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Mathematics

8th Standard

Based on the New Textbook & New Syllabus for 2019-20

Term - I

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- Term-wise Guide as per the New Textbook for the year 2019-20, for Term - I
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NOTE FROM PUBLISHER

It gives me great pride and pleasure in bringing to you **Sura's Mathematics Guide** for **First Term** for **8th Standard**. It is prepared as per the New Syllabus and New Textbook for Term-I for the year 2019-20.

This guide encompasses all the requirements of the students to comprehend the text and the evaluation of the textbook.

- Additional questions have been provided exhaustively for clear understanding of the units under study.
- Chapter-wise Unit Test are given.

In order to learn effectively, I advise students to learn the subject section-wise and practice the exercises given. It will be a teaching companion to teachers and a learning companion to students.

Though these salient features are available in this Guide, I cannot negate the indispensable role of the teachers in assisting the student to understand the subject thoroughly.

I sincerely believe this guide satisfies the needs of the students and bolsters the teaching methodologies of the teachers.

I pray the almighty to bless the students for consummate success in their examinations.

Subash Raj, B.E., M.S.
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CONTENTS

RATIONAL NUMBERS

1

POINTS TO REMEMBER

- Proper fraction are greater than zero and less than one.
- Every non zero number has a reciprocal.
- Every number has an opposite number.
- A rational number is defined as a ratio of integers.
- The set of rational numbers which is denoted by the letter Q.
- The set of rational numbers 'Q' is defined as the set of all numbers that can be written in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$. E.g. $\frac{1}{3}, -\frac{3}{5}$
- Here the number 'a' is called the numerator and b is called the denominator.
- The mixed numbers are rational numbers. Eg. $3\frac{1}{2}, 4\frac{1}{3}$.
- All the integers and fractions are rational numbers. Eg. 7, –4
- The decimal numbers are rational numbers. Eg. 0.75, 1.3
- The word ratio in maths refers to comparison of the sizes of two different quantities.
- Ratios can be written as fractions. Eg. $1 : 20 = \frac{1}{20}$
- Every terminating or repeating decimal can be written in rational form. Eg. $3.0 = \frac{3}{1}$ (or) $0.666..... = \frac{2}{3}$
- The decimal numbers which are non terminating and non-repeating are not rational numbers. Eg. $\pi = 3.1415926535.....$ and 3.010020004
- We get an equivalent rational number of a given rational number by multiplying the numerator and the denominator by a non zero integer.
- The rational number '0' is neither positive nor negative.

- The quotient of two numbers with different signs, is a positive number.
  Eg. $\frac{-4}{5} = -\frac{4}{5}$
- The two numbers are of the same sign, then the quotient is a positive number.
  Eg. $\frac{-3}{-4} = \frac{3}{4}$ and $\frac{+3}{+4} = \frac{3}{4}$
- The set of rational numbers 'Q' contains all quotient, except those involving division by 0.
- A positive number is always greater than a negative number.

(A) Four Basic Operations on Rational Numbers:

(a) Addition:

- To add two rational numbers with the same denominator, we add only the numerators and write the same denominator. Eg. $\frac{3}{4}+\frac{5}{4} = \frac{3+5}{4} = \frac{8}{4}$
- To add rational numbers with different denominators after converting them to equivalent rational numbers with common denominators and then add the numerators.

(b) Subtraction:

- To subtract the rational numbers with the same denominators, subtract only the numerators of the two rational numbers and write the same denominator.
- To subtract rational numbers with different denominators convert them to equivalent rational numbers with common denominators and then subtract the numerators.
- Subtracting two rational numbers is the same as adding the additive inverse of the rational number that is to be subtracted from the other rational number.

(c) Multiplication:

- Product of two or more rational numbers can be found by multiplying the corresponding numerators and denominators of the numbers and then write them in the standard form.
- If the product of two rational numbers is 1, then one rational is said to be the reciprocal of the other.
- For the rational number a, its reciprocal is $\frac{1}{a}$

(d) Division:

- To divide a rational number by another rational number, we have to multiply the rational number in the numerator by the reciprocal of rational number given in the denominator.
- For any non-zero b, c and d we have (i) $\frac{a}{b} \div c$ (ii) $a \div \left(\frac{b}{c}\right) = \frac{ac}{b}$ (iii) $\frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc}$.

RECAP

Page No. 3 & 4

1. Write the following fractions in the appropriate boxes.

$\frac{-4}{5}, \frac{6}{7}, \frac{8}{3}, 4\frac{2}{3}, \frac{10}{7}, \frac{9}{12}, \frac{-12}{17}, 1\frac{4}{5}$

Sol.

Proper fraction	Improper fraction	Mixed fraction	Negative Fraction
$\frac{9}{12}, \frac{6}{7}$	$\frac{8}{3}, \frac{10}{7}$	$4\frac{2}{3}, 1\frac{4}{5}$	$\frac{-4}{5}, \frac{-12}{17}$

2. Which of the following is not an equivalent fraction of $\frac{8}{12}$?

(A) $\frac{2}{3}$ (B) $\frac{16}{24}$ (C) $\frac{32}{60}$ (D) $\frac{24}{36}$

[*Ans:* (C) $\frac{32}{60}$]

Sol.

$$\frac{8}{12} = \frac{8\div4}{12\div4} = \frac{2}{3}$$
$$\frac{8}{12} = \frac{8\times2}{12\times2} = \frac{16}{24}$$
$$\frac{8}{12} = \frac{8\times3}{12\times3} = \frac{24}{36}$$

But $\frac{32}{60} = \frac{32\div5}{60\div5} = \frac{6.4}{12}$

$\therefore$ $\frac{32}{60}$ is not an equivalent fraction of $\frac{8}{12}$

3. The simplest form of $\frac{125}{200}$ is _____.

[*Ans:* $\frac{5}{8}$]

Sol.

$$\frac{125}{200} = \frac{125\div25}{200\div25} = \frac{5}{8}$$

4. Which is bigger $\frac{4}{5}$ or $\frac{8}{9}$?

Sol. LCM of 5 and 9 = 45

$$\frac{4}{5} = \frac{4\times9}{5\times9} = \frac{36}{45}$$
$$\frac{8}{9} = \frac{8\times5}{9\times5} = \frac{40}{45}$$

$$\therefore \quad \frac{40}{45} > \frac{36}{45}$$

$$\frac{8}{9} > \frac{4}{5}$$

$\frac{8}{9}$ is bigger than $\frac{4}{5}$.

5. **Add the fractions : $\frac{3}{5}+\frac{5}{8}+\frac{7}{10}$.**

Sol.

$$\text{LCM of } 5, 8, 10 = 5 \times 2 \times 4$$
$$= 40$$
$$\frac{3}{5}+\frac{5}{8}+\frac{7}{10} = \frac{(3\times 8)+(5\times 5)+(7\times 4)}{40}$$
$$= \frac{24+25+28}{40}$$
$$= \frac{77}{40} = 1\frac{37}{40}$$

Hint:

5	5, 8, 10
2	1, 8, 2
4	1, 4, 1
	1, 4, 1

6. **Simplify : $\frac{1}{8}-\left(\frac{1}{6}-\frac{1}{4}\right)$.**

Sol.

$$\frac{1}{8}-\left(\frac{1}{6}-\frac{1}{4}\right) = \frac{1}{8}-\left[\frac{(1\times 2)-(1\times 3)}{12}\right]$$
$$= \frac{1}{8}-\left(\frac{2-3}{12}\right)$$
$$= \frac{1}{8}-\left(-\frac{1}{12}\right)$$
$$= \frac{1}{8}+\frac{1}{12} = \frac{(1\times 3)+(1\times 2)}{24}$$
$$= \frac{3+2}{24} = \frac{5}{24}$$

7. **Multiply $2\frac{3}{5}$ and $1\frac{4}{7}$.**

Sol.

$$2\frac{3}{5}\times 1\frac{4}{7} = \frac{13}{5}\times\frac{11}{7}$$
$$= \frac{143}{35} = 4\frac{3}{35}$$

8. **Divide $\frac{7}{36}$ by $\frac{35}{81}$.**

Sol.

$$\frac{7}{36}\div\frac{35}{81} = \frac{7}{36}\times\frac{81}{35}$$
$$= \frac{9}{20}$$

9. **Fill in the boxes :** $\frac{\square}{66}=\frac{70}{\square}=\frac{28}{44}=\frac{\square}{121}=\frac{7}{\square}$.

Sol.

$$\frac{28}{44} = \frac{28\div 4}{44\div 4} = \frac{7}{11}$$

$$\frac{7}{11} = \frac{28}{44} = \frac{42}{66} = \frac{70}{110} = \frac{77}{121}$$

$$\frac{\boxed{42}}{66} = \frac{70}{\boxed{110}} = \frac{28}{44} = \frac{\boxed{77}}{121} = \frac{7}{\boxed{11}}.$$

10. **In a city, $\frac{7}{20}$ of the population is women and $\frac{1}{4}$ is children. Find the fraction of the population of men.**

Sol. Let the total population = 1

$$\text{Population of men} = \text{Total population} - \text{Women} - \text{Children}$$

$$= 1 - \frac{7}{20} - \frac{1}{4}$$

$$= \frac{20}{20} - \frac{7}{20} - \frac{5}{20}$$

$$= \frac{20-7-5}{20} = \frac{8}{20}$$

$$= \frac{2}{5}$$

$$\therefore \quad \text{Population of men} = \frac{2}{5}$$

TRY THIS

Page No. 6

(i) Is the number $\frac{7}{-5}$ a fraction or a rational number ? Why?

Sol. $\frac{7}{-5}$ is a rational number

Because of rational number is a number which is of the form $\frac{p}{q}$, $q \neq 0$ and p and q are integers.

But fraction is part of a whole.

(ii) Write any 6 rational numbers of your choice.

Sol. $0, -\frac{1}{2}, \frac{1}{2}, \frac{3}{4}, \frac{6}{7}, -5, 6$

TRY THIS

Explain why the following statements are true?

(i) $0.8 = \frac{4}{5}$ **(ii)** $1.4 > \frac{1}{4}$ **(iii)** $0.74 < \frac{3}{4}$

(iv) $0.4 > 0.386$ **(v)** $0.096 < 0.24$ **(vi)** $1.128 = 0.1280$

Sol. **(i)**

$$0.8 = \frac{8}{10} = \frac{4}{5}$$

$$\therefore 0.8 = \frac{4}{5}$$

(ii)

$$1.4 = \frac{14}{10} = \frac{28}{20}$$

$$\frac{1}{4} = \frac{1\times5}{4\times5} = \frac{5}{20}$$

$$\frac{28}{20} > \frac{5}{20}$$

$$1.4 > \frac{1}{4}$$

(iii)

$$0.74 = \frac{74}{100}$$

$$\frac{3}{4} = \frac{3\times25}{4\times25} = \frac{75}{100}$$

$$\frac{75}{100} > \frac{74}{100}$$

$$\frac{3}{4} > 0.74 \text{ (or) } 0.74 < \frac{3}{4}$$

(iv)

$$0.4 = \frac{4}{10} = \frac{400}{1000}$$

$$0.386 = \frac{386}{1000}$$

$$\frac{400}{1000} > \frac{386}{1000}$$

$$0.4 > 0.386$$

(v)

$$0.096 = \frac{96}{1000}$$

$$0.24 = \frac{240}{1000}$$

$$\frac{240}{1000} > \frac{96}{1000}$$

$$0.24 > 0.096 \text{ (or) } .096 < 0.24$$

(vi) $0.128 = \frac{128}{1000} = \frac{1280}{10000}$

$0.1280 = \frac{1280}{10000}$

$\therefore$ Both are equal.

i.e. $0.128 = 0.1280$.

TRY THIS

Page No. 9

1. Which of the pairs are equivalent rational numbers?

(i) $\frac{-6}{4}, \frac{33}{-22}$ **(ii)** $\frac{-4}{-20}, -\frac{1}{5}$ **(iii)** $\frac{-48}{-68}, \frac{+60}{+85}$

Sol. **(i)** $\frac{-6}{4} = \frac{-6 \div 2}{4 \div 2} = \frac{-3 \times 11}{2 \times 11} = \frac{-33}{22} = \frac{33}{-22}$

$\therefore \frac{-6}{4}$ equivalent to $\frac{33}{-22}$

(ii) $\frac{-4}{-20} = \frac{-4 \div (-4)}{-20 \div (-4)} = \frac{1}{5} \neq -\frac{1}{5}$

$\therefore \frac{-4}{-20}$ not equivalent to $\frac{1}{-5}$

(iii) $\frac{-48}{-68} = \frac{-48 \div (-4)}{-68 \div (-4)} = \frac{12 \times 5}{17 \times 5} = \frac{60}{85}$

$\therefore \frac{-48}{-68}$ and $\frac{60}{85}$ are equivalent.

2. Find the standard form of

(i) $\frac{36}{-96}$ **(ii)** $\frac{-56}{-72}$ **(iii)** $\frac{27}{18}$

Sol. **(i)** $\frac{36}{-96} = \frac{-36 \div 12}{96 \div 12} = \frac{-3}{8}$

(ii) $\frac{-56}{-72} = \frac{-56 \div (-8)}{-72 \div (-8)} = \frac{7}{9}$

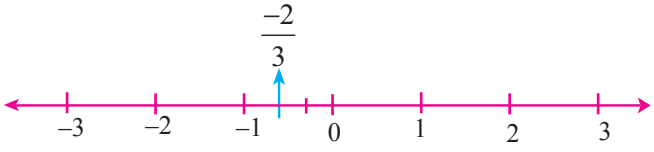
(iii) $\frac{27}{18} = 1\frac{9}{18} = 1\frac{1}{2}$

3. Mark the following rational numbers on a number line.

(i) $\frac{-2}{3}$ **(ii)** $\frac{-8}{-5}$ **(iii)** $\frac{5}{-4}$

Sol. (i) $\frac{-2}{3}$ lies between 0 and –1.

The unit part between 0 and –1 is divided into 3 equal parts and second part is taken.



(ii) $\frac{-8}{-5} = 1\frac{3}{5}$

$1\frac{3}{5}$ lies between 1 and 2. The unit part between 1 and 2 is divided into 5 equal parts and the third part is taken.

(iii) $\frac{5}{-4} = -\frac{5}{4} = -1\frac{1}{4}$

$-1\frac{1}{4}$ lies between –1 and –2. The unit part between –1 and –2 is divided into four equal parts and the first part is taken.

THINK

Page No. 15

Are there any rational numbers between $\frac{-7}{11}$ and $\frac{6}{-11}$?

Sol. $\frac{-7}{11} = \frac{-70}{110}$; $\frac{6}{-11} = \frac{-60}{110}$

We have $\frac{-61}{110}, \frac{-62}{110}, \ldots\ldots, \frac{-69}{110}$ between $\frac{-7}{11}$ and $\frac{6}{-11}$.

TRY THIS

Page No. 19

Divide : (i) 5 by $\frac{-7}{3}$ (ii) $\frac{-7}{3}$ by 5

Sol. (i) $5 \div \left(\frac{-7}{3}\right) = \frac{5}{1} \times \frac{3}{-7} = \frac{15}{-7} = -2\frac{1}{7}$

(ii) $\frac{-7}{3} \div 5 = \frac{-7}{3} \div \frac{5}{1} = \frac{-7}{3} \times \frac{1}{5} = \frac{-7}{15}$

Exercise 1.1

1. Fill in the blanks:

(i) $\frac{-19}{5}$ lies between the integers _____ and _____. [*Ans:* **–4 and –3**]

(ii) The rational number that is represented by 0.44 is _____. [*Ans:* $\frac{11}{25}$]

(iii) The standard form of $\frac{+58}{-78}$ is _____. [*Ans:* $\frac{-29}{39}$]

(iv) The value of $\frac{-5}{12}+\frac{7}{15}$ = _____. [*Ans:* $\frac{1}{20}$]

(v) The value of $\left(\frac{-15}{23}\right)\div\left(\frac{+30}{-46}\right)$ is _____. [*Ans:* **1**]

2. Say True or False.

(i) 0 is the smallest rational number. [*Ans:* **False**]

(ii) There are an unlimited rationals between 0 and 1. [*Ans:* **True**]

(iii) The rational number that does not have a reciprocal is 0. [*Ans:* **True**]

(iv) The only rational number which is its own reciprocal is –1. [*Ans:* **False**]

(v) The rational numbers that are equal to their additive inverses are 0 and –1. [*Ans:* **False**]

3. List five rational numbers between

(i) –2 and 0 **(ii) $\frac{-1}{2}$ and $\frac{3}{5}$** **(iii) 0.25 and 0.35** **(iv) –1.2 and –2.3**

Sol. (i) –2 and 0

i.e. $\frac{-2}{1}$ and $\frac{0}{1}$

$$\frac{-2}{1} = \frac{-2\times10}{1\times10} = \frac{-20}{10}$$

$$\frac{0}{1} = \frac{0\times10}{1\times10} = \frac{0}{10}$$

∴ Five rational numbers between $\frac{-20}{10}$ (= –2) and $\frac{0}{10}$ (= 0) are $\frac{-20}{10}, \frac{-19}{10}, \frac{-18}{10}, \frac{-7}{10}, \frac{-6}{10}, \frac{-5}{10}, \frac{0}{10}$ (= 0).

(ii) $\frac{-1}{2}$ and $\frac{3}{5}$

LCM of 2 and 5 = 2 × 5 = 10

$$-\frac{1}{2} = \frac{-1\times5}{2\times5} = \frac{-5}{10}$$
$$\frac{3}{5} = \frac{3\times2}{5\times2} = \frac{6}{10}$$

$\therefore$ Five rational numbers between $\frac{-1}{2}\left(=\frac{-5}{10}\right)$ and $\frac{3}{5}\left(=\frac{6}{10}\right)$ are $\frac{-3}{10}, \frac{-1}{10}, 0, \frac{1}{10}, \frac{2}{10}, \frac{5}{10}$

(iii) 0.25 and 0.35

$$0.25 = \frac{0.25\times100}{1\times100} = \frac{25}{100}$$
$$0.35 = \frac{0.35\times100}{1\times100} = \frac{35}{100}$$

$\therefore$ Five rational numbers between 0.25 $\left(=\frac{25}{100}\right)$ and 0.35 $\left(=\frac{35}{100}\right)$ are $\frac{26}{100}, \frac{27}{100}, \frac{30}{100}, \frac{32}{100}, \frac{33}{100}$

(iv) –1.2 and –2.3

$$-1.2 = \frac{-1.2\times10}{1\times10} = \frac{-12}{10}$$
$$-2.3 = \frac{-2.3\times10}{1\times10} = \frac{-23}{10}$$

$\therefore$ Five rational numbers between –1.2 $\left(=\frac{-12}{10}\right)$ and –2.3 $\left(=\frac{-23}{10}\right)$ are $\frac{-21}{10}, \frac{-20}{10}, \frac{-15}{10}, \frac{-14}{10}, \frac{-13}{10}$

4. Write four rational numbers equivalent to

(i) $\frac{-3}{5}$ **(ii)** $\frac{7}{-6}$ **(iii)** $\frac{8}{9}$

Sol. (i)

$$\frac{-3}{5} = \frac{-3\times2}{5\times2} = \frac{-6}{10}$$
$$\frac{-3}{5} = \frac{-3\times3}{5\times3} = \frac{-9}{15}$$
$$\frac{-3}{5} = \frac{-3\times4}{5\times4} = \frac{-12}{20}$$
$$\frac{-3}{5} = \frac{-3\times5}{5\times5} = \frac{-15}{25}$$

Four equivalent rational numbers of $-\frac{3}{5}$ are $\frac{-6}{10}, \frac{-9}{15}, \frac{-12}{20}, \frac{-15}{25}$

(ii)

$$\frac{7}{-6} = \frac{7\times2}{-6\times2} = \frac{14}{-12}$$
$$\frac{7}{-6} = \frac{7\times3}{-6\times3} = \frac{21}{-18}$$

32. Simplify $\frac{2}{5}+\frac{8}{3}+\frac{-11}{15}+\frac{4}{5}+\frac{-2}{3}$

33. What number should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?

34. Simplify $\left(\frac{13}{7}\times\frac{11}{26}\right)-\left(\frac{-4}{3}\times\frac{5}{6}\right)$.

35. Verify $x \times (y \times z) = (x \times y) \times z$ for $x = \frac{5}{7}, y = \frac{-12}{13}$ and $z = \frac{-7}{18}$

VI. Answer any four of the following questions. 4 × 5 = 20

36. Find three rational numbers between –2 and 5 by average method.

37. Find four rational numbers between $\frac{2}{3}$ and $\frac{4}{5}$.

38. Divide the sum of $\frac{15}{12}$ and $\frac{12}{7}$ by their difference.

39. Divide the sum of $\frac{-13}{5}$ and $\frac{12}{7}$ by the product of $\frac{-31}{7}$ and $\frac{-1}{2}$.

40. The cost of $2\frac{1}{3}$ metres of cloth is $275\frac{1}{4}$. Find the cost of cloth per meter.

ANSWERS

I. **1.** +2 **2.** $\frac{-4}{1}$ **3.** Multiplication by 0 **4.** 0 **5.** $b + a$

II. **6.** (c) $\frac{2}{1}$ **7.** (c) $\frac{5}{18}$ **8.** (c) $\frac{4}{6}$ **9.** (b) associative property **10.** (a) 1

III. **11.** False **12.** True **13.** False **14.** True **15.** False

IV. **16.** $\frac{-12}{11}$ **17.** $\frac{-67}{8}$ **18.** $\frac{-17}{18}$ **19.** Hence it is verified **20.** $\frac{3}{2}$ **21.** $\frac{1}{13}$

22. $\frac{324}{77}$ **23.** $\frac{33}{13}$ **24.** $\frac{12}{35}$ **25.** Hence it is verified **26.** $\frac{46}{3}$ **27.** $\frac{4}{3}$

28. $\frac{-7}{5}$

V. **29.** $1\frac{9}{10}$ **30.** $\frac{1}{5}$ **31.** Hence it is verified **32.** $\frac{37}{15}$ **33.** $\frac{-5}{2}$ **34.** $\frac{239}{126}$

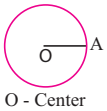
VI. **35.** Hence it is verified **36.** $-\frac{1}{4}, \frac{3}{2}, \frac{13}{4}$ **37.** $\frac{41}{60}, \frac{42}{60}, \frac{43}{60}, \frac{44}{60}$ **38.** $\frac{599}{311}$

39. $\frac{-2}{5}$ **40.** ₹ 32.25

MEASUREMENTS 2

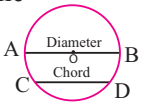
POINTS TO REMEMBER

- Value of the constant π is a non terminating and non-recurring decimal number.
- We use the approximate value of π as $\frac{22}{7}$ or 3.14.
- Exact value of $\pi = \frac{\text{Circumference of a circle}}{\text{Its diameter}}$
- Circumference of a circle = $2\pi r$ units (or) circumference = πd units.
- For quick calculations we can say that circumference of a circle is approximately slightly more than three times its diameter.
- **(A) Parts of a circle:**
  - A circle is the path traced by a moving point keeping its distance from a fixed point to be always a constant.
  - The fixed point of the circle is called its 'centre'.
  - The constant distance is called its 'radius'.



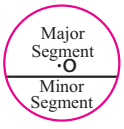
O - Center
OA - Radius

  - If any two points on a circle are joined by a line segment, the line segment is called 'chord'.
  - The chord which passes through the center of a circle is called as 'diameter'.

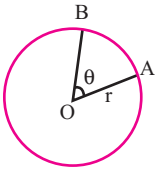


  - The diameter is the longest chord of a circle.
  - A diameter divides the circle into two equal parts.
  - A part of the circumference of a circle is called the circular arc.
  - The plane surface that is enclosed between two radii and the circular arc of a circle is called the 'sector'.

  - Each part of a circle which is divided by a chord is called segment.
  - The part which has a smaller arc is called as the minor 'segment'.
  - The part which has a larger arc is called as the major segment.



(B) Central Angle:



- The angle formed by a sector of a circle at its centre is called the central angle.
- The central angle of a circle = 360°.
- If a circle is divided into 'n' equal sectors, the central angle of each of the sector is $\theta^\circ = \frac{360^\circ}{n}$.
- Area of circle = πr^2 sq. units.
- Circumference of a circle = $2\pi r$ units.
- The length of a semicircular arc is half of the circumference of the circle.
- Length of the semicircular arc = πr units.
- The area of the semicircle = $\frac{1}{2}\pi r^2$ sq.units.
- If θ is the central angle and 'r' is the radius then the ratio of the central angle θ° to 360° is $\frac{\theta^\circ}{360^\circ}$.
- Length of the arc $l = \frac{\theta^\circ}{360^\circ} \times 2\pi r$ units.
- Area of the sector A = $\frac{\theta^\circ}{360^\circ} \times \pi r^2$ sq. units.
- If a circle is divided into 'n' equal sectors then length of the arc of each sector = $\frac{1}{n} \times 2\pi r$ units.
- Area of each of the sectors = $\frac{1}{n} \times \pi r^2$ sq.units.
- If length of the arc is given then area of the sector = $\frac{lr}{2}$

(C) Perimeter of a Sector:

- Perimeter of a sector P = $l + 2r$ units.
- Perimeter of a semicircle P = $(\pi + 2)\, r$ units.
- Perimeter of a circular quadrant = $\left(\frac{\pi}{2} + 2\right) r$ units.

THINK

Page No. 35

$\frac{22}{7}$ and 3.14 are rational numbers. Is 'π' a rational number? Why?

Sol. $\frac{22}{7}$ and 3.14 are rational numbers π has non-terminating and non-repeating decimal expansion. So it is not a rational number. It is an irrational number.

THINK

Page No. 38

The given circular figure is divided into six equal parts. Can we call the parts as sectors? Why?

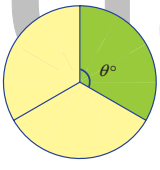
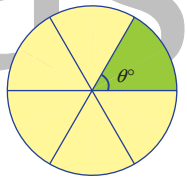
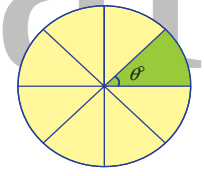
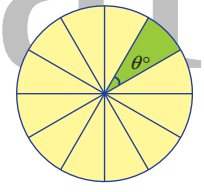
Sol. No, the equal parts are not sectors. Because a sector is a plane surface that is enclosed between two radii and the circular arc of the circle.

Here the boundaries are not radii.

TRY THESE

Page No. 38

Fill the central angle of the shaded sector (each circle is divided into equal sectors)

Sector				
Central angle $\theta^\circ = \frac{360^\circ}{n}$	$\theta^\circ = 120^\circ$	$\theta^\circ = 60^\circ$	$\theta^\circ = 45^\circ$	$\theta^\circ = 30^\circ$

THINK

Page No. 44

If the radius of a circle is doubled, what will the area of the new circle so formed?

Sol. If $r = 2r_1 \Rightarrow$ Area of the circle $= \pi r^2 = \pi(2r_1)^2 = \pi 4r_1^2 = 4\pi r_1^2$

Area = 4 × old area.

Exercise 2.1

1. Fill in the blanks:

(i) The ratio between the circumference and diameter of any circle is _____. **[Ans: π]**

(ii) A line segment which joins any two points on a circle is a _____. **[Ans: chord]**

(iii) The longest chord of a circle is _____. **[Ans: diameter]**

(iv) The radius of a circle of diameter 24 cm is _____. **[Ans: 12 cm]**

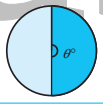
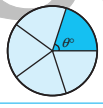
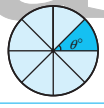
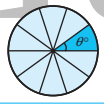
(v) A part of circumference of a circle is called as _____. **[Ans: an arc]**

2. Match the following:

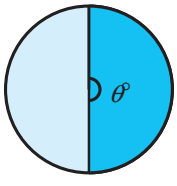
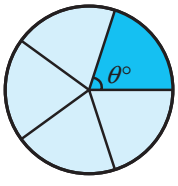
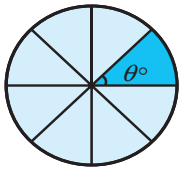
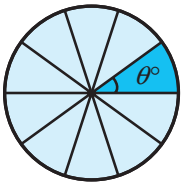
(i)	Area of a circle	1.	$\frac{1}{4}\pi r^2$
(ii)	Circumference of a circle	2.	$(\pi + 2)r$
(iii)	Area of the sector of a circle	3.	πr^2
(iv)	Circumference of a semicircle	4.	$2\pi r$
(v)	Area of a quadrant of a circle	5.	$\frac{\theta^\circ}{360^\circ} \times \pi r^2$

[Ans: (i)-3, (ii)-4, (iii)-5, (iv)-2, (v)-1]

3. Find the central angle of the shaded sectors (each circle is divided into equal sectors).

Sectors				
Central angle of each sector (θ°)				

Sol.

Sector				
Central angle of each sector (θ°)	Number of equal parts $n = 2$ $\theta^\circ = \frac{360^\circ}{n} = \frac{360^\circ}{2}$ $\theta^\circ = 180^\circ$	$n = 5$ $\theta^\circ = \frac{360^\circ}{n}$ $\theta^\circ = \frac{360^\circ}{5}$ $\theta^\circ = 72^\circ$	$n = 8$ $\theta^\circ = \frac{360^\circ}{n}$ $\theta^\circ = \frac{360^\circ}{8}$ $\theta^\circ = 45^\circ$	$n = 10$ $\theta^\circ = \frac{360^\circ}{n}$ $\theta^\circ = \frac{360^\circ}{10}$ $\theta^\circ = 36^\circ$

4. For the sectors with given measures, find the length of the arc, area and perimeter. ($\pi = 3.14$)

(i) central angle 45°, r = 16 cm **(ii) central angle 120°, d =12.6 cm**

(iii) central angle 60°, r =36 cm **(iv) central angle 72°, d =10 cm**

Sol. **(i)** Central angle 45°, r = 16 cm

$$\text{Length of the arc } l = \frac{\theta^\circ}{360^\circ} \times 2\pi r \text{ units}$$

$$l = \frac{45^\circ}{360^\circ} \times 2 \times 3.14 \times 16 \text{ cm}$$

$$l = \frac{1}{8} \times 2 \times 3.14 \times 16 \text{ cm}$$

$$l = 12.56 \text{ cm}$$

$$\text{Area of the sector} = \frac{\theta^\circ}{360^\circ} \times \pi r^2 \text{ sq. units}$$

$$A = \frac{45^\circ}{360^\circ} \times 3.14 \times 16 \times 16$$

$$A = 100.48 \text{ cm}^2$$

$$\text{Perimeter of the sector P} = l + 2r \text{ units}$$

$$P = 12.56 + 2(16) \text{ cm}$$

$$P = 44.56 \text{ cm}$$

(ii) Central angle 120°, d = 12.6 cm

$$\therefore r = \frac{12.6}{2} \text{ cm}$$

$$r = 6.3 \text{ cm}$$

$$\text{Length of the arc } l = \frac{\theta^\circ}{360^\circ} \times 2\pi r \text{ units}$$

$$l = \frac{120^\circ}{360^\circ} \times 2 \times 3.14 \times 6.3 \text{ cm}$$

$$l = 13.188 \text{ cm}$$

$$l = 13.19 \text{ cm}$$

$$\text{Area of the sector A} = \frac{\theta^\circ}{360^\circ} \times \pi r^2 \text{ sq. units}$$

$$A = \frac{120^\circ}{360^\circ} \times 3.14 \times 6.3 \times 6.3 \text{ cm}^2$$

$$A = 3.14 \times 6.3 \times 2.1 \text{ cm}^2$$

$$A = 41.54 \text{ cm}^2$$

$$\text{Perimeter of the sector P} = l + 2r \text{ cm}$$

$$P = 13.19 + 2\,(6.3) \text{ cm}$$

$$= 13.19 + 12.6 \text{ cm}$$

$$P = 25.79 \text{ cm}$$

(iii) Central angle $60°$, $r = 36$ cm

$$\text{Length of the arc } l = \frac{\theta°}{360°} \times 2\pi r \text{ units}$$

$$l = \frac{60°}{360°} \times 2 \times 3.14 \times 36 \text{ cm}$$

$$l = 37.68 \text{ cm}$$

$$\text{Area of the sector A} = \frac{\theta°}{360°} \times \pi r^2 \text{ sq. units}$$

$$A = \frac{60°}{360°} \times 3.14 \times 36 \times 36 \text{ cm}^2$$

$$A = 678.24 \text{ cm}^2$$

$$\text{Perimeter of the sector P} = l + 2r \text{ units.}$$

$$P = 37.68 + 2(36) \text{ cm}$$

$$P = 37.68 + 72 \text{ cm}$$

$$P = 109.68 \text{ cm}$$

(iv) Central angle $72°$, $d = 10$ cm

$$\text{Radius } r = \frac{10}{2} \text{ cm}$$

$$r = 5 \text{ cm}$$

$$\text{Length of the arc } l = \frac{\theta°}{360°} \times 2\pi r \text{ units}$$

$$l = \frac{72°}{360°} \times 2 \times 3.14 \times 5 \text{ cm}$$

$$l = 6.28 \text{ cm}$$

$$\text{Perimeter of the sector P} = l + 2r \text{ units}$$

$$P = 6.28 + 2(5) \text{ cm}$$

$$P = 6.28 + 10 \text{ cm}$$

$$P = 16.28 \text{ cm}$$

$$\text{Area of the sector A} = \frac{\theta}{360°} \times \pi r^2 \text{ sq.units}$$

$$= \frac{\cancel{72}}{\cancel{360}_{\cancel{5}}} \times 3.14 \times \cancel{5} \times 5 \text{ cm}^2 = 15.70 \text{ cm}^2$$

5. From the measures given below, find the area of the sectors.

S.No.	length of the arc (l)	radius (r)
(i)	48m	10 m
(ii)	12.5 cm	6 cm
(iii)	50 cm	13.5 cm

Sol. (i) $\text{Area of the sector A} = \frac{lr}{2}$ sq. units

$$l = 48 \text{ m}$$

$$r = 10 \text{ m}$$

$$= \frac{48\times10}{2}\ m^2$$

$$= 24 \times 10\ m^2$$

$$= 240\ m^2$$

Area of the sector = $240\ m^2$

(ii) Length of the arc l = 12.5 cm

Radius r = 6 cm

Area of the sector A = $\frac{lr}{2}$ sq. units

$$A = \frac{12.5\times6}{2}$$

$$A = 12.5 \times 3\ cm^2$$

$$A = 37.5\ cm^2$$

Area of the sector A = $37.5\ cm^2$

(iii) Length of the arc l = 50 cm

Radius r = 13.5 cm

Area of the sector A = $\frac{lr}{2}$ sq. units

$$= \frac{50\times13.5}{2}\ cm^2 = 25 \times 13.5\ cm^2$$

$$= 337.5\ cm^2$$

Area of the sector = $337.5\ cm^2$

6. Find the central angle of each of the sectors whose measures are given below. ($\pi = \frac{22}{7}$)

S.No.	area (A)	length of the arc (l)	radius (r)
(i)	462 cm^2	-	21 cm
(ii)	18.48 cm^2	-	8.4 cm
(iii)		44 m	35 m
(iv)	-	22 mm	105 mm

Sol. (i) Radius of the sector = 21 cm

Area of the sector = $462\ cm^2$

$$\frac{lr}{2} = 462$$

$$\frac{l\times21}{2} = 462$$

$$l = \frac{462\times2}{21}$$

$$l = 22 \times 2$$

Length of the arc l = 44 cm

$$\frac{\theta^\circ}{360^\circ} \times 2\pi r = 44 \text{ cm}$$

$$\frac{\theta^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 21 = 44 \text{ cm}$$

$$\theta^\circ = \frac{44 \times 360 \times 7}{2 \times 22 \times 21}$$

$$\theta^\circ = 120^\circ$$

∴ Central angle of the sector = 120°.

Hint:

$$\frac{{}^{1}\cancel{2}\ \cancel{44} \times \cancel{360}^{120} \times \cancel{7}^{1}}{\cancel{2}_{1} \times \cancel{22}_{1} \times \cancel{21}_{3_1}}$$

(ii) Radius of the sector = 8.4 cm

Area of the sector = 18.48 cm^2

$$\frac{lr}{2} = 18.48$$

$$\frac{l \times 8.4}{2} = 18.48$$

$$l = \frac{18.48 \times 2}{8.4}$$

Hint:

$$\frac{{}^{4.4}\cancel{9.24}\ \cancel{18.48} \times \cancel{2}}{\cancel{8.4}\ \cancel{4.2}\ \cancel{2.1}_{1}}$$

Length of the arc l = 4.4 cm

$$\frac{\theta^\circ}{360^\circ} \times 2\pi r = 4.4 \text{ cm}$$

$$\frac{\theta^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 8.4 = 4.4 \text{ cm}$$

$$\theta^\circ = \frac{4.4 \times 360 \times 7}{2 \times 22 \times 8.4}$$

$$= 30^\circ$$

Hint:

$$\frac{{}^{1}\cancel{0.1}\ \cancel{0.2}\ \cancel{4.4} \times \cancel{360} \times \cancel{7}}{\cancel{2}_{1} \times \cancel{22}_{1} \times \cancel{8.4}\ \cancel{0.7}\ \cancel{0.1}_{1}}$$

Central angle = 30°

(iii) Radius of the sector = 35 m

Length of the arc l = 44 m

$$\frac{\theta^\circ}{360^\circ} \times 2\pi r = 44 \text{ m}$$

$$\frac{\theta^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 35 = 44 \text{ m}$$

$$\theta^\circ = \frac{44 \times 360 \times 7}{2 \times 22 \times 35}$$

$$\theta^\circ = 72^\circ$$

Central Angle of the sector = 72°

Hint:

$$\frac{{}^{1}\cancel{2}\ \cancel{44} \times \cancel{360}^{72} \times \cancel{7}^{1}}{\cancel{2}_{1} \times \cancel{22}_{1} \times \cancel{35}_{5_1}}$$

(iv) Radius of the sector = 105 mm

Length of the arc l = 22 mm

$$\frac{\theta^\circ}{360^\circ} \times 2\pi r = 22 \text{ mm}$$

$$\frac{\theta^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 105 = 22$$

$$\theta^\circ = \frac{22 \times 360 \times 7}{2 \times 22 \times 105}$$

$$\theta^\circ = 12^\circ$$

Central angle of the sector $\theta^\circ = 12^\circ$.

Hint:

$$\frac{{}^{1}\cancel{22} \times \cancel{360}^{\cancel{180}^{12}} \times \cancel{7}^{1}}{\cancel{2} \times \cancel{22} \times \cancel{105}_{\cancel{15}_{1}}}$$

7. Answer the following questions:

(i) A circle of radius 120 m is divided into 8 equal sectors. Find the length of the arc of each of the sectors.

(ii) A circle of radius 70 cm is divided into 5 equal sectors. Find the area of each of the sectors.

Sol. (i) Radius of the circle r = 120 m

Number of equal sectors = 8

$$\therefore \text{Central angle of each sector} = \frac{360^\circ}{n}$$

$$\theta^\circ = \frac{360^\circ}{8}$$

$$\theta^\circ = 45^\circ$$

$$\text{Length of the arc } l = \frac{\theta^\circ}{360^\circ} \times 2\pi r \text{ units}$$

$$= \frac{45^\circ}{360^\circ} \times 2\pi \times 120 \text{ m}$$

Length of the arc = $30 \times \pi$ m

Another method:

$$l = \frac{1}{n} \times 2\pi r = \frac{1}{8} \times 2 \times \pi \times 120$$

$$= 30\,\pi \text{ m}$$

Length of the arc = $30\,\pi$ m

(ii) Radius of the sector r = 70 cm

Number of equal sectors = 5

$$\therefore \text{Central angle of each sector} = \frac{360^\circ}{n}$$

$$\theta^\circ = \frac{360^\circ}{5}$$

$$\theta^\circ = 72^\circ$$

$$\text{Area of the sector} = \frac{\theta^\circ}{360^\circ} \times \pi r^2 \text{ sq. units}$$
$$= \frac{72^\circ}{360^\circ} \times \pi \times 70 \times 70 \text{ cm}^2$$
$$= 14 \times 70 \times \pi \text{ cm}^2$$
$$= 980\,\pi \text{ cm}^2$$

Hint:
$$\frac{\cancel{72}^{1} \times \pi \times 70 \times \cancel{70}^{14}}{\cancel{360}_{5}}$$

Note : We can solve this problem using $A = \frac{1}{n}\pi r^2$ sq. units also.

8. Find the area of a sector whose length of the arc is 50 mm and radius is 14 mm.

Sol. Length of the arc of the sector l = 50 mm

Radius r = 14 mm

$$\text{Area of the sector} = \frac{lr}{2} \text{ sq. units}$$
$$= \frac{50 \times 14}{2} \text{ mm}^2 = 50 \times 7 \text{ mm}^2 = 350 \text{ mm}^2$$
$$\text{Area of the sector} = 350 \text{ mm}^2$$

9. Find the area of a sector whose perimeter is 64 cm and length of the arc is 44 cm.

Sol. Length of the arc of the sector l = 44 cm

Perimeter of the sector P = 64 cm

$$l + 2r = 64 \text{ cm}$$
$$44 + 2r = 64$$
$$2r = 64 - 44$$
$$2r = 20$$
$$r = \frac{20}{2} = 10 \text{ cm}$$
$$\text{Area of the sector} = \frac{lr}{2} \text{ sq. units}$$
$$= \frac{44 \times 10}{2} \text{ cm}^2 = 22 \times 10 \text{ cm}^2 = 220 \text{ cm}^2$$
$$\text{Area of the sector} = 220 \text{ cm}^2$$

10. A sector of radius 4.2 cm has an area 9.24 cm^2. Find its perimeter.

Sol. Radius of the sector r = 4.2 cm

Area of the sector = 9.24 cm^2

$$\frac{lr}{2} = 9.24$$
$$\frac{l \times 4.2}{2} = 9.24$$
$$l \times 2.1 = 9.24$$

$$l = \frac{9.24}{2.1}$$
$$l = 4.4 \text{ cm}$$
Perimeter of the sector = $l + 2r$ units = $4.4 + 2(4.2)$ cm
$= 4.4 + 8.4$ cm $= 12.\ 8$ cm
Perimeter of the sector = 12.8 cm

11. Infront of a house, flower plants are grown in a circular quadrant shaped pot whose radius is 2 feet. Find the area of the pot in which the plants grow. ($\pi = 3.14$)

Sol.
Central angle of the quadrant = 90°
Radius of the circle = 2 feet
Area of the quadrant $= \frac{\theta^\circ}{360^\circ} \times \pi r^2$ sq. units $= \frac{90^\circ}{360^\circ} \times \pi \times 2 \times 2$ sq. feet
$= \frac{1}{4} \times 3.14 \times 4 = 3.14$ sq. feet
Area of the quadrant = 3.14 sq. feet (approximately)

12. Dhamu fixes a square tile of 30 cm on the floor. The tile has a sector design on it as shown in the figure. Find the area of the sector. ($\pi = 3.14$).

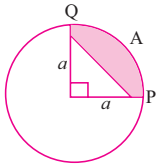
Sol.
Side of the square = 30 cm
$\therefore$ Radius of the sector design = 30 cm
Given the design of a circular quadrant.
Area of the quadrant $= \frac{1}{4} \pi r^2$ sq. units
$= \frac{1}{4} \times 3.14 \times 30 \times 30 \text{ cm}^2$
$= 3.14 \times 15 \times 15 \text{ cm}^2$
$\therefore$ Area of the sector design = 706.5 cm^2 (approximately)

13. A circle is formed with 8 equal granite stones as shown in the figure each of radius 56 cm and whose central angle is 45º. Find the area of each of the granite. $\left(\pi = \frac{22}{7}\right)$

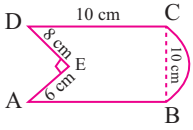
Sol.
Number of equal sectors 'n' = 8
Radius of the sector 'r' = 56 cm
Area of each sector $= \frac{1}{n} \pi r^2$ sq. units
$= \frac{1}{8} \times \frac{22}{7} \times 56 \times 56 \text{ cm}^2 = 1232 \text{ cm}^2$
Area of each sector = 1232 cm^2 (approximately)

IV. Answer any three of the following questions. 3 × 5 = 15

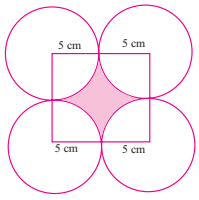
30. Find the area of the shaded portion.



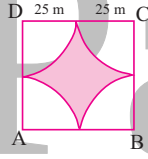
31. Find the area enclosed.



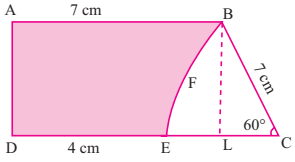
32. Find the area of the shaded part.



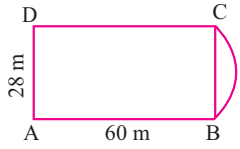
33. Find the area of the shaded part.



34. **Find the area of the shaded region.**



35. **Find the area of the figure.**



ANSWERS

I. **1.** (c) cuboid **2.** (c) 8 **3.** (d) $\frac{\text{Circumference}}{\text{Diameter}}$ **4.** (b) irrational **5.** (b) chord
6. (a) circular arc **7.** (c) $l + 2r$ **8.** (d) polygon **9.** (d) area
10. (a) edges

II. **11.** 44 **12.** 7744 cm^2 **13.** 77 cm^2 **14.** 21 m **15.** 7000
16. 220 m **17.** $\frac{50\sqrt{2}}{\pi}$ **18.** 462 cm^2 **19.** 72.7cm **20.** r^2
21. 210 cm^2 **22.** 140 cm^2

III. **23.** quadrupled **24.** 19% **25.** $\pi : \sqrt{2}$ **26.** r^2 **27.** $\sqrt{3} : \pi$ **28.** $= r^2$
29. 14 cm

V. **30.** $\frac{a^2}{4}(\pi - 2)$ sq. units **31.** 115.3 cm^2 **32.** 21.5 cm^2
33. 535.71 m^2 **34.** 28.89 cm^2
35. 1988 m^2

ALGEBRA

3

POINTS TO REMEMBER

- Algebra is thew study of mathematical symbols and rules for calculating these symbols.
- In arithmetic only numbers and their arithmetical operations (such as +, –, ×, ÷). occur
- In algebra numbers are often represented by symbols called variables.
- An algebraic expression may contain fractions, negative powers on their variables.
  Eg : $zy^2 + \frac{5}{y}$
- An expression which contains only one term is called a **monomial.**
  Eg. $4x$, $3x^2 y$, $-2y^2$
- An expression which contains only two terms is called a **binomial.**
  Eg. $2x + 3$, $5y^2 + 9y$, $a^2 b^2 + 2b$
- An expression which contains only three terms is called a **trinomial.**
  Eg. $2a^2 b - 8ab + b^2$, $m^2 - n^2 + 3$
- A polynomial contains only whole numbers as the powers of their variables
  Eg. $3x^2 - 5$

(A) MULTIPLICATION OF AGEBRAIC EXPRESSIONS

- To multiply or to find out the product of algebraic expressions follow the steps.
  (i) Multiply the signs of the terms.
    - Product of two like signs are positive
    - Product of two unlike signs is negative

  (ii) Multiply the corresponding co-efficients of the terms.
  (iii) Multiply the variable factors using laws of exponents.
    - $x^m \times x^n = x^{m+n}$
- Product of two terms is represented by the symbol ×, ( ), or '.'.
- If 'a' is a constant, x and y are variables then $a(x + y) = ax + ay$ states the **distributive law.**

RECAP

Page No. 66 & 67

1. Write the numbers of terms in the following expressions.

(i) $x + y + z - xyz$ **[Ans: 4 terms]**

(ii) $m^2 n^2 c$ **[Ans: 1 term]**

(iii) $a^2 b^2 c - ab^2c^2 + a^2 bc^2 + 3abc$ **[Ans: 4 terms]**

(iv) $8x^2 - 4xy + 7xy^2$ **[Ans: 3 terms]**

2. Identify the numerical co-efficient of each term in the following expressions.

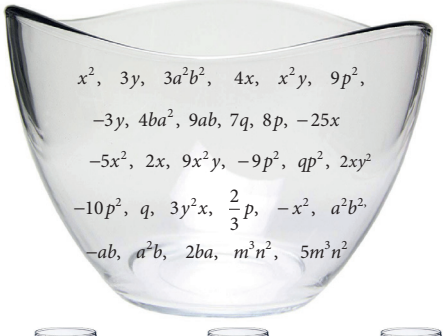
(i) $2x^2 - 5xy + 6y^2 + 7x - 10y + 9$

[Ans: Numerical co efficient in $2x^2$ is 2
Numerical co efficient in $-5xy$ is -5
Numerical co efficient in $6y^2$ is 6
Numerical co efficient in $7x$ is 7
Numerical co efficient in $-10y$ is -10
Numerical co-efficient in 9 is 9]

(ii) $\frac{x}{3} + \frac{2y}{5} - xy + 7$

[Ans: Numerical co efficient in $\frac{x}{3}$ is $\frac{1}{3}$
Numerical co efficient in $\frac{2y}{5}$ is $\frac{2}{5}$
Numerical co efficient in $-xy$ is -1
Numerical co efficient in 7 is 7]

3. Pick out the like terms from the following.



Like Terms

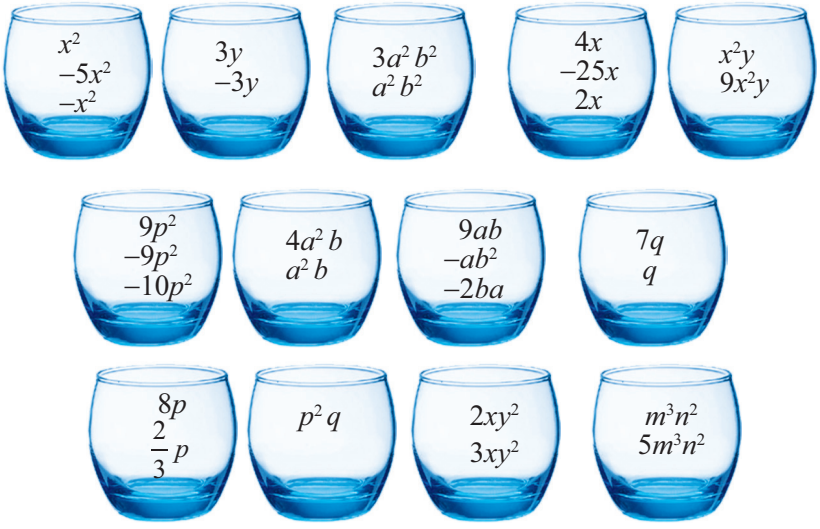
The variables of the terms along with their respective exponents must be same

Examples : $x^2, 4x^2$

$a^2b^2, -5a^2b^2$

$2m, -7m$

Sol.



4. Add : $2x, 6y, 9x - 2y$

Sol. $2x + 6y + 9x - 2y = 2x + 9x + 6y - 2y = (2 + 9)x + (6 - 2)y = 11x + 4y$

5. Simplify : $(5x^3y^3 - 3x^2y^2 + xy + 7) + (2xy + x^3y^3 - 5 + 2x^2y^2)$

Sol. $(5x^3y^3 - 3x^2y^2 + xy + 7) + (2xy + x^3y^3 - 5 + 2x^2y^2)$

$= 5x^3y^3 + x^3y^3 - 3x^2y^2 + 2x^2y^2 + xy + 2xy + 7 - 5$

$= (5 + 1)x^3y^3 + (-3 + 2)x^2y^2 + (1 + 2)xy + 2$

$= 6x^3y^3 - x^2y^2 + 3xy + 2$

6. The sides of a triangle are $2x - 5y + 9$, $3y + 6x - 7$ and $-4x + y + 10$. Find perimeter of the triangle.

Sol. Perimeter of the triangle = Sum of three sides

$= (2x - 5y + 9) + (3y + 6x - 7) + (-4x + y + 10)$

$= 2x - 5y + 9 + 3y + 6x - 7 - 4x + y + 10$

$= 2x + 6x - 4x - 5y + 3y + y + 9 - 7 + 10$

$= (2 + 6 - 4)x + (-5 + 3 + 1)y + (9 - 7 + 10)$

$= 4x - y + 12$

$\therefore$ Perimeter of the triangle $= 4x - y + 12$ units.

7. Subtract $-2mn$ from $6mn$.

Sol. $6mn - (-2mn) = 6mn + (+2mn)$

$= (6 + 2)mn = 8mn$

8. Subtract $6a^2 - 5ab + 3b^2$ from $4a^2 - 3ab + b^2$.

Sol. $(4a^2 - 3ab + b^2) - (6a^2 - 5ab + 3b^2)$

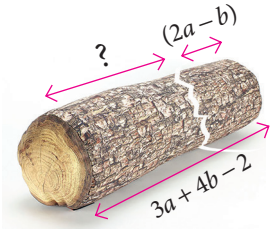
$= (4a^2 - 6a^2) + (-3ab - (-5ab)] + (b^2 - 3b^2)$

$= (4 - 6)a^2 + [-3ab + (+5ab)] + (1 - 3)b^2$

$= [4 + (-6)]a^2 + (-3 + 5)ab + [1 + (-3)]b^2$

$= -2a^2 + 2ab - 2b^2$

9. **The length of a log is $3a + 4b - 2$ and a piece $(2a - b)$ is remove from it. What is the length of the remaining log?**



Sol.

Length of the log = $3a + 4b - 2$

Length of the piece removed = $2a - b$

Remaining length of the log = $(3a + 4b - 2) - (2a - b)$

$= (3a - 2a) + [4b - (-b)] - 2$

$= (3 - 2)\,a + (4 + 1)\,b - 2$

$= a + 5b - 2$

10. **A tin had 'x' litre oil. Another tin had $(3x^2 + 6x - 5)$ litre of oil. The shopkeeper added $(x + 7)$ litre more to the second tin. Later he sold $(x^2 + 6)$ litres of oil from the second tin How much oil was left in the second tin?**

Sol.

Quantity of oil in the second tin = $3x^2 + 6x - 5$ litres.

Quantity of oil added = $x + 7$ litres

$\therefore$ Total quantity of oil in the second tin

$= (3x^2 + 6x - 5) + (x + 7)$ litres

$= 3x^2 + (6x + x) + (-5 + 7) = 3x^2 + (6 + 1)x + 2$

$= 3x^2 + 7x + 2$ litres

Quantity of oil sold = $x^2 + 6$ litres

$\therefore$ Quantity of oil left in the second tin

$= (3x^2 + 7x + 2) - (x^2 + 6) = (3x^2 - x^2) + 7x + (2 - 6)$

$= (3 - 1)\,x^2 + 7x + (-4) = 2x^2 + 7x - 4$

Quantity of oil left = $2x^2 + 7x - 4$ litres

THINK

Page No. 70

1. **Every algebraic expression is a polynomial. Is this statement true? Why?**

Sol. No, This statement is not true. Because Polynomials contain only whole numbers as the powers of their variables. But an algebraic expression may contains fractions and negative powers on their variables.

Eg. $2y^2 + 5y^{-1} - 3$ is a an algebraic expression. But not a polynomial.

THINK

Page No. 71

2. **$5y^2 + 2y - 6 = -(5y^2 + 2y - 6)$ Is this correct? If not , correct the mistake.**

Sol.

Taking $-(5y^2 + 2y - 6)$ = $5y^2 + [(-)(+)\,2y] + [(-) \times (-)6]$

$= -5y^2 - 2y + 6$

$\neq -5y^2 + 2y - 6$

$\therefore$ Correct answer is $-5y^2 + 2y - 6 = -(5y^2 + 2y + 6)$

TRY THESE

Page No. 71

Find the product of

(i) $3ab^2, -2a^2b^3$ **(ii)** $4xy,\ 5y^2x, (-x^2)$ **(iii)** $2m, -5n, -3p$

Sol.

(i) $(3ab^2) \times (-2a^2b^3) = (+) \times (-) \times (3 \times 2) \times (a \times a^2) \times (b^2 \times b^3) = -6a^3\,b^5$

(ii) $(4xy) \times (5y^2x) \times (-x^2) = (+) \times (+) \times (-) \times (4 \times 5 \times 1) \times (x \times x \times x^2) \times (y \times y^2)$

$= -20\,x^4\,y^3$

(iii) $(2m) \times (-5n) \times (-3p) = (+) \times (-) \times (-) \times (2 \times 5 \times 3) \times m \times n \times p$
$= +30mnp = 30\,mnp$

THINK

Page No. 71

Why $3 + (4x - 7y) \neq 12x - 21y$?

Sol. Addition and multiplication are different

$3 + (4x - 7y) = 3 + 4x - 7y$

We can add only like terms.

THINK

Page No. 72

Which is corrcet? $(3a)^2$ is equal to

(i) $3a^2$ **(ii)** 3^2a **(iii)** $6a^2$ **(iv)** $9a^2$

Sol. $(3a)^2 = 3^2\, a^2 = 9a^2$

(iv) $9a^2$ is the correct answer

TRY THESE

Page No. 72

1. Multiply

(i) $(5x^2 + 7x - 3)$ **by** $4x^2$ **(ii)** $(10x - 7y + 5z)$ **by** $6xyz$

(iii) $(ab + 3bc - 5ca)$ **by** $-3abc$

Sol. (i) $(5x^2 + 7x - 3) \times 4x^2 = 4x^2 \times (5x^2 + 7x - 3)$ Multiplication is commutative

$= 4x^2 (5x^2) + 4x^2 (7x) + 4x^2 (-3)$

$= (4 \times 5)(x^2 \times x^2) + (4 \times 7)(x^2 \times x) + (4 \times -3)(x^2)$

$= 20x^4 + 28x^3 - 12x^2$

(ii) $(10x - 7y + 5z)$ by $6xyz$

$(10x - 7y + 5z) \times 6xyz = 6xyz\,(10x - 7y + 5z)$ [$\because$ Multiplication is commutative]

$= 6xyz\,(10x) + 6xyz\,(-7y) + 6xyz\,(5z)$

$= (6 \times 10)(x \times x \times y \times z) + (6 \times -7) + (x \times y \times y \times z) + (6 \times 5)(x \times y \times z \times z)$

$= 60x^2\,yz + (-42xy^2z) + 30xyz^2$

$= 60x^2yz - 42xy^2z + 30xyz^2$

(iii) $(ab + 3bc - 5ca) \times (-3abc) = (-3abc)(ab + 3bc - 5ca)$

[$\because$ Multiplication is commutative]

$= (-3abc)(ab) + (-3abc)(3bc) + (-3abc)(5ca)$

$= (-3)(a \times a \times b \times b \times c) + (-3 \times 3) + (a \times b \times b \times c \times c) + (-3 \times 5)(a \times a \times b \times c \times c)$

$= -3a^2\,b^2\,c - 9\,ab^2c^2 - 30a^2\,bc^2$

TRY THESE

Page No. 74

Multiply

(i) $(a - 5)$ **and** $(a + 4)$ **(ii)** $(a + b)$ **and** $(a - b)$

(iii) $(m^4 + n^4)$ **and** $(m - n)$ **(iv)** $(2x + 3)(x - 4)$

(v) $(x - 5)(3x + 7)$ **(vi)** $(x - 2)(6x - 3)$

Sol. **(i)** $(a-5)\ (a+4) = a(a+4) - 5\ (a+4)$
$= (a \times a) + (a \times 4) + (-5 \times a) + (-5 \times 4)$
$= a^2 + 4a - 5a - 20 = a^2 - a - 20$

(ii) $(a+b)\ (a-b) = a(a-b) + b\ (a-b)$
$= (a \times a) + (a \times -b) + (b \times a) + b\ (-b)$
$= a^2 - ab + ab - b^2 = a^2 - b^2$

(iii) $(m^4 + n^4)\ (m-n) = m^4\ (m-n) + n^4\ (m-n)$
$= (m^4 \times m) + (m^4 \times (-n)) + (n^4 \times m) + (n^4 \times (-n))$
$= m^5 - m^4n + mn^4 - n^5$

(iv) $(2x+3)\ (x-4) = 2x\ (x-4) + 3\ (x-4)$
$= (2x^2 \times x) - (2x \times 4) + (3 \times x) - (3 \times 4)$
$= 2x^2 - 8x + 3x - 12 = 2x^2 - 5x - 12$

(v) $(x-5)\ (3x+7) = x\ (3x+7) - 5\ (3x+7)$
$= (x \times 3x) + (x \times 7) + (-5 \times 3x) + (-5 \times 7)$
$= 3x^2 + 7x - 15x - 35$
$= 3x^2 - 8x - 35$

(vi) $(x-2)\ (6x-3) = x\ (6x-3) - 2\ (6x-3)$
$= (x \times 6x) + (x \times (-3) - (2 \times 6x) - (2 \times 3)$
$= 6x^2 - 3x - 12x + 6$
$= 6x^2 - 15x + 6$

THINK Page No. 74

2. $3x^2\ (x^4 - 7x^3 + 2)$, what is the highest power in the expression.

Sol. $3x^2\ (x^4 - 7x^3 + 2) = (3x^2)\ (x^4) + 3x^2\ (-7x^3) + (3x^2)2$
$= 3x^6 - 21x^5 + 6x^2$

Highest power is 6 in x^6.

Exercise 3.1

1. Multiply a monomial by a monomial.

(i) $6x, 4$ **(ii)** $-3x, 7y$ **(iii)** $-2m^2, (-5m)^3$
(iv) $a^3, -4a^2b$ **(v)** $2p^2q^3, -9pq^2$

Sol. **(i)** $6x \times 4 = (6 \times 4)\ (x) = 24x$

(ii) $-3x \times 7y = (-3 \times 7)\ (x \times y) = -21xy$

(iii) $(-2m^2) \times (-5m)^3 = -2m^2 \times (-)^3\ (5^3\ (m)^3) = -2m^2 \times (-125m^3)$
$= (-) \times (-)\ (2 \times 125)\ (m^2 \times m^3) = +250m^5 = 250\ m^5$

(iv) $a^3 \times (-4a^2\ b) = (-4) \times (a^3 \times a^2) \times (b) = -4a^5b$

(v) $(2p^2\ q^3) \times (-9pq^2) = (+) \times (-) \times (2 \times 9)\ (p^2 \times p(q^3 \times q^2)) = -18p^3q^5$

2. **Complete the table.**

×	$2x^2$	$-2xy$	x^4y^3	$2xyz$	xz^2
x^4					
			$4x^5y^4$		
$-x^2y$					
$2y^2z$					$-10xy^2z^3$
$-3xyz$					
				$-14xyz^2$	

Sol.

×	$2x^2$	$-2xy$	x^4y^3	$2xyz$	$(-5)xz^2$
x^4	$2x^6$	$-2x^5y$	x^8y^3	$2x^5yz$	$-5x^5z^2$
$4xy$	$8x^3y$	$-8x^2y^2$	$4x^5y^4$	$8x^2y^2z$	$-20x^2yz^2$
$-x^2y$	$-2x^4y$	$2x^3y^2$	$-x^6y^4$	$-2x^3y^2z$	$5x^3yz^2$
$2y^2z$	$4x^2y^2z$	$-4xy^3z$	$2x^4y^5z$	$4xy^3z^2$	$-10xy^2z^3$
$-3xyz$	$-6x^3yz$	$6x^2y^2z$	$-3x^5y^4z$	$-6x^2y^2z^2$	$15x^2yz^3$
$-7z$	$-14x^2z$	$14xyz$	$-7x^4y^3z$	$-14xyz^2$	$35xz^3$

3. **Find the product of the terms.**

(i) $-2mn, (2m)^2, -3mn$ **(ii)** $3x^2y, -3xy^3, x^2y^2$

Sol. **(i)** $(-2mn) \times (2m)^2 \times (-3mn) = (-2mn) \times 2^2 m^2 \times (-3mn) = (-2mn) \times 4m^2 \times (-3mn)$

$= (-)(+)(-)(2 \times 4 \times 3)(m \times m^2 \times m)(n \times n)$

$= +24\, m^4 n^2$

(ii) $(3x^2y) \times (-3xy^3) \times (x^2y^2) = (+) \times (-) \times (+) \times (3 \times 3 \times 1)(x^2 \times x \times x^2) \times (y \times y^3 \times y^2)$

$= -9x^5y^6$

4. **If $l = 4pq^2$, $b = -3p\,2q$, $h = 2p^3q^3$ then, find the value of $l \times b \times h$.**

Sol. Given $l = 4pq^2$

$b = -3p^2q$

$h = 2p^3q^3$

$l \times b \times h = (4pq^2) \times (-3p^2q) \times (2p^3q^3)$

$= (+)(-)(+)(4 \times 3 \times 2)(p \times p^2 \times p^3)(q^2 \times q \times q^3)$

$= -24p^6q^6$

5. **Expand**

(i) $5x\,(2y - 3)$ **(ii)** $-2p\,(5p^2 - 3p + 7)$

(iii) $3mn(m^3n^3 - 5m^2n + 7mn^2)$ **(iv)** $x^2(x + y + z) + y^2(x + y + z) + z^2(x - y - z)$

Sol. **(i)** $5x\,(2y - 3) = (5x)(2y) - (5x)(3)$

$= (5 \times 2)(x \times y) - (5 \times 3)x$

$= 10xy - 15x$

(ii) $-2p\,(5p^2-3p+7) = (-2p)\,(5p^2) + (-2p)\,(-3p) + (-2p)\,(7)$

$= [(-)\,(+)\,(2\times 5)\,(p\times p^2)] + [(-)\,(-)\,(2\times 3)\,(p\times p)] + (-)\,(+)\,(2\times 7)\,p$

$= -10p^3 + 6p^2 - 14p$

(iii) $3mn(m^3n^3 - 5m^2n + 7mn^2)$

$= (3mn)\,(m^3n^3) + (3mn)\,(-5m^2n) + (3mn)(7mn^2)$

$= (3)\,(m\times m^3)\,(n\times n^3) + (+)\,(-)\,(3\times 5)\,(m\times m^2)\,(n\times n) + (3\times 7)\,(m\times m)(n\times n^2)$

$= 3m^4n^4 - 15m^3n^2 + 21m^2n^3$

(iv) $x^2\,(x+y+z) + y^2\,(x+y+z) + z^2\,(x-y-z)$

$= (x^2\times x) + (x^2\times y) + (x^2\times z) + (y^2\times x) + (y^2\times y) + (y^2\times z) + (z^2\times x) + z^2\,(-y) + z^2\,(-z)$

$= x^3 + x^2y + x^2z + xy^2 + y^3 + y^2z + xz^2 - yz^2 - z^3$

$= x^3 + y^3 - z^3 + x^2y + x^2z + xy^2 + zy^2 + xz^2 - yz^2$

6. Find the product of

(i) $(2x+3)(2x-4)$ **(ii)** $(y^2-4)(2y^2+3y)$

(iii) $(m^2-n)(5m^2n^2-n^2)$ **(iv)** $3(x-5)\times 2(x-1)$

Sol. (i) $(2x+3)\,(2x-4) = (2x)\,(2x-4) + 3\,(2x-4)$

$= (2x\times 2x) - 4\,(2x) + 3(2x) - 3\,(4)$

$= 4x^2 - 8x + 6x - 12 = 4x^2 + (-8+6)x - 12$

$= 4x^2 - 2x - 12$

(ii) $(y^2-4)\,(2y^2+3y) = y^2\,(2y^2+3y) - 4\,(2y^2+37)$

$= y^2(2y^2) + y^2\,(3y) - 4\,(2y^2) - 4\,(3y)$

$= 2y^4 + 3y^3 - 8y^2 - 12y$

(iii) $(m^2-n)\,(5m^2n^2-n^2) = m^2\,(5m^2n^2-n^2) - n\,(5m^2n^2-n^2)$

$= m^2\,(5m^2n^2) + m^2\,(-n^2) - n\,(5m^2n^2) + (-)\,(-)\,n\,(n^2)$

$= 5m^4n^2 - m^2n^2 - 5m^2n^3 + n^3$

(iv) $3(x-5)\times 2\,(x-1) = (3\times 2)\,(x-5)\;(x-1)$

$= 6\times [x\,(x-1) - 5\,(x-1)]$

$= 6\,[x.x - x.1 - 5.x + (-1)\,(-)\,5\,1]$

$= 6\,[x^2 - x - 5x + 5] = 6\,[x^2 + (-1-5)x + 5]$

$= 6\,[x^2 - 6x + 5] = 6x^2 - 36x + 30$

7. **Find the missing term.**

(i) $6xy \times$ _____ $= -12x^3y$ **(ii)** _____ $\times(-15m^2n^3p) = 45m^3n^3p^2$

(iii) $2y(5x^2y -$ ___ $+ 3$ ___ $) = 10x^2y^2 - 2xy + 6y^3$

Sol. **(i)** $6xy \times \underline{(-2x^2)} = -12x^3y$.

(ii) $\underline{-3mp} \times (-15m^2n^3p) = 45m^3n^3p^2$

(iii) $2y(5x^2y - \underline{x} + 3\underline{y^2}) = 10x^2y^2 - 2xy + 6y^3$

8. **Match the following.**

(a)	$4y^2 \times -3y$	(i)	$20x^2y - 20x$
(b)	$-2xy\,(5x^2 - 3)$	(ii)	$5x^3 - 5xy^2 + 5x^2y$
(c)	$5x(x^2 - y^2 + xy)$	(iii)	$4x^2 - 9$
(d)	$(2x + 3)(2x - 3)$	(iv)	$-12y^3$
(e)	$5x(4xy - 4)$	(v)	$-10x^3y + 6xy$

A) iv, v, ii, i, iii B) v, iv, iii, ii, i C) iv, v, ii, iii, i D) iv, v, ii, iii, i

[*Ans:* **(c)-iv, (b)-v, (c)-ii, (d)-iii, (e)-i**]

9. **A car moves at a uniform speed of $(x + 30)$ km/hr. Find the distance covered by the car in $(y + 2)$hours. (Hint: distance = speed × time).**

Sol.

Sppeed of the car = $(x + 30)$ km / hr.

Time = $(y + 2)$ hours

Distance = Speed × time

$= (x + 30)(y + 2) = x(y + 2) + 30(y + 2)$

$= (x)(y) + (x)(2) + (30)(y) + (30)(2)$

$= xy + 2x + 30y + 60$

Distance covered = $(xy + 2x + 30y + 60)$ km

Objective Type Questions

10. **The product of $7p^3$ and $(2p^2)^2$ is**

(A) $14p^{12}$ (B) $28p^7$ (C) $9p^7$ (D) $11p^{12}$

[*Ans:* **(B) $28p^7$**]

11. **The missing terms in the product $-3m^3n \times 9(- -) =$ _____ m^4n^3 are**

(A) mn^2 ,27 (B) m^2n, 27 (C) m^2n^2,-27 (D) mn^2, -27

[*Ans:* **(A) mn^2 ,27**]

12. **If the area of a square is $36x^4y^2$ then, its side is _____.**

(A) $6x^4y^2$ (B) $8x^2y^2$ (C) $6x^2y$ (D) $-6x^2y$

[*Ans:* **(C) $6x^2y$**]

13. If the area of a rectangle is $48m^2n^3$ and whose length is $8mn^2$ then, its breadth is__.

(A) $6\,mn$ (B) $8m^2n$ (C) $7m^2n^2$ (D) $6m^2n^2$

[*Ans:* **(A) $6mn$**]

14. If the area of a rectangular land is $(a^2 - b^2)$ sq.units whose breadth is $(a - b)$ then, its length is_____

(A) $a - b$ (B) $a + b$ (C) $a^2 - b$ (D) $(a + b)^2$

[*Ans:* **(B) $a + b$**]

THINK

Page No. 77

1. Are the following correct?

(i) $\frac{x^3}{x^8} = x^{8-3} = x^5$ (ii) $\frac{10m^4}{10m^4} = 0$

(iii) When a monomial is divided by itself, we will get 1?

Sol. (i) $\frac{x^3}{x^8} = x^{3-8} = x^{-5}$ (or) $\frac{x^3}{x^8} = \frac{1}{x^{8-3}} = \frac{1}{x^5}$

$\therefore$ The given answer is wrong.

(ii) $\frac{10m^4}{10m^4} = \frac{10}{10} m^{4-4} = 1\ m^0 = 1$ $[\because m^0 = 1]$

$\therefore$ The given answer is not correct.

(iii) When a monomial is divided by itself we get 1.

Eg. $\frac{x}{x} = x^{1-1} = x^0 = 1$

$\therefore$ The given statement is correct

Division of Algebraic expressions

POINTS TO REMEMBER

- Division is the reverse operation of multiplication.
- If x is a variable and m, n are constants then $x^m \div x^n = x^{m-n}$ where $m > n$
- For dividing a polynomial by a monomial, divide each term of the polynomial by a monomial.

TRY THESE

Page No. 77

Divide

(i) $12x^3y^2$ by x^2y (ii) $-20a^5b^2$ by $2a^3b^7$ (iii) $28a^4c^2$ by $21ca^2$

Sol. (i) $\frac{12x^3y^2}{x^2y} = 12x^{3-2}y^{2-1} = 12x^1y^1 = 12xy$

(ii) $\frac{-20a^5b^2}{2a^3b^7} = \frac{-20a^{5-3}}{2b^{7-2}} = \frac{-10a^2}{b^5}$

(iii) $\frac{28a^4c^2}{21ca^2} = \frac{28}{21} a^{4-2} c^{2-1} = \frac{4}{3} a^2 c^1 = \frac{4}{3} a^2 c$

GEOMETRY

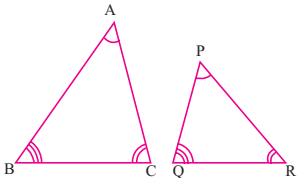
4

POINTS TO REMEMBER

- **Similar triangles:**
- Similar shapes are same in shape and different in size where as congruent shpes are same in shape and size too.
- Two geometrical figures are said to be similar (~) if the measures of one to the corresponding measures of the other are in a constant ratio.
- Every part of a photographic enlargement is similar to the corresponding part of the original is an example for similar shapes.
- **Properties of similarity of triangles:**

AA Similarity

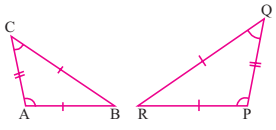
Two angles of one triangle arc equal respectively to two angles of the other triangle. This is called AAA similarity or AA similarity.



i.e, If $\angle A = \angle P$, $\angle B = \angle Q$ then: $\Delta ABC \sim \Delta PQR$

SAS Similarity

Two sides of one triangle are proportional to two sides of the other triangle and the included angles are equal

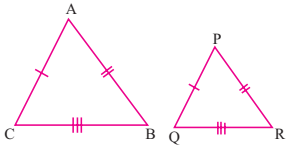


i.e. $\frac{AC}{PQ} = \frac{AB}{PR}$ and $\angle A = \angle P$ $\therefore \Delta CB \sim \Delta PQR$

This is SAS similarity.

SSS Similarity

If the corresponding sides of two triangles are in the same ratio then, this is SSS similarity.

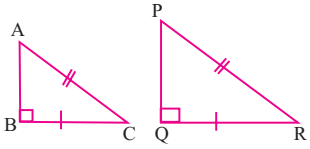


i.e. $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$ then $\Delta ABC \sim \Delta PQR$

This is SSS similarity

RHS Similarity

If two right triangles are similar if the hypotenuse and log of one triangle the respectively proportional to the hypotenuse and a log of the other triangle then this is RHS similarity.

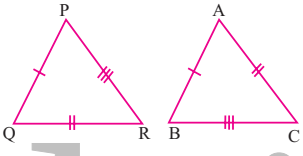


- If two triangles are similar then the corresponding angles are respectively equal and their corresponding sides are proportional.
  - ✦ All circles and squares are similar to each other.
  - ✦ Not all rectangles need to be similar always.
- **Congruent Triangles:**
  - ✦ Shapes are congruent if one fits exactly over the other.

SSS (Side – Side – Side) Congruence

If the three sides of a triangle are congruent to the three sides of another triangle, then the triangles are congruent. That is AB = PQ, BC = QR and AC = PR

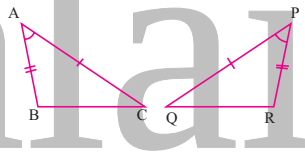
$\Rightarrow \Delta ABC \equiv \Delta PQR$



SAS (Side – Angle – Side) Congruence

If two sides and the included angle (the angle between them) of a triangle are congruent to two sides and the included angle of another triangle, then the triangles are congruent.

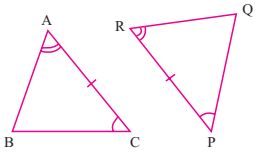
Here, AC = PQ, $\angle A = \angle P$ and AB = PR and hence $\Delta ACB \equiv \Delta PQR$.



ASA (Angle-Side-Angle) Congruence

If two angles and the included side of a triangle are congruent to two angles and the included side of anther triangle, then the triangles are congruent.

Here, $\angle A = \angle R$, CA=PR and $\angle C = \angle P$ and hence $\Delta ABC \equiv \Delta RQP$

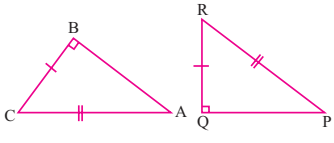


RHS (Right Angle – Hypotenuse – Side)

If the hypotenuse and a leg of one right triangle are congruent to the hypotenuse and a leg of another right triangle, then the triangles are congruent.

Here, BC = QR (leg),

AB = PQ (leg) and AC = PR (hypotenuse) and hence $\Delta ABC \equiv \Delta PQR$.



- Any segment or angle is congruent to itself. This is called **Reflexive** property.
- If two triangles are congruent then their corresponding parts arc congruent. This is called CPCTC (Corresponding Parts of Congruent Triangles are Congruent).

- If angles then sides means if two angles are equal in a triangle then the sides opposite to them are equal.
- If sides then angles means if two sides are equal in a triangle then the angles opposite to them are equal.
- All congruent triangles are similar.
- If two angles are both congruent and supplementary then, they are right angles.

Recalling the Properties of Triangles

I. Answer the following questions:

1. The sum of the three angles of a triangle is _____ . [*Ans:* **180°**]
2. The exterior angle of a triangle is equal to the sum of the _____ angles opposite to it. [*Ans:* **interior**]
3. In a triangle, the sum of any two sides is _____ than the third side. [*Ans:* **greater**]
4. The difference between any two sides of a triangle is _____ than the third side. [*Ans:* **Smaller**]
5. Angles opposite to equal sides are _____ and vice – versa. [*Ans:* **Equal**]
6. The angles of a triangle are in the ratio 4:5:6
   (i) Is it an acute, right or obtuse triangle?
   (ii) Is it scalene, isosceles or equilateral?

Sol. **(i)** Given the angles of a triangle are in the ratio 4 : 5 : 6 Sum of three angles of a triangle = 180°.

Let the three angles $4x$, $5x$ and $6x$

$$4x + 5x + 6x = 180°$$
$$15x = 180°$$
$$\therefore\ x = \frac{180°}{15}$$
$$\therefore\ x = 12°$$

$\therefore$ The angles are $4x \Rightarrow 4 \times 12 = 48°$

$5x \Rightarrow 5 \times 12 = 60°$

$6x \Rightarrow 6 \times 12 = 72°$

$\therefore$ The angle of the triangle are 48°, 60°, 72°

$\therefore$ It is an acute angles triangle.

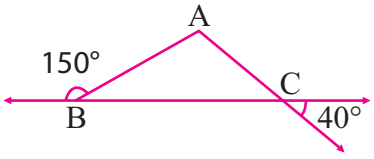
(ii) We know that the sides opposite to equal angles are equal.

Here all the three angles are different.

$\therefore$ The sides also different.

$\therefore$ The triangle is a scalene triangle.

7. What is $\angle A$ in the triangle ABC?



Sol. The exterior angle = sum of interior opposite angles.

$$\begin{aligned} \therefore \angle A + \angle C &= 150^\circ \text{ in } \Delta ABC \\ \text{But } \angle C &= 40^\circ \qquad [\because \text{Vertically opposite angler are equal}] \\ \therefore \angle A + \angle C &= 150^\circ \\ \Rightarrow \angle A + \angle 40^\circ &= 150^\circ \\ \angle A &= 150^\circ - 40^\circ \\ \angle A &= 110^\circ \end{aligned}$$

8. Can a triangle have two supplementary angles? Why?

Sol. Sum of three angles of a triangle is 180°.

$\therefore$ Sum of any two angles in a triangle will be less than 180°.

$\therefore$ A triangle cannot have two supplimentary angles.

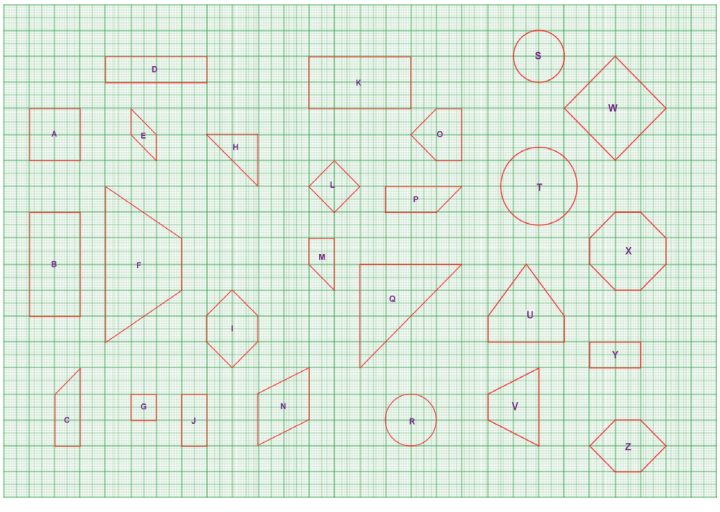
9. _____ shapes have the same shapes but different sizes. [*Ans:* **Similar**]

10. _____ shapes are exactly the same in shape and size. [*Ans:* **Congruent**]

TRY THESE

Page No. 99

Identify the pairs of shapes which are similar and congruent.



Sol. **Similar shapes:**

(i) W and L
(ii) B and J
(iii) A and G
(iv) B and J
(v) B and Y
(vi) E and N
(vii) H and Q
(viii) R and T
(ix) S and T

Congruent shapes:

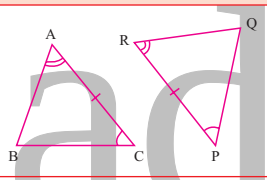
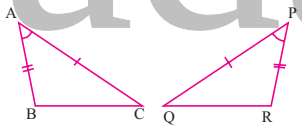
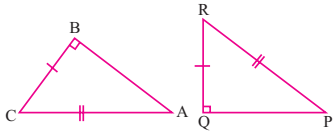
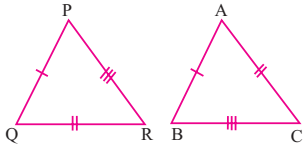
(i) Z and I
(ii) J and Y
(iii) C and P
(iv) B and K
(v) R and S
(vi) I and Z

You can find more.

TRY THESE

Page No. 108

1. **Match the following by their congruence**

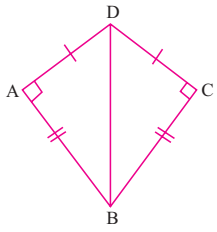
S.No.	A		B
1.		(i)	RHS
2.		(ii)	SSS
3.		(iii)	SAS
4.		(iv)	ASA

[*Ans:* **1- (iv), 2-(iii), 3-(i), 4-(ii)**]

THINK

Page No. 108

In the figure, DA = DC and BA = BC. Are the triangles DBA and DBC congruent? Why?



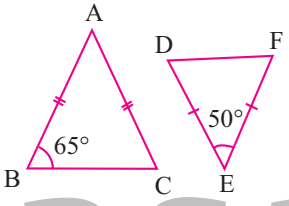
Sol.

Here AD = CD
AB = CB
DB = DB (common)
ΔDBA ≡ ΔDBC [∵ By SSS congruency]

Also RHS rule also bind here to say their congruency.

Exercise 4.1

1. From the figure given, prove that ΔABC ~ ΔDEF.



Sol. From the ΔABC, AB = AC

It is an isosceles triangle

Angles opposite to equal sides are equal

$\therefore \angle B = \angle C = 65°$

$\therefore \angle B + \angle C = 65° + 65°$

$= 130°$

We know that sum of three angles is a triangle = 180°

$\angle A + \angle B + \angle C = 180°$

$\angle A + 130° = 180°$

$\angle A = 180° - 130°$

$\angle A = 50°$

From ΔDEF, $\angle D = 50°$

$\therefore$ Sum of Remaining angles $= 180° - 50° = 130°$

$DE = FD$

$\therefore \angle D = \angle F$

From ΔABC and ΔDEF $\therefore \angle E = = \frac{130}{2} = 65°$

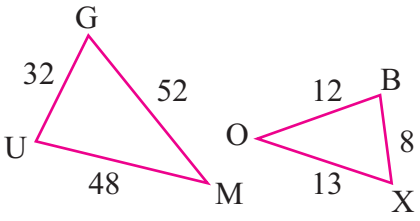
$\angle A = \angle D = 50°$

$\angle B = \angle E = 65°$

$\angle C = \angle F = 65°$

$\therefore$ By AAA criteria ΔDEF ~ ΔABC

2. **Prove that ΔGUM ~ Δ BOX from the given figure.**



Sol.

$$\frac{GU}{BO} = \frac{32}{8} = \frac{4}{1}$$

$$\frac{UM}{OX} = \frac{48}{12} = \frac{4}{1}$$

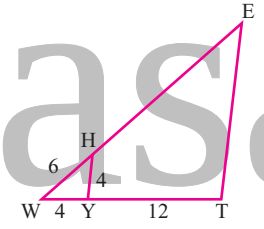
$$\frac{GM}{BX} = \frac{52}{13} = \frac{4}{1}$$

We find that $\frac{GU}{BO} = \frac{UM}{OX} = \frac{GM}{BX} = \frac{4}{1}$

That is their corresponding sides are proportional.

∴ By SSS similarity ΔGUM ~ ΔBOX.

3. **In the given figure YH ||TE Prove that ΔWHY ~ ΔWET and also find HE and TE.**



Sol.

S.No.	Statements	Reasons
1.	∠EWT = ∠HWY	Common Angle
2.	∠ETW = ∠HYW	Since YH || TE, corresponding angles
3.	∠WET = ∠WHY	Since YH || TE corresponding angles
4.	ΔWHY ~ ΔWET	By AAA criteria

Also ΔWHY ~ ΔWET

∴ Corresponding sides are proportionated

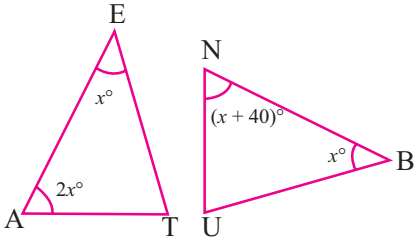
$$\frac{WH}{WE} = \frac{HY}{ET} = \frac{WY}{WT}$$

$$\frac{6}{6+HE} = \frac{4}{ET} = \frac{4}{16}$$

$$\Rightarrow \quad \frac{6}{6+HE} = \frac{4}{16}$$

$$\Rightarrow \quad 6 + HE = \frac{6}{4} \times 16$$
$$6 + HE = 24$$
$$\therefore HE = 24 - 6$$
$$HE = 18$$
$$\text{Again } \frac{4}{ET} = \frac{4}{16}$$
$$ET = \frac{4}{4}$$
$$ET = 16$$

4. In the given figure, if ΔEAT ~ ΔBUN find the measure of all angles.



Sol. Given ΔEAT ≡ ΔBUN

∴ Corresponding angles are equal

$$\therefore \angle E = \angle B \quad ...(1)$$
$$\angle A = \angle U \quad ...(2)$$
$$\angle T = \angle N \quad ...(3)$$
$$\angle E = x°$$
$$\angle A = 2x°$$

Sum of three angles of a triangle = 180°

$$\text{In } \Delta EAT,\ x + 2x + \angle T = 180°$$
$$\angle T = 180° - (x° + 2x°)$$
$$\angle T = 180° - 3x° \quad ...(4)$$

Also in ΔBUN

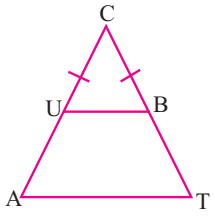
$$(x + 40)° + x° + \angle U = 180°$$
$$x + 40° + x + \angle U = 180°$$
$$2x° + 40° + \angle U = 180°$$
$$\angle U = 180° - 2x - 40° = 140° - 2x°$$

Now by (2)

$$\angle A = \angle U$$
$$2x = 140° - 2x°$$
$$2x + 2x = 140°$$

$$
\begin{aligned}
4x &= 140^\circ \\
x &= \frac{140}{4} = 35^\circ \\
\angle A = 2x^\circ &= 2 \times 35^\circ = 70^\circ \\
\angle N &= x + 40^\circ = 35^\circ + 40^\circ = 75^\circ \\
\therefore \angle T = \angle N &= 75^\circ \\
\angle E = \angle B &= 35^\circ \\
\angle A = \angle U &= 70^\circ
\end{aligned}
$$

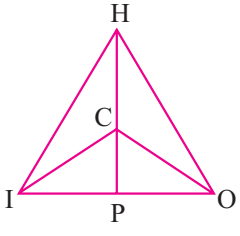
5. From the given figure, UB || AT and CU ≡ CB Prove that ΔCUB ~ ΔCAT and hence ΔCAT is isosceles.



Sol.

S.No.	Statements	Reasons
1.	∠CUB = ∠CBU	∵ In ΔCUB, CU = CB
2.	∠CUB = ∠CAB	∵ UB || AT, corresponding angle if CA is the transversal.
3.	∠CBU = ∠CTA	CT is transversal UB || AT, corresponding angle common angle.
4.	∠UCB = ∠ACT	Common angle
5.	ΔCUB ~ Δ CAT	By AAA criteria
6.	CA = CT	∵ ∠CAT = ∠CTA
7.	Also ΔCAT is isosceles	By 1, 2 and 3 and sides opposite to equal angles are equal.

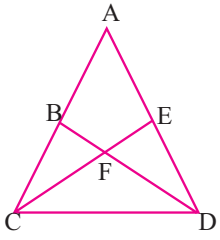
6. In the figure, ∠CIP ≡ ∠COP and ∠HIP ≡ ∠HOP . Prove that IP ≡ OP.



Sol.

S.No.	Statements	Reasons
1.	CI = CO	∵ CIP ≡ COP, by CPCTC
2.	IP = OP	By CPCTC
3.	CP = CP	By CPCTC
4.	Also HI = HO	CPCTC ΔHIP ≡ HOP given
5.	IP = OP	By CPCTC and (4)
6.	∴ IP ≡ OP	By (2) and (4)

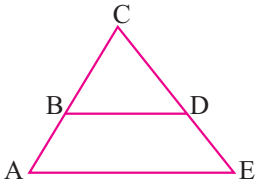
7. In the given triangle, AC ≡ AD and ∠CBD ≡ ∠DEC . Prove that Δ BCF ≡ ΔEDF .



Sol.

S.No.	Statements	Reasons
1.	∠BFC = ∠EFD	Vertically opposite angles
2.	∠CBD = ∠DEC	Angles on the same base given
3.	∠BCF = ∠EDF	Remaining angles of ΔBCF and ΔEDF
4.	ΔBCF ≡ ΔEDF	By (1) and (2) AAA criteria

8. In the given figure, Δ BCD is isosceles with base BD and ∠BAE ≡ ∠DEA . Prove that AB ≡ ED .

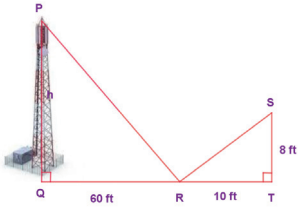


Sol.

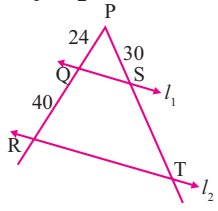
S.No.	Statements	Reasons
1.	∠BAE ≡ ∠DEA	Given
2.	AC = EC	By (1) sides opposite to equal angles are equal
3.	BC = DC	Given BCD is isosceles with base BD
4.	AC – BC = EC – DC	2 – 3
5.	AB ≡ ED	By 4

II. Answer any 2 questions. 2 × 5 = 10

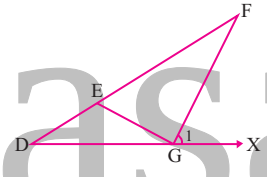
12. The height of a tower is measured by a mirror on the ground by which the top of the tower's reflection is seen. Find the height of the tower.



13. In the given figure, find PT given that $l_1 \parallel l_2$.



14. In the figure, if ∠FEG ≡ ∠1 then, prove that $DG^2 = DE.DF$.



ANSWERS

I.

1. Refer : Exercise No. 4.1 Q. No. 4
2. Refer : Exercise No. 4.1 Q. No. 1
3. Refer : Exercise No. 4.1 Q. No. 5
4. Refer : Exercise No. 4.1 Q. No. 3
5. Refer : Exercise No. 4.1 Q. No. 10
6. Refer : Exercise No. 4.1 Q. No. 7
7. Refer : Exercise No. 4.1 Q. No. 8
8. Refer : Exercise No. 4.1 Q. No. 9
9. Refer : Exercise No. 4.2 Q. No. 2
10. Refer : Exercise No. 4.2 Q. No. 5
11. Refer : Exercise No. 4.2 Q. No. 5

II.

12. Refer : Exercise No. 4.2 Q. No. 3
13. Refer : Exercise No. 4.1 Q. No. 1
14. Refer : Exercise No. 4.1 Q. No. 7

INFORMATION PROCESSING

5

POINTS TO REMEMBER

❑ **Addition principle:**

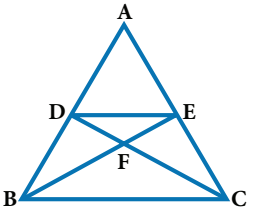
- If there are two choices, such that they can be conducted independently in m ways and n ways respectively, then either of the two choices can be conducted in $(m + n)$ ways.
- If an operation A can occur in m ways and another operation B can occur in n ways and suppose that both cannot occur together, then A or B can occur in $(m + n)$ ways.

❑ **Multiplication principle:**

- If an operation can be performed in m ways, following which another operation can be performed in n ways and both the operations are dependent on each other then, the two operations can be performed in exactly $(m \times n)$ different ways.

RECAP

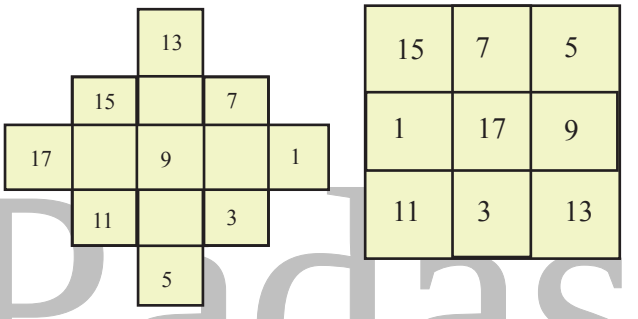
1. Find the number of all possible triangles that can be formed from the triangle given below.



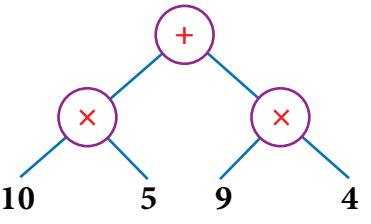
Ans: Single Triangles ⇒ 5
Combination of 2 ⇒ 4
Combination of 3 ⇒ 2
Big triangle ⇒ 1
12

2. Use the given figure to form a 3 x 3 magic square.

Ans:



3. Convert the tree diagram into a numeric expression

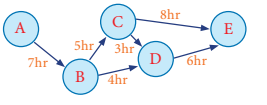


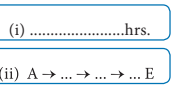
Ans: (10 × 5) + (9× 4)

4. (i) Find out the total time taken by the bus to reach from A to E via B , C and D.
(ii) Find which is the shortest route from A to E.

Sol. **(i)** Route ⇒ A → B → C → D → E

Time taken ⇒ (7 + 5 + 3 + 6) hrs = 21 hrs





(ii)

Available routes	Time taken
(a) A → B → C → D → E	7 + 5 + 3 + 6 = 21 hrs
(b) A → B → D → E	7 + 4 + 6 = 17 hrs
(c) A → B → C → E	7 + 5 + 8 = 20 hrs

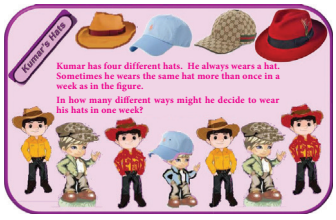
Shortest route ⇒ A → B → D → E

TRY THIS

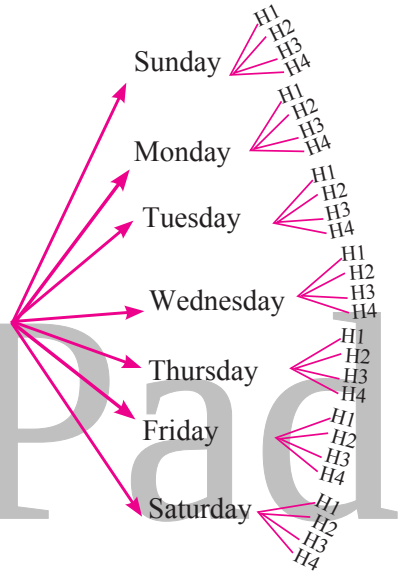
Page No. 127

Kumar has four different hats. He always wears a hat. Sometimes he wears the same hat more than once in a week as in the figure.

In how many different ways might he decide to wear his hats in one week?



Sol.



Let H1, H2, H3, H4 be Hat 1, Hat 2, Hat 3, Hat 4 respectively.

$\therefore$ In $7 \times 4 = 28$ different ways kumar may decide to wear his hat in one week.

Exercise 5.1

I. Choose the best answer.

1. How many outcomes can you get when you toss three coins once?

(A) 6 (B) 8 (C) 3 (D) 2 **[*Ans:* (B) 8]**

2. In how many ways can you answer 3 multiple choice questions, with the choices A,B,C and D ?

(1) 4 (2) 3 (3) 12 (4) 64

[*Ans:* (4) 64]

3. How many 2 digit numbers contain the number 7 ?

(A) 10 (B) 18 (C) 19 (D) 20

[*Ans:* (B) 18]

II. Answer the following.

1. You are going to have an ice cream or a cake. There are three flavours (chocolate, strawberry , vanilla) in ice creams, and two flavours (orange or red velvet) in the cake. In how many possible ways can you choose an ice cream or the cake?

Sol. We are going to have either a ice cream or a cake.

Ice cream can be selected from 3 flavors and cake from two flavors. Both the events cannot occur simultaneously selecting ice cream and cake.

$\therefore$ Number of possible ways $= 3 + 2$

$= 5$ ways

2. In how many ways, can the teacher choose 3 students, in all one each from 10 students in VI std, 15 students in VII std and 20 students in VIII std to go to an excursion ?

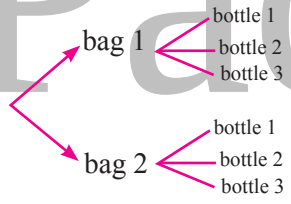
Sol. The teacher is going to select one student from class VI out of 10 students in 10 ways from class VII out of 15 students in 15 ways and from class VIII out of 20 students in 20 ways.

$\therefore$ Number of ways 3 students can be selected

$= 10 + 15 + 20 = 45$ ways

3. If you have 2 school bags and 3 water bottles then, in how many different ways can you carry a school bag and a water bottle, while going to school ?

Sol. We can select one school bag from 2 and one bottle from 3 as follows.



$\therefore$ A bag and a water bottle can be selected in $2 \times 3 = 6$ ways.

4. Roll numbers are created with a letter followed by 3 digits in it. From the letter A, B, C, D, E and any 3 digits from 0 to 9. Then, in how many possible ways can the roll numbers be generated?

Sol. We have a letter followed by 3 digits in the roll number.

The letter is selected from the five letters A, B, C, D, E.

For these 5 letters we have to select a 3 digit number using the digits 0 to 9.

Ones place can be formed using any one of the 10 number 0 to 9 in 10 ways.

Tens place can be formed in 10 ways.

$\therefore$ A two digit number can be formed in $10 \times 10 = 100$ ways.

Thousands place can be formed in 10 ways

$\therefore$ A 3 digit number can be formed in $10 \times 10 \times 10 = 1000$ ways.

$\therefore$ 5 letters can be attached in $5 \times 1000 = 5000$ ways.

$\therefore$ The roll number can be formed in 5000 ways.