}=11$$

$\Rightarrow$ 11=11 True

10. let a, b, c, d,e and f be the rods then

$$\frac{a+b+c+d+e+f}{6}=44.2$$

$$\frac{46+f}{6} = 44.2$$

46 + f= 265.2

$$\frac{a+b+c+d+e}{5}=46$$

a+ b+ c+ d+ e=230

Thus 230 +f=265.2

$\Rightarrow$ f= 35.2cm

Therefore, the six rod length is 35.2 cm

Answer to Activity 4.3

1. a) mode = 10
   b) mode = 24 and 25
   c) mode = 60, 70 and 80
   d) no modal value.

Answers to Exercise 4F

1 a) mode = 4
  b) mode = 5, 7 and 9
  c) mode = 6
  d) mode = 113 and 118

Answers to Group work 4.3

1. a) Numerical order: 2, 3,4,8,12,13,14,18,19
   9 data items $\Rightarrow$ Odd items

The median of the odd items = $\left(\frac{n+1}{2}\right)^{th}$ value

$= \left(\frac{9+1}{2}\right)^{th}$ value

$= 5^{th}$

= 12

b) Numerical order: 3, 8,8,9,10,12,14,18,21,23,25,30
   12 data items $\Rightarrow$ even items

$$\text{The median of the even items} = \frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th} \text{Values}}{2}$$

$$= \frac{\left(\frac{12}{2}\right)^{th} + \left(\frac{12}{2}+1\right)^{th} \text{Values}}{2}$$

$$= \frac{6^{th} + 7^{th}}{2}$$

$$= \frac{12+14}{2}$$

$$= \frac{26}{2}$$

$$= 13$$

Answers to Exercise 4G

1. a) The functional values: 2, x, 5, 7, 1, 3

Median = $\frac{7}{2}$

Numerical ordered: 1,2,3,x,5,7 Since $3 < \frac{7}{2} < x$

Median = $\frac{3+x}{2}$

$$\frac{7}{2} = \frac{3+x}{2}$$

$x = 4$

Therefore, the included number is 4

b) The functional values: 4,7,2,x,2,9,6

median = 5

Numerical order: 2,2,4,x,6,7,9 since $4 < x < 6$

Median = x

$\Rightarrow x = 5$

Therefore, the included number is 5.

2. a) numerical order: 5,11,28,28,29,30,35,35,35,38

$$\text{Median} = \frac{29+30}{2}$$

$$= 29.5$$

b) Numerical order:

1,3,17,18,19,20,21,21,24

9 data items $\Rightarrow$ Odd data

$$\text{Median} = \left(\frac{n+1}{2}\right)^{th} \text{ item}$$

$$= \left(\frac{9+1}{2}\right)^{th} \text{ item}$$

$$= 19$$

The Range

You can begin the discussion by asking the students if they can tell what range is. Following the replay of the students you can formally define rang and discuss.

Example1: Find the range of thus sets of data.

a)	-200	-700	0	-1000
b)	400	-300	-200	0

***Solution*:-** a) Range = highest Value- lowest value

=0-(-1000)

= 1000

b) Range = highest value- lowest value

= 400-(-300)

=700

When you answer the students can calculate the range, you can then encourage students to do Activity 4.6 and Exercise 4H individually

Answers to class Activity 4.4

1. a) 28 b) 10,500 c) 1000
2. The smallest value = 20

Answers to Exercise 4H

1. 31 2. 63 3. 5999 4. 42 or 2

Assessment

Dear Teachers you are best wished to exercise your maximum teaching potential to deliver to your students the knowledge and skills contained in this sub-unit.

Finally, you can ask students the following additional exercise problems to check if they have gained the insight and for consolidating the entire sub-unit.

Let the student:

- What are the three measure of central tendency?
- What is mean?
- What is mode?
- What is the difference between mean and range?

For gifted students, you can give additional exercise problems like:

1. Given 38 35 35 40 70 90 79 99 120 then
   a) Calculate, the mean, mode, media and range.
2. A goal shooter has scores of 14, 18, 10, 24, 32, 26 and 32 in seven games.

How many must she score in the 8^{th} game to bring her mean score up to 24?

Answers to Miscellaneous Exercise 4

1. Range
2. Media
3. Mean, Mode and Media while Range
4. Bimodal
5. Line graphs

6. Walk= $\frac{10}{100} \times 120 = 12$

Cycle: $\frac{25}{100} \times 120 = 30$

Car: $\frac{30}{100} \times 120 = 36$

Buse= x

Bus + Cycle + Car+ Walk = 120

x+ 30 +36 +12 = 120

x= 42

The number of students that travel to school by bus is 42.

7. Measure of the arc of the sector =

$$\frac{\text{The number of students appearing from each center} \times 360^0}{\text{Total number of students}}$$

Therefore, the number of students appearing from each centre

$$= \frac{\text{measure of the arc}}{360^0} \times 3000$$

Using the above formula complete the following table:

Centre	Measure of arc	Number of students
C_1	108^0	$\frac{108^0 \times 3000}{360^0}$ =900
C_2	54^0	$\frac{54^0 \times 3000}{360^0} = 450$
C_3	72^0	$\frac{72^0 \times 3000}{360^0} = 600$
C_4	36^0	$\frac{36^0 \times 3000}{360^0} = 300$
C_5	90^0	$\frac{90^0 \times 3000}{360^0} = 750$

8. The measure of the arc of the sector corresponding to each trade of the apprentice workers is given by the following formula:

$$\frac{\text{Number of workers in as particular trade}}{\text{Total number of workers}} = \frac{\text{measure of the are } (\theta) \text{ of the sector}}{360^0}$$

$\therefore$ Measure of the arc of the sector

$= \dfrac{\text{number of workers in a particular trade}}{\text{Total number of workers}} \times 360^0$

Using the above formula, the measure of the arc of the sector corresponding to workers of each trade is calculated and tabulated as given below:

Trade	***Number***	***Measure of the arc (θ)***
Fitting	25	$\frac{25}{90} \times 360^0 = 100^0$
Turning	30	$\frac{30}{90} \times 360^0 = 120^0$
Welding	8	$\frac{8}{90} \times 360^0 = 32^0$
Moulding	15	$\frac{15}{90} \times 360^0 = 60^0$
Spray painting	12	$\frac{12}{90} \times 360^0 = 48^0$
Total	90	360^0

9. a) 126 b) 31. 5 c) 8 d) no modal age

10. a) y=3 b) y= 7 c) y=4

11. Let x be the six number then

$$\text{Meane}\left(\overline{x}\right) = \frac{11+7+21+14+9+x}{6}$$

$$\Rightarrow 12 = \frac{62+x}{6}$$

$\Rightarrow 72 = 62+x$

$\Rightarrow x = 10$

$\therefore$ Therefore, 10 be the required number.

12. a) 14
    b) any number except 1, 3 or 5
    c) 2
    d) 3.7

13. 4 14. 2 15. 4 4 5 7 10

16. a) 21.8 , 23 , no mode
    b) 121.8, 123, no mode
    c) 8.8 , 4 , no mode
    d) 3x , 3x, no mode

17. a) 8 b) 3

UNIT 5

GEOMETRIC FIGURES AND MEASUREMENT

Total allotted period: 40 periods

Introduction

Most of the concepts in this unit are not new to the students. They are continuations of the course on Geometric figures and measurement which was introduce in grades 5 and 6. In this unit students should be revise the basic concepts in geometry and stabilize the knowledge they have gained in lower grades. Students comprehension for the necessity of proof of mathematical statements has to be stabilized by dealing with the important theorems of triangles. In this way their ability in understanding proofs should be developed further. Moreover in this unit includes constructions of a circle, and measurements of special polygons discuss in detailed.

Unit out comes:

After completing this unit, students should be able to:

- identify, construct and describe properties of quadrilaterals such as trapezium and parallelogram.
- identify the difference between convex and concave polygons.
- find the sum of the measures of the interior or angles of a convex polygon.
- calculate perimeters and areas of triangles and trapeziums.

Suggested Teaching Aids in Unit 5

In addition to the Student's text book and the teacher's Guide, you are advised to prepare and bring in to the class the following materials whenever the topic requires.

Tools: pair of Compass, ruler, protractor, Sissoors etc if they are available.

Chart Containing

- Set of regular polygons such as:

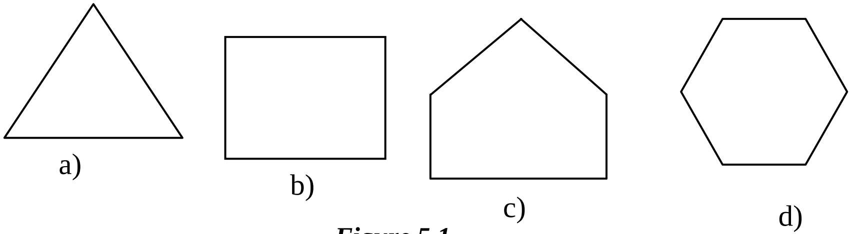


Figure 5.1

- Set of parallelograms such as:

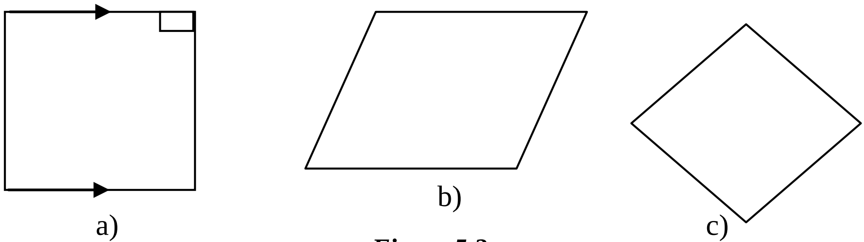


Figure 5.2

- Space (solid) figures such as prisms, cylinders, pyramids and cones.

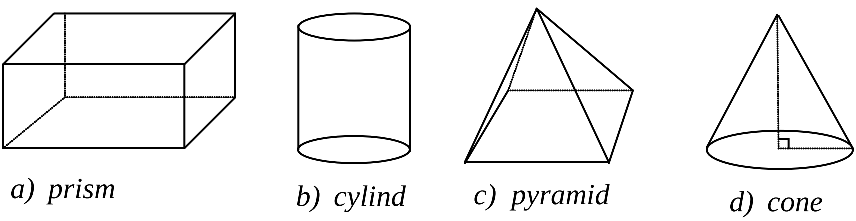


Figure 5.3

5.1. Quadrilaterals, polygons and circles

Period allotted: 12 periods

Competencies

At the end of this sub-unit, students should be able to:

- explain the concept of a quadrilateral.
- identify the parts of a quadrilateral.
- explain the parts of a trapezium.
- construct a trapezium with given dimensions.
- describe the properties of trapezium.
- explain the concept of parallelogram.
- construct a parallelogram with given dimensions.
- describe the properties of parallelogram.
- construct rectangles, squares and rhombuses.
- describe the properties of a rectangle.
- describe the properties of a square.
- describe the properties of a rhombus.
- identify the relationship between a parallelogram, a rhombus, a rectangle;
- define a polygon.
- identify the difference between convex and concave polygons.
- name polygons having up to ten sides based on their number of sides.
- define a circle.
- identify the center, radius, diameter, chord and arc of a circle.
- explain the relations between radius, diameter and chord of a circle.

Introduction

The main task of this sub-unit is to familize the students with the concepts of Quadrilaterals, polygons and circles. The subunit is sub-divided in to three main subtopics. The first subtopic deals with Quadrilaterals. In this subtopic, you will discuss and state the type of Quadrilaterals. The second subtopic deals with the measures of angles of polygon. The third subtopic deals with circles and will define what is meant by diameter, radius, chord, arc, semicircle and Circumference of a circle.

Teaching Notes

This topic which deals with Quadrilaterals, polygons and Circle encompasses Various Subtopics in it. Each of the sub-topic is treated with descriptive and illustrative examples. The following narrates those ideas that are useful for the delivery of this topic.

Quadrilaterals

Construct various, trapezium, parallelogram, rectangle, Rhombs and Squares.

Dear teachers, ask the following question for your students

1. List the properties of a parallelogram.
2. List the properties of a rectangle.
3. List the properties of a rhombus.
4. List the properties of a square.

Discuss the answers and Lead the students to come to the concept of Quadrilaterals. You can proceed to ***Group Work 5.1, Activity 5.1*** **and *Exercise 5A***. The purpose of Group Work 5.1 and Activity 5.1 is to help the students recall several concepts they studied about Quadrilateral in to lower grades.

Answer to Group Work 5.1

1. Point, lines and planes
2. a) A **line segment** is a subset of the points on a line consisting any two distinct points of the line and all points between them. The two given points are the end points of the segment.

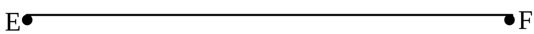


Figure 5.4

***Example*:** $\overline{EF}$ (read as line segment (EF).

b) Ray AB $(\overrightarrow{AB})$ in figure 5.5 is the part of $\overleftrightarrow{AB}$ with starts at a point A and extends without ending through point B. The end point of $\overrightarrow{AB}$ is A.

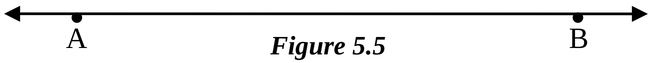


Figure 5.5

c) An **angle** is the union of two non-collinear rays with the same vertex.

d) A **adjacent angles** are two angles in a plane that have common vertex and a common side but no common interior points.

e) **Vertically opposite** angles are two angles whose side form two pairs of opposite rays.

f) **Angle bisectors** is a ray that divides the angle in to two equal adjacent angles.

g) **Complementary angles** are two angles whose measures have the sum 90^0.

h) **Supplementary angles** are two angles whose measures have the sum 180^0.

3. a) A, B, C and D

b) A, B, C and D

c) $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ and $\overline{DA}$

d) $\overline{AB}$ and $\overline{DC}$, $\overline{AD}$ and $\overline{BC}$

e)

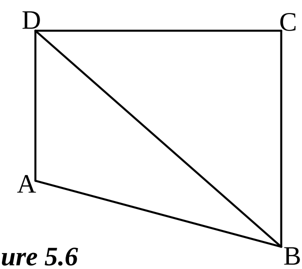


Figure 5.6

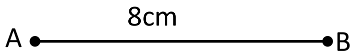
Answer to Activity 5.1

1. Yes, trapezium ABCD
2. Opposite sides of a trapezium are parallel.
3. Similar to the given examples.
4. **Given**: AB = 8cm, BC = 4cm, CD = 3cm and DA = 3.5cm

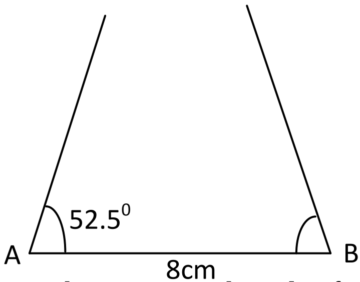
   Required:- To find measure $\angle A$

   Solution:-

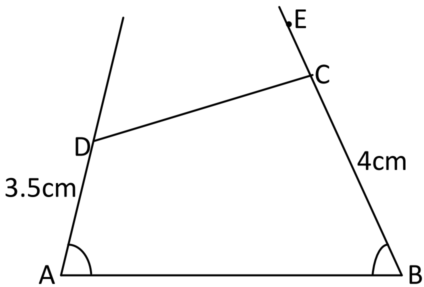
   Step i: Draw a line segment AB = 8cm.



   Step ii: Construct m($\angle$A) and m($\angle$B) with the given measures.



   Step iii: Mark point C on the side of $\angle$B such that BC = 4cm



   Step iv: Draw a line through C and parallel to $\overline{AB}$ so that it intersects the side of $\angle$A at point D.

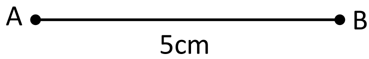
   Therefore ABCD is the required trapezium.

5. **Given:** AB = 5cm, BC = 6cm, CD=2cm and DA = 4cm.

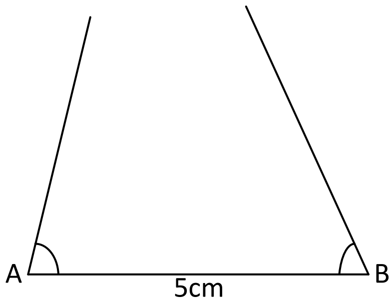
Required: To find measure of ∠A.

Solution:

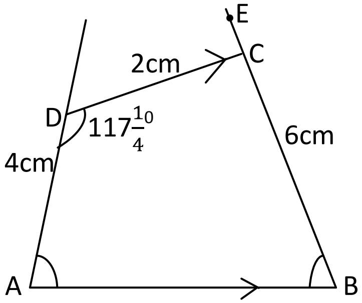
Step i: Draw a line segment AB = 5cm.



***Step ii**:* Construct m(∠A) and m(∠B) with the given measures.



Step iii: Mark point C on the side of ∠B such that BC=6cm



Ste iv: Draw a line through C and parallel to $\overline{AB}$ so that it intersects the side of ∠A at point D.

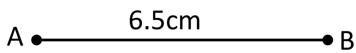
Therefore, ABCD is the required trapezium.

6. **Given:** AB = 6.5cm, CD = 3cm, AC = 7cm and BD = 5cm

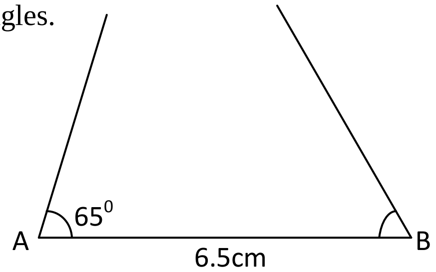
Required: Explain the methods

Solution:

Step i: Draw a line segment AB = 6.5cm

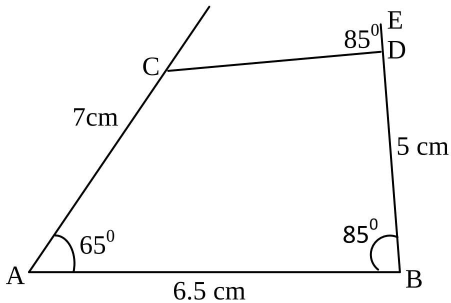


Step ii: Construct m(∠A) and m(∠B) with the given measures angles.



Step iii**:** Mark point D on the side of ∠B such that

BD = 5cm.



Step iv: Draw a line through D and parallel to $\overline{AB}$ so that it intersects the side of ∠ A at point C.

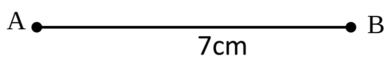
Therefore, ABCD is the required construction

7. **Give:** AB= 7cm, AC = 10 cm and BD = 8cm

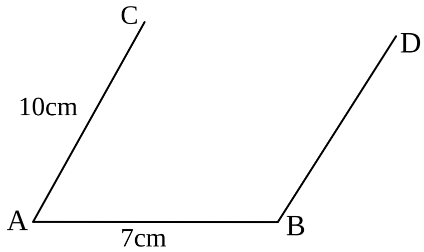
Required: BC=?

Solution:

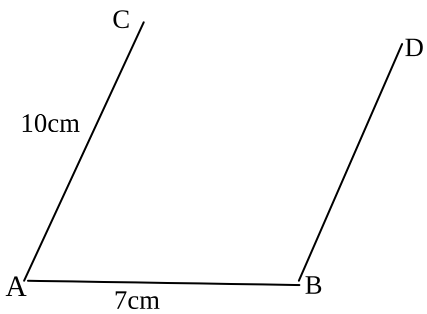
Step i**:** Draw a line segment AB = 7cm



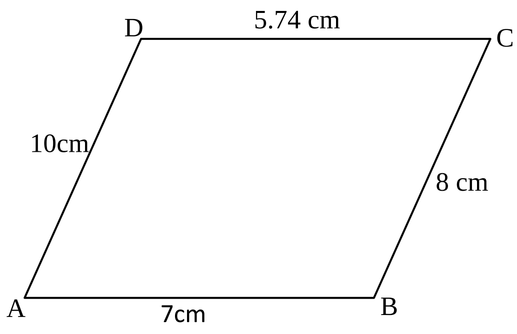
Step ii: Construct m (∠A) and m (∠B) with the given measures



Step iii: mark point D on side of < B such that BD = 8cm



Step iv: Draw a line through D and parallel to $\overline{AB}$ so that it meets the sides of $\angle$ A at point D.



Answers to Exercise 5A

1. ABCD is a parallelogram, OC= 4cm since the diagonal of a parallelogram bisect each other.

$$\Rightarrow AC = AO + OC$$
$$= 4cm + 4cm$$
$$= 8cm$$

Therefore, the length of $AC = 8$cm.

2. **Given**: m(∠ABC)= 43^0

   m (∠AED) = 68^0

   a) m (∠ADE)= 43^0 since opposite angle of a parallelogram are equal.

   b) m (∠DAE)= m (∠D) +m (∠A) +m (∠E)= 180^0

   $\Rightarrow 43^0 + m(\angle A) + 68^0 = 180^0$

   $\Rightarrow m(\angle A) = 69^0$

   Therefore, m (∠DAE) = 69^0

   c) m (∠ADC)+ m (∠BCD) = 180^0

   $\Rightarrow 43^0 + m(\angle BCD) = 180^0$

   $\Rightarrow m(\angle BCD) = 137^0$

   Therefore, m (∠BCD) .= 137^0

3. $x = y = \dfrac{970}{24}$

4. $\beta + 120^0 = 180^0$

   $\Rightarrow \beta = 60^0$

   $\beta + \theta = 180^0$ since by definition of a parallelogram.

   $60^0 + \theta = 180^0$

   $\Rightarrow \theta = 120^0$

   $\sigma = 60^0$

5. $\beta = 110^0$ and $\theta = 110^0$

6. $\beta = 45^0$

7.

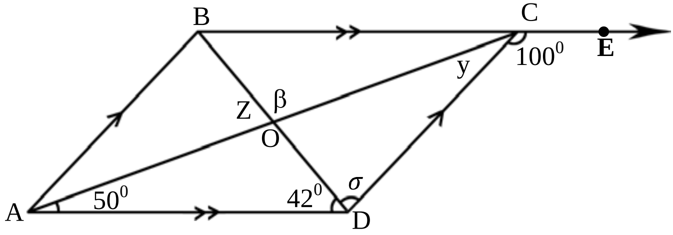


Figure 5.7

Consider Δ AOD,

$\Rightarrow$ m ($\angle$A) +m($\angle$O)+m($\angle$D)= 180^0

$\Rightarrow 50^0$ +m ($\angle$O) +42^0= 180^0

$\Rightarrow$m ($\angle$O) = 88^0

Therefore β = m ($\angle$O) = 88^o

m ($\angle$CAD) = m ($\angle$ACB) = 50^0 by AIA

But m ($\angle$ECD) + m ($\angle$ACD) +m ($\angle$ACB)= 180^0

$\Rightarrow 100^0$ +y +50^0 = 180^0

$\Rightarrow$y= 30^0

Consider ΔDCZ

$\Rightarrow$m ($\angle$D)+m($\angle$C)+m($\angle$Z)= 180^0

σ +30^0 +92^0 = 180^0

σ= 58^0

Construction and Properties of Special Parallelogram

Here, to teach this, we use the experimentation approach. Experimentation approach is the technique of marking the transition from particular facts to general knowledge about these facts. Then to each group, you may give one of the following activities.

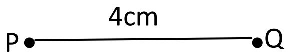
Activity 5.2, to Group 2, Activity 5.3 , to Group 2 and Activity 5.4, to Group 3.

Dear teacher based on the performance to give proper feedback for your students.

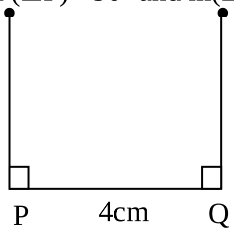
Answer to class Activity 5.2

1. **Given:** $\overline{PQ} \| \overline{RS}$, $\overline{PQ}$ = 4cm, $\overline{QR}$ = 3cm and m (∠P) = 90°.

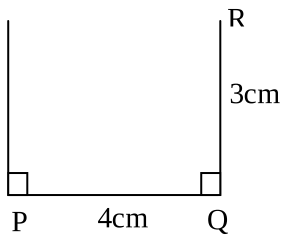
Step i : Draw a line segment $\overline{PQ}$ = 4cm



***Step* ii**: Construct m (∠P)= 90° and m(∠Q)= 90°



***Step* iii**: Mark point R such that QR = 3cm



***Step* iv:** Construct m (∠QRS) where measure is 90° (where S is the intersection of $\overline{PS}$ and $\overline{RS}$ then PQRS is the required rectangle.

Figure 5.8

2. a) $\overline{PQ}$ b) $\overline{RQ}$ c) $\overline{PR}$

3. a)

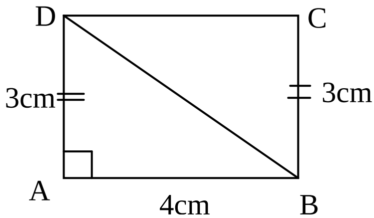


Figure 5.9

b) $\Rightarrow (AD)^2+(AB)^2=(BD)^2$

$\Rightarrow (3cm)^2+(4cm)^2=(BD)^2$

$\Rightarrow BD=\sqrt{25cm^2}=5cm$

4. 4.47 cm
5. 3.54 cm
6. 2.55 cm

Therefore, the length of the diagonal is 5cm.

Dear teacher give Exercise **5B and 5C** group work, class activities quizzes, home work and assignments will help you as formative assessment techniques to collect relevant data about the performance of the students so that you can assist individual students during instruction

Answer to Exercise 5B

1. Consider ΔDCB, right angle at C.

   $m(\angle D)+m(\angle C)+m(\angle B)=180^0$

   $\Rightarrow 54^0+90^0+m(\angle B)=180^0$

   $\Rightarrow m(\angle B)=36^0$

   Therefore, $m(\angle CBD)=36^0$

   $m(\angle ABD)=m(\angle BDC)=54^0$

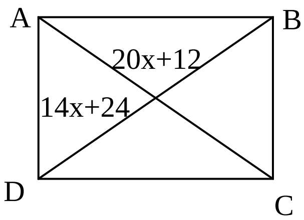
2. 

Figure 5.10

The diagonals $\overline{AC}$ and $\overline{BD}$ intersect each other, then AC = BD

$\Rightarrow 20x + 12 = 14x + 24$

$\Rightarrow 20x - 14x = 24 - 12$

$\Rightarrow 6x = 12$

$\Rightarrow x = 2$

AC = BD

$20(2) + 12 = 14(2) + 24$

$40 + 12 = 28 + 24$

$52 = 52$

The value of AC and BD is 52.

3. m $(\angle EF\beta) = 90^0 - 37^0 = 53^0$, EFGH is a rectangle.

m $(\angle FE\beta) = 53^0$ …………… why?

Therefore, m $(\angle EF\beta) = 74^0$……why?

4. $(PS)^2 + (SR)^2 = (PR)^2$ ……..Pythagoreans' Theorem

$\Rightarrow (5cm)^2 + (SR)^2 = (13cm)^2$

$\Rightarrow (SR)^2 = 144cm^2$

$\Rightarrow SR = \sqrt{144cm^2} = 12cm$

$(SR)^2 + (RQ)^2 = (QS)^2$

$(12cm)^2 + (5cm)^2 = (SQ)^2$

$144cm^2 + 25cm^2 = (SQ)^2$

$(SQ)^2 = \sqrt{169cm^2}$

$SQ = 13cm$

5. Similar to Activity 5.2 question number 4, 5 and 6.

Answers to Activity 5.3 and 5.4

Activity 5.3 and 5.4 similar to the student text book examples.

Answers to Exercise 5C

1.

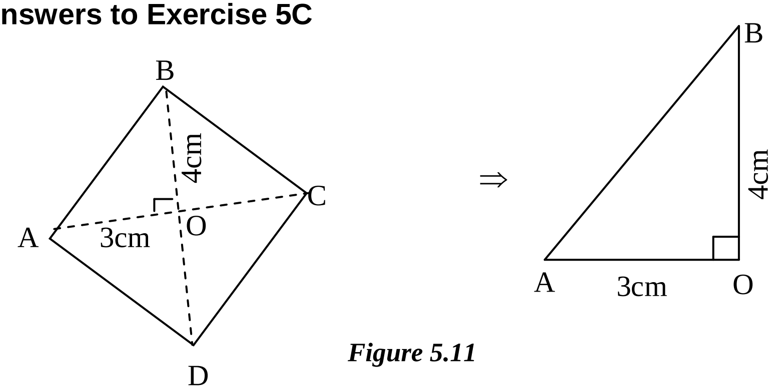


Figure 5.11

$$(AO)^2+(OB)^2 = (AB)^2$$

$$\Rightarrow (3cm)^2 +(4cm)^2 = (AB)^2$$

$$\Rightarrow AB = \sqrt{25cm^2} \quad = 5cm$$

Therefore, the length of the side of a rhombus is 5cm.

2.

Statements	Reasons
1. $\overline{AD} \equiv \overline{AB}$	1. Sides of a rhombus
2. $\overline{DC} \equiv \overline{CB}$	2. Sides of a rhombus
3. $\overline{AC} \equiv \overline{AC}$	3. Reflexivity
4. $\Delta DAC \equiv \Delta BAC$	4. SSS
5. $\angle DAC \equiv \angle BAC$	5. Corresponding angles of congruent triangles.
6. $\overline{AC}$ is the bisector of $\angle BAD$	6. Definition of

3. m($\angle$ABD)= 20^0 and m($\angle$ADC)= 40^0
4. 45^0

Polygons

In this subunit you will see the different types of polygons, simple, convex and concave polygons. To start the lesson, ask your students the following questions by writing them on the board.

1. What is a polygon?
2. What is Simple polygon?
3. What is Convex Polygon?
4. What is Concave Polygon?

Then, write on the board, all the answers that each students gives whatever the answer is.

Activity 5.5 and Activity 5.6 will be helpful in enabling Students acquire deeper knowledge about number of sides of polygon, Name of polygon and possible diagonals of polygon. Group your students in pairs and let them discuss and do the activity in the class. In the mean time go around and check how they do it.

Answers to Activity 5.5

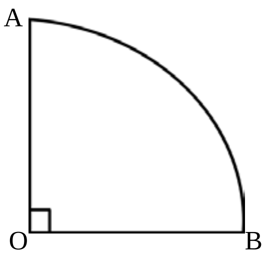
1. 

Figure 5.12

- $\overline{OA}$ and $\overline{OB}$ is a line segment but $\overline{AB}$ is an arc therefore a polygon is a simple closed plane figure formed by three or more line segment. Therefore, it is a quarter circle.

2. a) convex
   b) concave
   c) convex
   d) concave

3.

For picture A			For picture B		
Description	No of sides	Name of polygon	Description	No of sides	Name of polygon
1.Neck	4	Quadrilateral	1.Head	5	Pentagon
2.Head	6	Hexagon	2. T – shirt	5	Pentagon
3. T-shirt	8	Octagon	3.Name of bag	4	Quadrilateral
3. Name of bag	4	Quadrilateral	4.Trousers	8	Octagon
5.skirt	4	Quadrilateral	5.Legs	8	Octagon
6.shoes	8	octagon	6.Shoes	12	Dodecagon

Answers to Activity 5.6

1. a) $\overline{RY}, \overline{RZ}, \overline{XW}, \overline{XZ}$and $\overline{YW}$
   b) $\overline{AE}$, $\overline{AD}$, $\overline{AC}$, $\overline{BF}$, $\overline{BE}$, $\overline{BD}$, $\overline{CF}$, $\overline{CE}$ andDF

2.

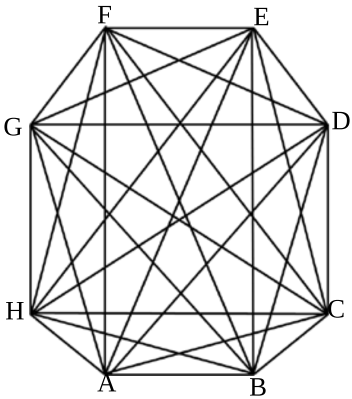


Figure 5.13

$\overline{BH}$, $\overline{BG}$, $\overline{BF}$, $\overline{BE}$, $\overline{BD}$, $\overline{AC}$, $\overline{AD}$
$\overline{AE}$, $\overline{AF}$, $\overline{AG}$, $\overline{HC}$, $\overline{HD}$, HE, $\overline{HF}$
$\overline{GC}$, $\overline{GD}$, $\overline{GE}$, $\overline{FC}$, $\overline{FD}$, and$\overline{EC}$

Answers to Exercise 5D

1. Number of all possible diagonals

$$= \frac{n(n-3)}{2}$$

$$= \frac{80(80-3)}{2}$$

= 3080 different diagonals.

2. 12

3. 20

4. a) A, B, C, D, E and F   b) DE

c)

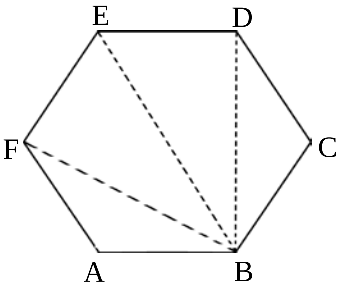


Figure 5.14

$\Rightarrow \overline{BF}, \overline{BE} \text{and} \overline{BD}$

d) six

e) Hexagon

Circles

Students are expected to have some background about the circle and its properties. Thus, group the students in pairs, and then, you may start the lesson by asking students to do **Group Work 5.2 and Exercise 5E**. That is you may ask students to give the definition of a circle, radius of a circle, a diameter and an arc of a circle. You may also ask draw a radius of a circle with the given measurement. Etc.

Answers to Group Work 5.2

1.

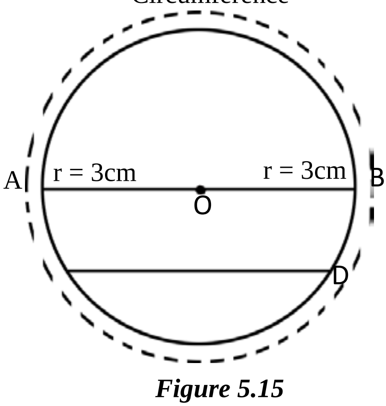


Figure 5.15

2. a) AB

   b) $\overline{AO}$ and $\overline{BO}$

   c) $\overline{CD}$

   d) CD and CABD

   e) $\overset{\frown}{AB}$

   f) look at figure 5.15

Answers to Exercise 5E

1. a) Similar to Group Work 5.2 2(b)

   b) Similar to Activity 5.8 2(a). This chord is called **diameter**.

   c) No

2. a) $\overline{AO}$, $\overline{DO}$, $\overline{CO}$ and $\overline{BO}$

   b) $\overline{AD}$ and $\overline{CB}$

   c) $\overline{AB}$ and $\overline{CD}$

   d) $\overline{AB}$ and $\overline{CD}$

Assessment

Dear teachers, at the end of this sub-unit, a part from Exercise 5A, 5B, 5C, 5D and 5E, you can

- Ask oral questions on the meanings of quadrilaterals and trapeziums and identification of their parts.
- Give activities on construction of trapeziums in the given dimension can be given and checks the performance of your students.
- Give activities on construction of parallelograms and describing its properties can be given and cheeked your students work.
- Give different exercise problems can be given as class work, home work and group work and checked your students work.
- Give assignments, quiz or test to assess their level of understanding.

Finally for slow learners and fast learners or interested students, you can give the following additional exercise problems.

For slow learners

Work out Question

1. In Figure 5.16belowe, ABCD is a parallelogram. Find the measure of $\angle C$ and $\angle D$

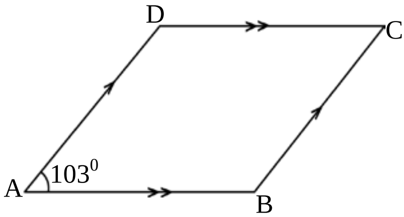


Figure 5.16

2. In the rhombus PQRS, m ($\angle$QSR) = 29^0. Find m ($\angle$PSQ).

For Fast learners

1. ABCD is a rhombus and M is the mid-point of $\overline{DC}$. $\overline{BD}$ and $\overline{AM}$ intersect at N. if m ($\angle$DBC) = 30^0 and m($\angle$DAM)= 40^0. Find m($\angle$BNM) and m($\angle$AMC).
2. Find the angles of a parallelogram in which one ange is three times the other.
3. ABCD is a parallelogram whose diagonals intersect at E. m($\angle$DAC)= 50^0, m($\angle$ABD)=45^0 and m($\angle$DEC)= 80^0. Find m($\angle$ACD) and the exterior angle at D.

5.2. Theorems of triangles

Period allotted: 11 periods

Competencies

At the end of this sub-unit students should be able to:

- state the angle sum theorem of a triangle.
- prove the sum of the measures of interior angles of a triangle is 180^0.
- apply the angle sum theorem of a triangle in solving related problems.
- explain the relation between the exterior angle and the two remote interior angles of a triangles.

- prove the exterior angle of a triangle equals the sum of the two remote interior angle.
- apply the exterior angle theorem of triangle in solving related problems.
- derive a formula for the sum of the interior angles of n-sides convex polygon.
- apply the formula for the sum of the interior angles of n-sided convex polygon to solved related problems.

Introduction

The main task of this subunit is to familiarize the students with the concepts of straight line, parallel lines, transversal line, Angle- sum theorem, and the sum of the interior angles of a polygon. In this subtopic, you will discuss and state formulas for the measures of any triangle, and interior and exterior angles of a polygon.

Teaching Notes

This topic with deals with lines, Angle-sum theorem and the sum of the interior angles of a polygon.

Revision on Lines

First revising the following basic concept:-

1. The angles on a straight line add up to 180°

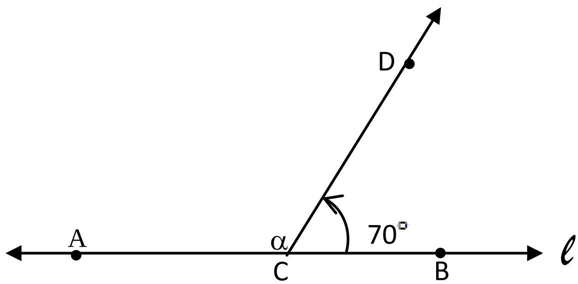


Figure 5.17

Solution: - m(∠ACD) + m(∠BCD) = 180º ……..why?

$\propto + 70^{o} = 180^{o}$ ……. why?

$\propto = 110^{o}$

2. Ask your students on Student text book Theorem 5.1,5.2, and 5.3 to state its own wards.
3. Ask your students to show that the sum of the degree measures of the three angles of any triangles is 180°.
4. Ask your students to show that the sum of the degree measures of the four angles of any quadrilaterals is 360°.

   In teaching the "Angle Sum theorem of a triangle" the objective is to teach students that the sum of the measures of the three angles of any triangle whatever its shape or size, turns out to be always that same i.e 180°

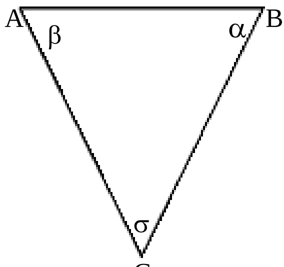


Figure 5.18

Based on the above teaching Note, first form the students in to groups. Then to each group, you may give one of the following Group work 5.3 to Group 1, Exercise 5F to Group 2, Activity 5.7 to Group three and Exercise 5G to Group four. Dear teacher give all the answers that each side gives on the board. Discuss the answers and lead the students to come to the generalization.

Answers to Group work 5.3

The answer of group work 5.3 already given in the student text book.

Answers to Exercise 5F

1.

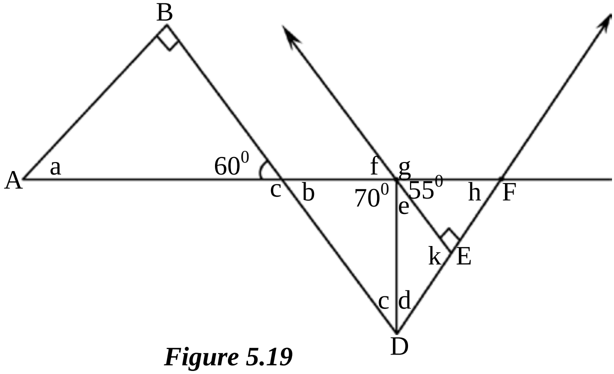


Figure 5.19

$\rightarrow$ $m(\angle A)+m(\angle B)+m(\angle C)=180^o$…….Angle sum theorem

$m(\angle a)+90^0+60^0=180^0$

$\Rightarrow m(\angle a)=30^0$

$\rightarrow$ $m(\angle b)=60^0$………….Vertical opposite angle.

$\rightarrow$ $m(\angle b)+m(\angle c)+70^o=180^0$……..Angle sum theorem

$60^0+m(\angle c)+70^0=180^0$

$\Rightarrow m(\angle c)=50^0$

$\rightarrow m(\angle k)=90^o$

$m(\angle h)+55^0+90^0=180^0$……..Angle sum theorem

$\Rightarrow m(\angle h)=35^0$

$m(\angle e)+70^0+55^0=180^0$…….Definition of straight angle.

$\Rightarrow m(\angle e)=55^0$

$\rightarrow m(\angle d)+m(\angle e)+90^o=180^0$……..Angle sum theorem

$m(\angle d)+55^0+90^0=180^0$

$m(\angle d)=35^0$

$m(\angle f)=55^0$……………Vertical opposite angle.

$m(\angle f)+m(\angle g)=180^0$…Definition of straight line

$55^0+m(\angle g)=180^0$

$\Rightarrow m(\angle g)=125^0$

2. $\rightarrow$ $m(\angle q) + 125^0 = 180^0$…………Angle sum theorem

$m(\angle q) = 55^0$

$\rightarrow$ $m(\angle p) + m(\angle q) + 50^0 = 180^0$………..Angle sum theorem

$\Rightarrow m(\angle p) + 55^0 + 50^0 = 180^0$

$\Rightarrow m(\angle p) = 75^0$

$\rightarrow$ $m(\angle q) = m(\angle r) = 55^0$……………….Vertical opposite angle

$\rightarrow$ $m(\angle r) + m(\angle s) + 85^0 = 180^0$ ………….Angle sum theorem

$m(\angle s) + 55^0 + 85^0 = 180^0$

$\Rightarrow m(\angle s) = 40^0$

$\rightarrow$ $m(\angle s) = m(\angle u) = 40^0$…………….Vertical opposite angle.

$m(\angle u) + m(\angle t) = 180^0$……………Definition of straight angle.

$40^0 + m(\angle t) = 180^0$

$\Rightarrow m(\angle t) = 140^0$

$\rightarrow$ $m(\angle w) = 65^0$……..Vertical opposite angle.

$m(\angle w) + m(\angle x) = 180^0$………….Definition of straight angle.

$m(\angle x) = 115^0$

$m(\angle u) + m(\angle V) + m(\angle w) = 180^0$………..Angle sum theorem

$40^0 + m(\angle V) + 65^0 = 180^0$

$\Rightarrow m(\angle p) = 75^0$

3.

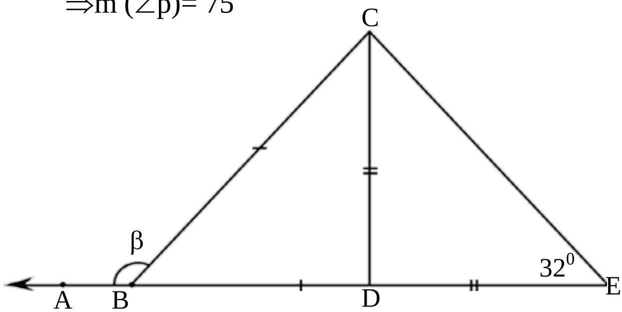


Figure 5.20

Δ EDC is isosceles then

$m(\angle E) = m(\angle C) = 32^0$………Since $\angle$ E and $\angle$ C are base angle.

$m(\angle E) + m(\angle C) + m(\angle D) = 180^0$

$\Rightarrow 32^0 + 32^0 + m(\angle D) = 180^0$

$\Rightarrow m(\angle D)=116^0$

$m(\angle BDC) + m(\angle EDC) = 180^0$ ………Definition of straight angle.

$\Rightarrow m(\angle BDC)+116^0=180^o$

$\Rightarrow m(\angle BDC)= 64^0$

Similarly consider ΔBDC

$m(\angle D) = m(C) = 64^0$…………Since ΔBDC is isosceles triangle

$m(\angle ABC)= m(\angle BDC)+m(\angle DCB)$

$= 64^0+64^0$

$= 128^0$

4.

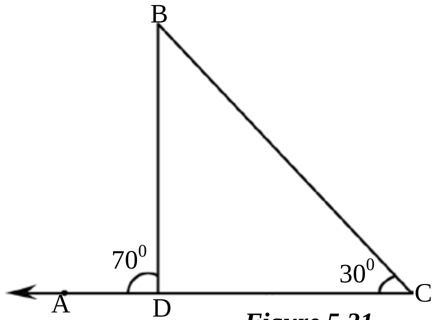


Figure 5.21

$m(\angle ADB)+m(\angle CDB)= 180^0$

$\Rightarrow 70^0+m(\angle CDB) = 180^0$

$\Rightarrow m(\angle CDB)= 110^0$

Consider ΔDBC

$\Rightarrow m(\angle D)+m(\angle B)+m(\angle C)= 180^0$

$\Rightarrow 110^0+m(\angle B)+30^0= 180^0$

$\Rightarrow m(\angle B)= 40^0$

Therefore, $m(\angle CBD) = 40^0$

5.

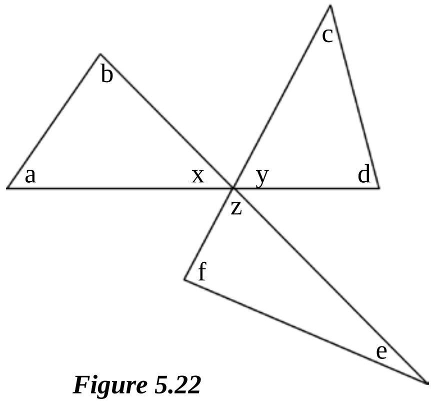


Figure 5.22

$$\underbrace{\angle a + \angle b + \angle x}_{180^0} + \underbrace{\angle c + \angle d + \angle y}_{180^0} + \underbrace{\angle e + \angle f + \angle z}_{180^0}$$

$= 540^0$ and $\angle x + \angle y + \angle z = 180^0$

Therefore, $\angle a + \angle b + \angle c + \angle d + \angle e + \angle f$

$= 540^0 - 180^0$

$= 360^0$

= 4 right angle.

6.

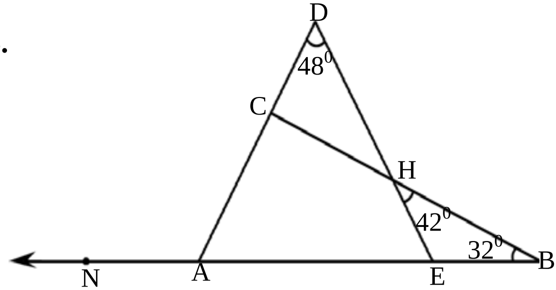


Figure 5. 23

Given: m ($\angle$ABC)= 32^0

m ($\angle$BHE)= 42^0

m ($\angle$ADE)= 48^0

m ($\angle$NAD)=?

m ($\angle$B) +m ($\angle$H)+ m($\angle$E)= 180^0

$\Rightarrow 32^0 + 42^0$ +m ($\angle$E)= 180^0

$\Rightarrow$m ($\angle$E)= 106^0

m ($\angle$AED)+m($\angle$HEB) = 180^0………….Definition of straight angle.

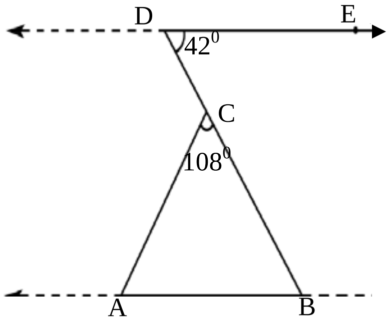
$\Rightarrow$ m ($\angle$AED) +106^0= 180^0

$\Rightarrow$ m ($\angle$AED)= 74^0

Thus m ($\angle$NAD)= m($\angle$ADE) +m($\angle$AED)

= 48^0 +74^0

= 132^0

7. 

m($\angle$EDB)= m($\angle$ABD)

= 42^0………..AIA

m($\angle$C)+ m($\angle$B)+m($\angle$A) =180^0

$\Rightarrow 108^0$+ 42^0 +m($\angle$A)= 180^0

$\Rightarrow$ m($\angle$A)= 30^0

Figure 5.24

Answers to Activity 5.7

1. x + 95^0 +134^0 + 100^0 +88^0 = (n-2) 180^0

x+ 417^0 = (5-2) 180^0

x+ 417^0 = 540^0

x= 123^0

2. y+ 94^0 +140^0 +153^0 +98^0 +110^0= (n -2) 180^0

y+ 595^0 = (6-2) 180^0

y+ 595^0 = 720^0

y= 125^0

3. a) measure of each interior angle

$= \frac{(n-2)180°}{n}$

$= \frac{(4-2)180°}{4}$

= 90^0

b) measure of each interior angle

$= \frac{(n-2)180°}{n}$

$= \frac{(5-2)180°}{5}$

= 108^0

c) measure of each interior angle

$= \frac{(n-2)180°}{n}$

$= \frac{(6-2)180°}{6}$

= 120^0

d) measure of each interior angle

$= \frac{(n-2)180°}{n}$

$= \frac{(7-2)180°}{7}$

$= \frac{900°}{7}$

Answers to Exercise 5G

1. a) 1800^0 b) 3240^0 c) 2160^0 d) 2160^0
2. a) 540^0 b) 1080^0 c) 720^0 d) 2340^0
3. a) 18 sides b) 8 sides c) No d) 12 sides
4. $121\frac{1}{4}°$
5. $166\frac{2}{13}°$
6. 20^0
7. n =5
8.

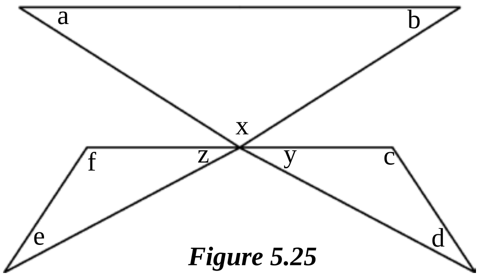


Figure 5.25

$$\underbrace{\angle a + \angle b + \angle x +}_{= 180^0} \underbrace{\angle f + \angle e + \angle z +}_{+ \quad 180^0 \quad +} \underbrace{\angle c + \angle d + \angle y}_{180^0}$$

$= 540^0$ and $\angle x + \angle y + \angle z = 180^0$

Therefore $\angle a + \angle b + \angle c + \angle d + \angle e + \angle f$

$= 540^0 - 180^0$

$= 360^0$

9.

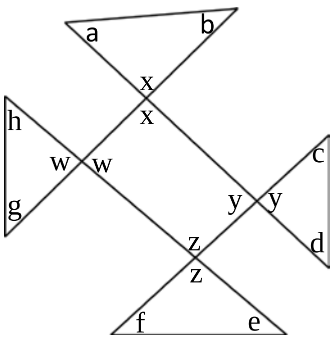


Figure 5.26

$\angle a + \angle b + \angle x + \angle c + \angle d + \angle y + \angle e + \angle f + \angle z + \angle g + \angle h + \angle w$

$= 180^0 + 180^0 + 180^0 + 180^0$

$= 720^0$ and $\angle x + \angle y + \angle z + \angle w = 360^0$

$= \angle a + \angle b + \angle c + \angle d + \angle e + \angle f + \angle g + \angle h$

$= 720^0 - 360^0$

$= 360^0$

10. $\rightarrow 70^0 + \beta = 180^0$

$\Rightarrow \beta = 110^0$

$\rightarrow 112^0 + \theta = 180^0$

$\Rightarrow \theta = 68^0$

$\rightarrow \delta + 120^0 = 180^0$

$\Rightarrow \delta = 60$

Now $\theta + \delta + \sigma + \beta = 360^0$

$\Rightarrow 68^0 + 60^0 + 110^0 + \sigma = 360^0$

$\Rightarrow \sigma = 122^0$

$\rightarrow \sigma + \alpha = 180^0$

$\Rightarrow 122^0 + \alpha = 180^0$

$\Rightarrow \alpha = 58^0$

11.

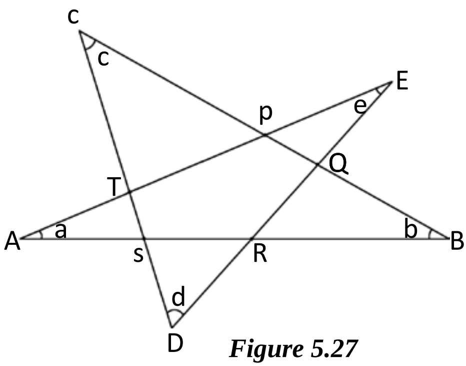


Figure 5.27

a+ m($\angle$ SRQ) +e +C +d +m ($\angle$EQP) +b +m($\angle$TSR) + C + a+ b + m ($\angle$TPQ) +e + d +m ($\angle$STP) = 5×180^0

2a + 2b +2c + 2d + 2e +m($\angle$SRQ)+m ($\angle$RQP) +m ($\angle$TSR)

$+m(\angle TPQ) + m(\angle STP) = 900^0$

Since TPQRS is a pentagon whose sum of interior angle is

$(5-2)\times 180^0 = 3\times 180^0$

$= 540^0$

Hence $2a + 2b + 2c + 2d + 2e + 540^0 = 900^0$

$2(a + b + c + d + e) = 900^0 - 540^0 = 360^0$

$a + b + c + d + e = 180^0$

12.

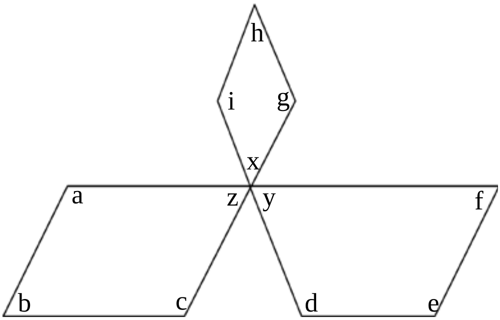


Figure 5.27

$$\underbrace{\angle a + \angle b + \angle c + \angle z}_{360^0} + \underbrace{\angle d + \angle e + \angle f + \angle y}_{360^0} + \underbrace{\angle h + \angle g + \angle I + \angle x}_{360^0}$$

$= 1080^0$ and $\angle x + \angle y + \angle z = 180^0$

Therefore, $\angle a + \angle b + \angle c + \angle d + \angle e + \angle f + \angle g + \angle h + \angle i$

$= 1080^0 - 180^0$

$= 900^0$

= 10 right angle.

13.

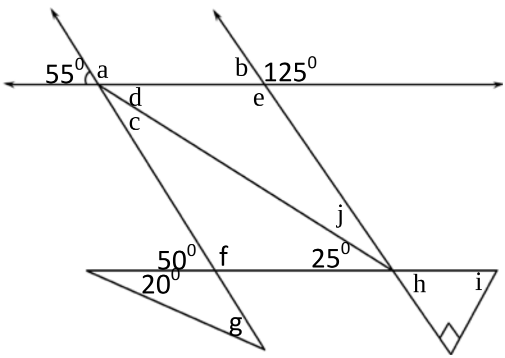


Figure 5.29

$\rightarrow 55^0 + a = 180^0$

$\Rightarrow a = 125^0$

$\rightarrow b + 125^0 = 180^0$

$\Rightarrow b = 55^0$

$\rightarrow e = 125^0$

$\rightarrow 50^0 + f = 180^0$

$\Rightarrow f = 130^0$

$\rightarrow 20^0 + 130^0 + g = 180^0$

$g = 30^0$

$\rightarrow c + 130^0 + 25^0 = 180^0$

$\Rightarrow c = 25^0$

$j = 55^0$

$d + j + e = 180^0$

$d + 55^0 + 125^0 = 180^o$

$d = 0^o$

Assessment

Remember that students are expected to solve real life problems using geometrical figures. We hope that you have used multiples of formal and informal assessment techniques like group work, class work, home work, oral and written questions, assignments, quize, tests etc during each period. It is also give additional exercise problems.

For slow learners

Answer the following questions.

1. Given ℓ is parallel to m, what is the value of X?

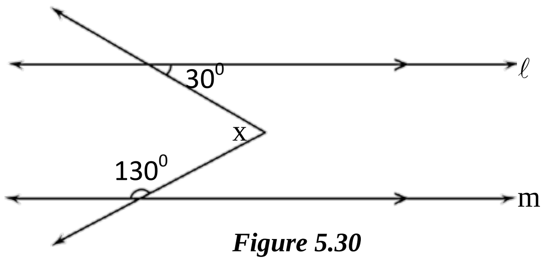


Figure 5.30

2. In the figure below , what is the
   Value of a+b?

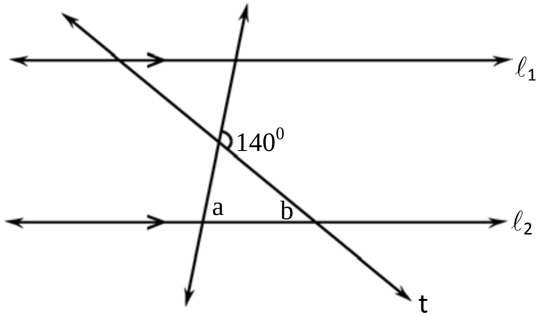


Figure 5.31

For Fast Learners

Question 1-3, Find the unknown marked angles

1.

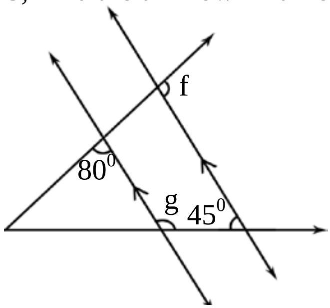


Figure 5.32

2.

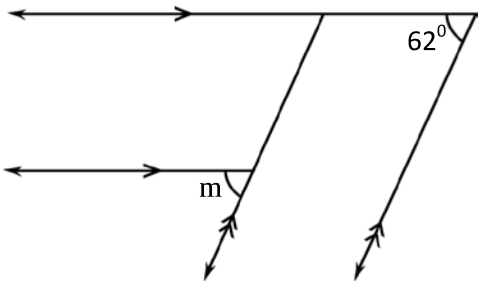


Figure 5.33

3.

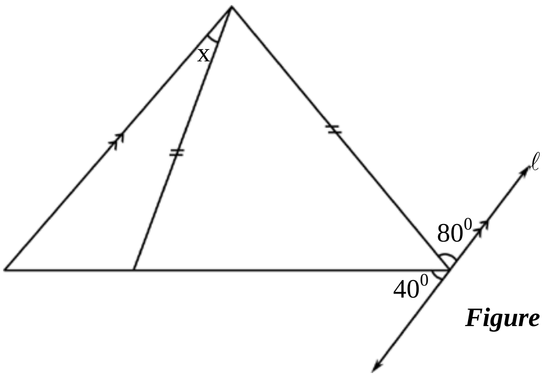


Figure 5.34

4. Can a regular polygon have an exterior angles of:
   a) 10^o b) 40^o c) 32°

5. The sum of the interior angles of a convex n-gon is twice the sum of the exterior angles. Find n.

5.3. Measurement

Period allotted: 17 periods

Competencies:

- derive the area formula for a triangle.
- state and apply the formula for computing the area of a triangle.
- solve real life problem using the formula.
- compute the perimeter of a trapezium.
- derive the area formula for trapezium.
- determine the area of trapezium.
- calculate the perimeter of parallelogram.
- derive the area formula for parallelogram.
- calculate the area of a parallelogram.
- to determine the quotient of circumference divided by diameter of a circle.
- explain the number π as a factor of proportionality.
- compute the circumference of a circle.

- determine the area formula of a circle.
- state the surface area formula of prism.
- calculate the surface area of prism using the formula.
- produce a model of right prism
- state the surface area formula of cylinder.
- calculate the surface area of cylinder using the formula.
- produce a model of cylinder.
- state the surface area formula of cylinder.
- calculate the surface area of cylinder using the formula.
- state the volume formula of prisms.
- calculate the volume of prisms.
- state the volume formula of cylinder.
- calculate the volume of cylinder.

Introduction

In this unit, the basic geometric notions learned in grade 5 and 6 are strengthened. One of the outcomes of this sub-unit is to enable students to

- Calculate the area of a triangle;
- Calculate the perimeter of a trapezium;
- Calculate the perimeter and area of parallelogram;
- Calculate the circumference of a circle;
- Calculated the area of a circle;
- Calculate the surface area of prisms and cylinder and
- Calculate the volume of prism and cylinders.

Finally, they should be able to derive area and perimeter formula for triangle, trapezium, parallelogram, circumference of a circle, surface area of prisms and cylinder and volumes of prism and cylinder.

Teaching Notes

In this sub unit you will see the different types of measurements, area and perimeter of triangle, perimeter and area of trapezium, perimeter and area of parallelogram, Circumference of a circle, area of a circle.

Dear teacher to start the lesson, ask your students to the following questions by writing them on the board.

1. Show that area of a right- angle triangle ABC with base b and height h is $A=\frac{bh}{2}$
2. Show that the area of any triangle whose base is b and altitude to this base is h is given by $A=\frac{1}{2}bh$.
3. Show that the perimeter p of any triangle ABC with the given sides of a, b and c is p= a+b+c.
4. Show that the lengths of the bases of a trapezium are denoted by b_1 and b_2 and its altitude is denoted by h then the area A of the trapezium is $A=\frac{1}{2}(b_1+b_2)h$.
5. Show that the area of a parallelogram with length of base *b* and Corresponding height h is given by A=bh.
6. Show that the area of a circle whose radius "r" unit long is given by $A = \pi r^2$ or $A = \pi\left(\frac{d}{2}\right)^2 = \pi\frac{d^2}{4}$.

Then, write on the board, all the answers that each students gives whatever the answers is.

Group work 5.4**,** Group Work 5.5, activity 5.8, Activity 5.9 and Activity 5.10 will be helpful in enabling students acquire deep knowledge about area of a triangle, perimeter and area of trapezium, perimeter and area of parallelogram, circumference of a circle and area of a circle.

Dear teacher Group your students in pairs and let them discuss and do the activity in the class. In the mean time, go around and check how they do it.

Group Work 5.4

1. The length of the side is 16cm.
2. Perimeter of a square = 36cm.
3. Width of a rectangle= 6cm and length of a rectangle= 12cm and Area of a rectangle = $72cm^{2.}$
4. Area of a rectangle = $1125cm^{2.}$
5. The answer is variety.

Answers to Exercise 5H

1. a) $80cm^2$ b) $24cm^2$
2. $21\ m^2$
3. $1cm^2$
4.

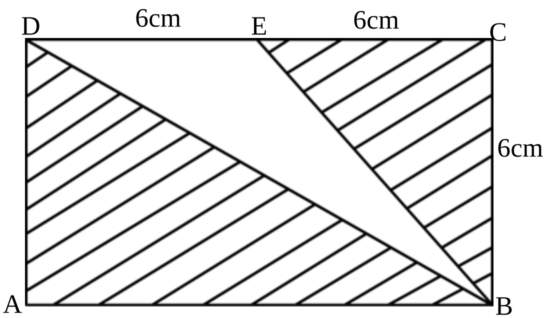


Figure 5.35

First calculate, the area of a rectangle:

$$a(ABCD) = AB \times BC$$
$$= 12cm \times 6cm$$
$$= 72cm^2$$

Second calculate the area of a triangle:

$$a(\Delta ABD) = \frac{1}{2}[(AB)\times(AD)]$$

$$= \frac{1}{2}\ [(12\text{cm} \times 6\text{cm})]$$

$$= 36\text{cm}^2$$

And $a(\Delta BCE) = \frac{1}{2}\ [(BC \times CE)]$

$$= \frac{1}{2}\ [(6\text{cm} \times 6\text{cm})]$$

$$= 18\text{cm}^2$$

Thus a(shaded region) = $a(\Delta ABD) + a(\Delta BCE)$

$$= 36\ \text{cm}^2 + 18\text{cm}^2$$

$$= 54\text{cm}^2$$

5. Perimeter= 16.2cm and Area = $\frac{21}{2}\ \text{cm}^2$

6.

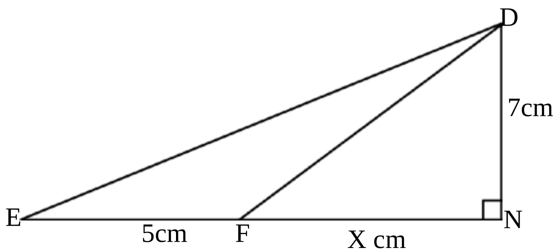


Figure 5.36

$$a(\Delta END) = \frac{1}{2}(5 + x) \times 7$$

$$= \frac{1}{2}(35 + 7x) \text{ ………….Equation (1)}$$

$$a\ (\Delta END) = a(\Delta EDF) + a(\Delta FDN)$$

$$\frac{1}{2}(35 + 7x) = \frac{1}{2}(x + 7) + a(\Delta EDF)$$

$$a(\Delta EDF) = 17.5\text{cm}^2$$

Answer to Group Work 5.5

1.

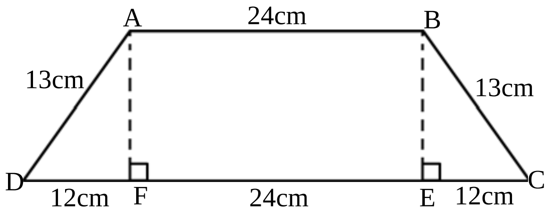


Figure 5.38

$(DF)^2 + (FA)^2 = (AD)^2$

$\Rightarrow 12^2 + (FA)^2 = 13^2$

$\Rightarrow FA = 5cm$

$A = \frac{h}{2}[b_1 + b_2]$

$= \frac{5}{2}(24 + 48)$

$= 180cm^2$

$P = AB + BC + CD + DA$

$= 24cm + 13cm + 48cm + 13cm$

$= 98cm$

2. a) Area $= 94cm^2$ b) Area $= 26cm^2$
3. $b_2 = 32cm$

Answer to Exercise 5I

1.

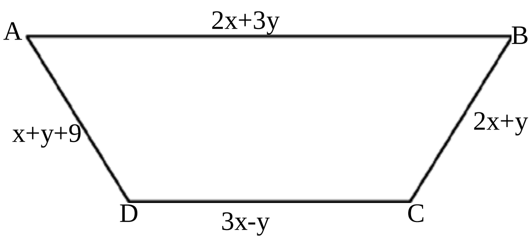


Figure 5.39

Perimeter = AB + BC + CD + DA

$= 2x + 3y + 2x + y + 3x – y + x + y + 9$

$= 8x + 4y + 9$

$= 8\times9 + 4\times7 + 9$

$= 109$

2. h= 5cm
3. b_1 = 4cm

Answers to Activity 5.8

1. Area= 67cm^2
2.

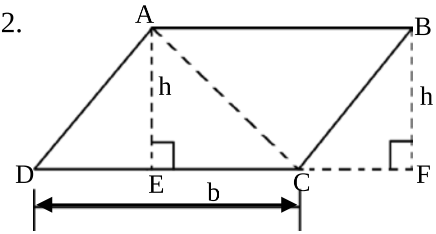


Figure 5.40

a (ABCD) = a(ΔADC) +a(ΔABC)

$= \frac{1}{2}$ (DC × AE) + $\frac{1}{2}$(AB × BF)

$= \frac{1}{2}$ bh + $\frac{1}{2}$ bh

= bh

Therefore, the area of the parallelogram = length of base × perpendicular height = b×h

Answers to Exercise 5J

1.

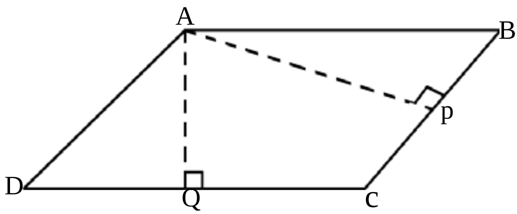


Figure 5.41

a) a(ABCD) = DC × AQ
= 5cm × 4cm
= 20cm^2

b) a(ABCD)= 24cm^2
AB = 6cm
a(ABCD)= AB×AQ
24cm^2= 6cm× AQ
⇒AQ= 4cm

c) a(ABCD) = AB × AD

$20 = 6 \times AQ$

$\Rightarrow AQ = \dfrac{10}{3}$ cm

2.

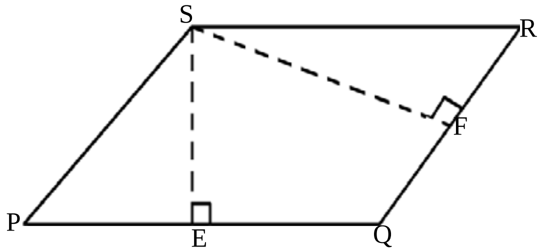


Figure 5.42

a) a(PQRS)= $18cm^2$

PQ= 5cm

QR= 4cm

a(PQRS)= PQ$\times$SE

$18cm^2$= 5cm$\times$SE

SE= 3.6cm

The length of the corresponding altitudes is 3.6cm

b) a(PQRS) = QR$\times$SF

$18cm^2$ = 4cm$\times$SF

SF= 4.5cm

The length of the corresponding altitudes is 4.5cm

3.

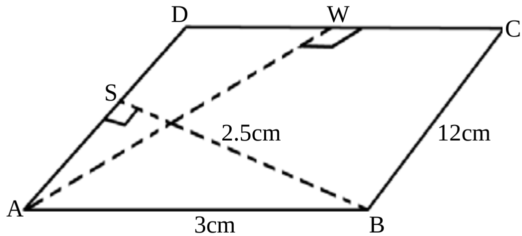


Figure 5.43

AB= 3cm

BC= 12cm

a(ABCD) = AB$\times$BS

= 12cm$\times$2.5cm

$= 30cm^2$

$A(ABCD) = CD \times AW$

$30cm^2 = CD \times AW$

$30cm^2 = 3cm \times AW$

$AW = 10cm$

Therefore, the length of the perpendicular from A to CD= 10cm

4.

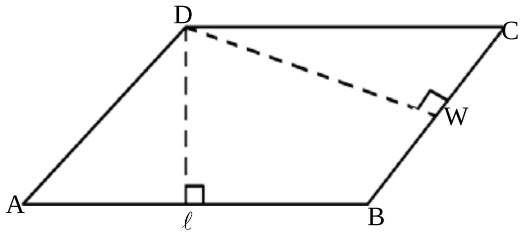


Figure 5.44

$P(ABCD) = 40cm$

$P(ABCD) = 2(\ell + w)$

$\Leftrightarrow 40cm = 2(\ell + w)$

$\Rightarrow \ell + w = 20cm$

Let A_1= area and A_2= area

$A_1 = \ell \times 4cm = 4\ell$…………Equation(1)

$A_2 = w \times 6cm = 6w$ ……….Equation (2)

sides of the parallelogram

$$\Rightarrow \ell = \frac{3}{2} w$$

$$20cm = \frac{3}{2} w + w$$

$$40cm = 5w$$

$$\Rightarrow w = 8cm$$

$$\text{Thus } \ell = \frac{3}{2} W$$

$$\ell = \frac{3}{2} \times 8cm$$

$\ell = 12$ cm

Therefore, the length of the sides of the parallelogram are $\ell = 12$ cm and w = 8cm

Answers to Activity 5.9

All things are discus in the students text book.

Answer to Exercise 5K

1. a) 12.56 cm c) 25.12cm e) 7.85cm
   b) 31.40 cm d) 37.68 cm f) 25.905cm

2. a) 50.24 cm c) 75.36 cm e) 22.61 cm
   b) 314.00 cm d) 15.70 cm f) 51.81cm

3. C= 125. 6cm

$C = 2\pi r$

$125.6 = 2\times3.14\times r$

$\Rightarrow r = \frac{125.6}{6.28} = 20$cm and d= 2r= 40cm

4. Perimeter = AB + $\frac{1}{2}(2\pi r)$

$= 200\text{m} + \frac{1}{2}(2\pi\times100\text{m})$

$= (200 + 100\pi)\text{m}$

$= 100(2+\pi)\text{m}$

5. Perimeter $= 200\text{m} + 200\text{m} + 2\left[\frac{1}{2}(2\pi r)\right]$

$= 400\text{m} + 2\times3.14\times100\text{m}$

$= 400\text{m} + 628\text{m}$

$= 1028\text{m}$

6. Perimeter = OA+ OB+ $\frac{1}{4}(2\pi r)$

$$= 14\text{cm} + 14\text{cm} + \frac{1}{4}(2\pi\times 14\text{ cm})$$

$$= 28\text{cm} + 7\pi\text{ cm}$$

$$= 7(4+\pi)\text{cm}$$

Answers to Activity 5.10

1. a) $64\pi cm^2$ c) $100\pi cm^2$
   b) $25\pi cm^2$ d) $144\pi cm^2$
2. a) $81\pi cm^2$ c) $64\pi cm^2$
   b) $100\pi cm^2$ d) $72.25\pi cm^2$

Answers to Exercise 5L

1. $2.88\pi cm^2$
2. (x, y)= (12, 3)

$\Rightarrow$ x- 3y

$\Rightarrow$12- 9

$\Rightarrow$3

Thus $A = \pi r^2$

$= \pi(3)^2$

$= 9\pi$ sq.unit

3.

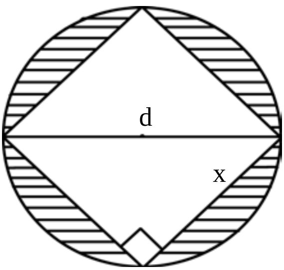


Figure 5.45

Area of the Circle= πr^2

$= 36\pi cm^2$

Let "d" be the side of the square, hence the diagonal

$d^2 = x^2 + x^2$

$12^2 = 2x^2$

$144 = 2x^2$

$x = 6\sqrt{2cm}$

Thus Area of the circle is $\pi r^2 = \pi(6cm)^2 = 36\pi cm^2$

Area of the square is $S^2 = x^2 = (6\sqrt{2}cm)^2 = 72cm^2$.

Area of the shaded region = Area of the circle - Area of the square

$= (36\pi - 72)\ cm^2$

$= 36(\pi - 2)\ cm^2$

Therefore, the area of the shaded region is $36(\pi-2)\ cm^2$.

4. Area of shaded part= a(bigger semi-circles)- a (two smaller semi-circles)

$= \frac{1}{2}\pi(2)^2 - \frac{1}{2}(2\pi(1)^2$

$= \pi$ sq. unit

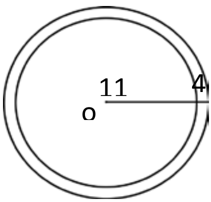
5. 

Figure 5.46

Area of brick is given by

= area of the big circle- area of the small circle.

$= \pi\ (15)^2 - \pi(11)^2$

$= 225\pi - 121\pi$

$= 104\pi m^2$

6. let $r_1 = 2r_2$

$A_1 = \pi r_1^2$

$= \pi(2r_2)^2$

$= 4\pi r_2^2$ and

$A_2 = \pi r_2^2$

$$\frac{A_1}{A_2} = \frac{4\pi r_2^2}{\pi r_2^2} = \frac{4}{1} = 4:1$$

7. a) r= 12cm b) r= 18cm c) r= 25cm d) r= $\frac{1}{9}$ cm

8. a) d= 20cm b) d= 8cm c) d= 40cm d) d= 1cm

9. let R= 9cm

   a(shaded region)= $2\pi r^2$

   a(shaded region)= a(bigger circle) –a (smaller circle)

   $2\pi r^2 = \pi R^2 - \pi r^2$

   $2\pi r^2 = \pi(9cm)^2 - \pi r^2$

   $3\pi r^2 = 81\pi cm^2$

   $\Rightarrow r = 3\sqrt{3}$cm

   Therefore, the radius of the smaller circle is $3\sqrt{3}$cm.

10. $A_{annulus}$ = a(bigger circle) - a (smaller circle)

    $= \pi R^2 - \pi r^2$

    $= \pi[(6cm)^2 - (3cm)^2]$

    $= 36\pi cm^2 - 9\pi cm^2$

    $= 27\pi cm^2$

Surface Area of prisms and Cylinder

Students are expected to have some back ground about solid figures and its properties. Thus group the students in pairs, and then you may start the lesson by asking students to do group work 5.6 and Give home work and class work for Exercise 5M. That is you may ask students to give the definition net, cylinder and give the following formula correctly:-

- Surface area of a prism $= ph$
- Total surface are of a prism = $2(lh + wh + lw)$
- Lateral surface area of circular cylinder (A_s) $=2\pi rh)$
- Total surface area of circular cylinder (A_T) = $2\pi r (r + h)$

Group work 5.6

1. Properties of a rectangular prisms
   - Each lateral edge is perpendicular distance between its bases.
   - The lateral faces are rectangles and lateral edge is an altitude.

2.

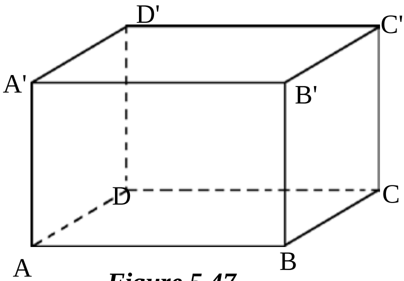


Figure 5.47

- Vertices, A, B, C, D, A', B', C', and D'.
- Lateral edge, AA', DD', BB' and CC'.
- Lateral faces, AA' D'D, DD'C'C, BB'C'C and AA' B'B .

3. A cube is all the edge are equal since a cube is also rectangular prism.
4. Similar to student text book examples
5. a) AG b) BE c) CF d) DH

Answers to Exercise 5M

1.

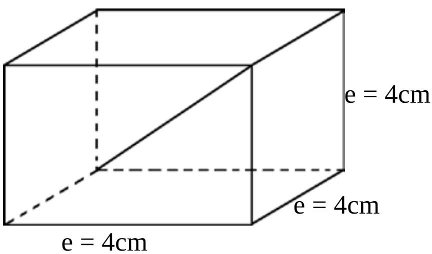


Figure 5.48

a) $LSA = 4e^2$

$= 4(4cm)^2 = 64cm^2$

b) $TSA = 6e^2 = 6(4cm)^2 = 96cm^2$

2.

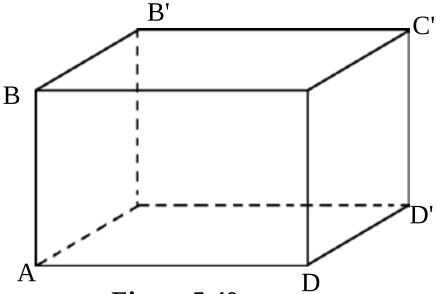


Figure 5.49

$LSA = ABB'A' + B'A'D'C' + ABCD + CDD'C'$

$= (25\times30)cm^2 + (63\times30)cm^2 + (63\times30)cm^2 + (25\times30)cm^2$

$= 750cm^2 + 1890cm^2 + 1890cm^2 + 750cm^2$

$= 5280cm^2$

$TSA = LSA + 2A_B$

$= 5280 + 2(63\times25)$

$= 5280 + 3150$

$= 8430cm^2$

3. $LSA = 120cm^2$

$C = 12cm$

$h = ?$

$LSA = 2\pi rh$

$120 = ch$

$\Rightarrow 120 = 12h \Rightarrow h = 10cm$

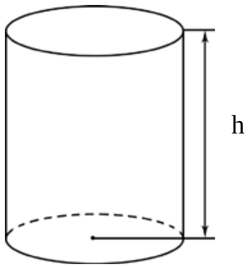


Figure 5.50

Therefore, the altitude of the cylinder is 10cm

4.

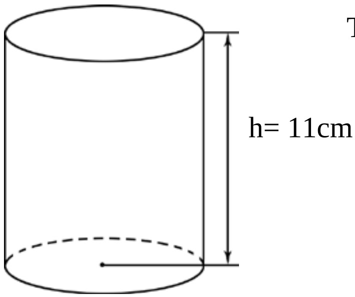


Figure 5.51

$TSA = 84\pi cm^2$

$h = 11cm$

$r = ?$

$TSA = LSA + 2A_B$

$84\pi = 2\pi rh + 2\pi r^2$

$84\pi = 2\pi r(11 + r)$

$42 = r(11 + r)$

$\Rightarrow r^2 + 11r - 42 = 0$

$r = -14$ or $r = 3$

but r is always apositive rational number so the radius of the base is 3cm.

5. a) The lateral surface area= The lateral surface area of the outer cylinder + inner cylinder

$$= 2\pi Rh + 2\pi rh$$

$$= 2\pi\times3cm\times5cm + 2\pi\times1cm\times5cm$$

$$= 40\pi cm^2$$

b) Total surface Area

$$= LSA + 2A_B$$

But the bases area of annulus of a circle is

Area of the base $= 2(\pi R^2 - \pi r^2)$

$$= 2(9\pi - \pi)$$

$$= 16\pi cm^2$$

Therefore, the TSA= LSA $+A_B$

$$= (40\pi + 16\pi)cm^2$$

$$= 56\pi cm^2$$

Volumes of Prism and Cylinder

In Grade 5 and 6 mathematics lesson you have learnt how to compute the volume of prism and cylinder. In this lesson you will learn how to compute the volume in a more detailed ones.

Let the students start the lesson by doing Group work 5.7 given in their textbook. Give them about 15 minutes to do and discuss the problems of the Group work. This will give the students the opportunity to revise the definitions of prisms and cylinders. Encourage and assist the students to make models of these solids before they came to class. In addition so that assist them to formulate and use area formula for these solids. Make sure that students are able to state in their own words that the volumes of solids are given as.

- Volume of Prism = length× width ×height

$$V = l \times w \times h$$

$$= \quad l^3$$

- Volume of a cube = length × length × length

$$V = l \times l \times l$$
$$= \quad l^3$$

- Volume of a right triangular prism= Base area × height

$$V = A_B \times h$$

- Volume of any rectangular prism= Base area × height

$$V = A_B \times h$$

- Volume of Cylinder = base area × height

$$V = A_B \times h$$
$$V = \pi r^2 h$$

Answers to Group work 5.7

1.

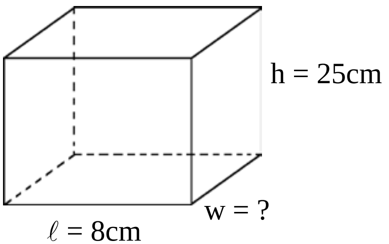


Figure 5.52

$V = 50cm^2$

$V = \ell \times w \times h$

$50 = 8 \times w \times 2.5$

$50 = 20w$

$\Rightarrow w = 2.5cm$

Therefore, the width of a cuboids= 2.5cm

2. $V = \pi r^2 h$

$V = \pi\,(3cm)^2 \times 20cm$ but $r = \frac{d}{2} \Rightarrow r = \frac{6cm}{2} = 3cm$

$V = 9\pi cm^2 \times 20cm$

$V = 180\pi cm^3$

Therefore, the volume of the cylinder is $180\pi cm^3$

3.

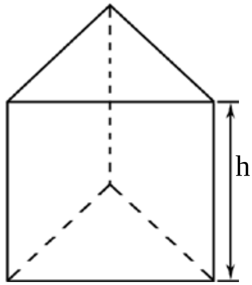


Figure 5.53

$V = A_B h$

$60cm^3 = 12cm \times A_B$

$\Rightarrow A_B = 5cm^2$

Therefore, the area of the triangular prism is $5cm^2$

Answers to Exercise 5N

1. a) $V_{cylinder} = \pi r^2 h$

$= \pi(8cm)^2 (20cm)$

$= 1280\pi cm^3$

b) First find the volume of a cube

$V cube = \ell^3$

$= 16^3$

$= 4096cm^3$

Therefore, total volume $= V_{cylinder} + V_{cube}$

$= (1280\pi + 4096)cm^3$

$= (4019.2 + 4096)cm^3$

$= 8115.2cm^3$

2. $A_B = 8.5cm$

3. $V = A_B h$

$V = \frac{1}{2}(3cm \times 8cm) \times 7cm$

$V = 84cm^3$

Therefore, the volume of the triangular prism is $84cm^3$

4. a) There are three solid

volume (v_1) = volume (v_2) = volume (v_3)

Thus $3(v_1) = 3(4cm \times 4cm \times 4cm)$

$= 3(64)cm^3$

$= 192cm^3$

b) There are two solid

Let volume $v_1 = \ell \times w \times h$

$= 8cm \times 6cm \times 3cm$

$= 144\ cm^3$

Let volume $v_2 = \ell \times w \times h$

$= 3cm \times 2cm \times 1cm$

$= 6\ cm^3$

Total volume = volume (v_1) + volume (v_2)

$= 144cm^3 + 6cm^3$

$= 150cm^3$

Assessment

Dear teachers, at this time, you have to identified the strengths and weaknesses of your students.

Give: activities on the derivation of area formula for the right angled triangle and checked the performance of your students.

- Activities on the computation of perimeter of trapezium.
- Different exercise problems in calculating areas and perimeter of parallelograms.
- Different exercise problems and activities on determination of circumference of a circle.
- Activities on the derivation of area formula for the circle.
- Various exercise problems on calculating of areas of prisms on calculating of areas of prisms and cylinders. Finally mark the assignment given. It is good if a test is given here to encourage them to study more. Some additional problems are given below for slow learners and fast learners.

For slow learners

1. The area of the small square is $49cm^2$. Find the area of the shaded region.

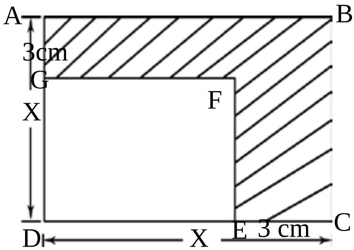


Figure 5.52

For Fast learners

1. Prove that the area of a rhombus is equal to half the product of its diagonals.

2. In the given Figure to the right , find:
   a) The area of the larger circles.
   b) The area of the smaller circles.
   c) The area of the shaded regions.

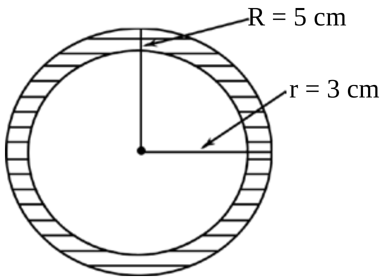


Figure 5.53

3. What is the area of the shaded region in the Figure below.

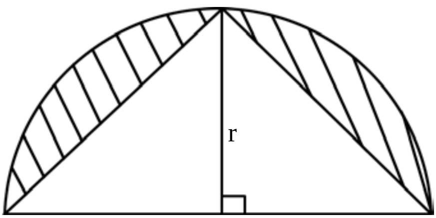


Figure 5.54

Answer to Miscellaneous Exercise 5

Part I

1) False	3) False	5) True	7) False
2) False	4) True	6) True	

Part II

1) d	5) a	9) c	13) b
2) C	6) b	10) d	14) c
3) a	7) d	11) a	
4) C	8) c	12) d	

Part II

15. Read students text book.
16. Read students text book.

17.

Name	***Number of sides***	***Number of Vertices***	***Number of diagonal***
Triangle	3	3	0
quadrilateral	4	4	2
Pentagon	5	5	5
Hexagon	6	6	9

18) $m(\angle ACB) + m(\angle CAB) = m(\angle ABD)$………… Why?

$30°+4x = 5x$

$\Rightarrow x = 30°$

Thus $4x = 4(30°)$

$4x = 120°$

And $5x = 5(30°)$

$5x = 150°$

Therefore $m(\angle CAB) + m(\angle ABC) + m(\angle BCA) = 180°$…Why?

$\Rightarrow 120° + m(\angle ABC) + 30° = 180°$

$\Rightarrow m(\angle ABC) = 30°$

19) a) The degree measure of a regular polyon

$$= \left(\frac{2n-4}{n}\right) \times 90°$$

$$= \left(\frac{2\times30-4}{30}\right) \times 90°$$

$= \frac{56}{30} \times\ 90°$

$= 168°$

b) The degree measure of a regular polyon

$= \left(\frac{2n-4}{n}\right) \times 90°$

$= \left(\frac{2\times45-4}{45}\right) \times 90°$

$= \left(\frac{90-4}{45}\right) \times 90°$

$= 172°$

c) The degree measure of a regular polygon

$= \left(\frac{2\mathrm{n}-4}{\mathrm{n}}\right) \times 90°$

$= \left(\frac{2\times90-4}{90}\right) \times 90°$

$= 176°$

20) First consider Δ ABC i. e

m $(\angle A)$ + m $(\angle B)$ + m $(\angle \mathrm{C}) = 180°$ ..... why?

$\Longrightarrow 50° + 58° + \ x + 42° = 180°$

$\Longrightarrow\ \mathrm{x} + 150° = 180°$

$\mathrm{x}=30°$

Therefore, m $(\angle DBC) = 30°$

Secondly consider Δ ABD

$\Longrightarrow$ m $(\angle D)$ + m $(\angle A)$ + m $(\angle B) =\ 180°$ ... why?

$\Longrightarrow 37° + \mathrm{y} + 50° + 58° = 180°$

$\Longrightarrow \mathrm{y} + 145° = 180°$

$\Longrightarrow \mathrm{y} = 35°$

Therefore, m $(\angle \mathrm{CAD}) = 35°$

21) $\mathrm{x} + \mathrm{y} + 112° = 180°$

$\mathrm{x} + \mathrm{y} = 68°$ ... Equation 1

$2\mathrm{x} + 2\mathrm{y} + \mathrm{C} = 180°$

$\Longrightarrow \mathrm{x} + \mathrm{y} + \frac{\mathrm{c}}{2} = 90°$

$\Longrightarrow 68° + \frac{\mathrm{c}}{2} = 90°$

$\frac{c}{2} = 22^0$

$C = 44^0$

Therefore $m(\angle C) = 44^0$,

22)

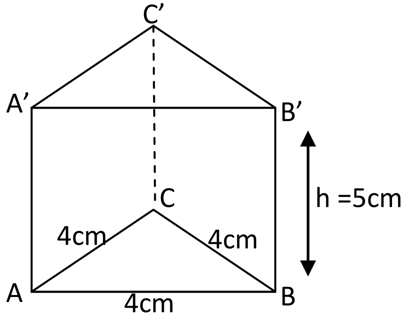


Figure 5.55

Volume = $A_B h$

$= \frac{1}{2}(4cm \times 4cm) \times 5cm$

$= 8cm^2 \times 5cm$

$= 40cm^3$

23) $C = 2\pi r$

a) $60 = 2\,\pi \times r$

$\Rightarrow r = \frac{30}{\pi} cm$

b) $A = \pi r^2$

$= \pi \left(\frac{30}{\pi}\right)^2$

$= \pi \left(\frac{900}{\pi^2}\right)$

$= \frac{900}{\pi} cm^2$

24) $V = 1540cm^3$

$h = 10cm$

$r = ?$

$V = \pi r^2 h$

$r^2 = \frac{V}{\pi h}$

$r = \sqrt{\frac{V}{\pi h}}$

$r = \sqrt{\frac{1540}{\frac{27}{7} \times 10}}$

$r = \sqrt{\frac{1540}{1} \times \frac{7}{220}}$

$r = \sqrt{\frac{10780}{220}}$

$r = \sqrt{49} = 7\text{cm}$

25) $V = 75\text{cm}^3$

$r = \frac{50}{2}\text{mm} = 25\text{mm} = 2.5\text{cm}$

$V = \pi r^2 h$

$h = \frac{v}{\pi r^2}$

$h = \frac{75\text{cm}^3}{\pi(2.5\text{cm})^2}$

$h = \frac{75\text{cm}^3}{\pi(6.25)\text{cm}^2}$ (Take $\pi = \frac{22}{7}$)

$h = \frac{75\text{cm}}{\frac{22}{7} \times \frac{625}{100}}$

$h = \frac{75 \times 700}{22 \times 625}$ cm

$h = \frac{52500}{13750}$ cm

$h = \underline{\underline{3.8\text{cm}}}$

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