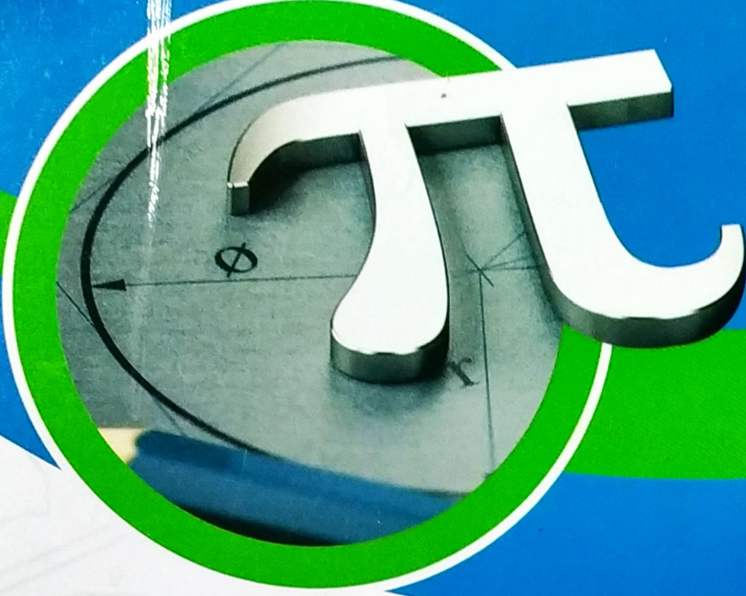

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10 Year-wise Solved Papers (2013-2022) for CBSE Class 10 MATHEMATICS (STANDARD)

with Value Added Notes

Includes

- CBSE All India 2022 Term I & Term II Solved Papers.
- 16 Authentic Papers (CBSE All India & CBSE Delhi)
- Errorless Solutions with step-wise marking scheme
- Concept Notes – highlighting Tips, Tricks, Alternate Solutions & Points to Remember.
- Supplemented with chapterwise important Points & Formulae to help solve MCQs & Numericals.
- Trend Analysis of 16 Papers (2022-2013)

2nd Edition

Note: In 2021 CBSE has Cancelled Board Exam due to Covid-19 Pandemic.

CONTENTS

Chapterwise Division of Questions

The table below presents the chapter-wise division of the questions of the 16 papers. So this book can be put to dual usage-yearwise as well as chapter-wise. To find questions of a chapter just follow the question numbers in its row against the 16 papers. This table also depicts the Trend Analysis of 2022-2013 papers.

[illegible]		Year of Examination																
		2022		2021	2020		2019		2018	2017		2016		2015		2014		2013
		(All India) Term-I	(All India) Term-II		All India	Delhi	All India	Delhi	All India	(All India) Term-II	(2016-2017) Term-I	(2015-2016) Term-I	(Delhi) Term-II	(All India) Term-II	(2014-2015) Term-I	(2013-2014) Term-I	(Delhi) Term-II	All India
1.	Real Numbers	1, 9, 17, 21, 27, 31, 36		Not Held in 2021 due to Covid-19 Pandemic	1, 2, 35	2, 5, 35 & OR	1, 7, 13 & OR	6, 7 & OR, 13	2, 7, 13		5, 6, 11, 21	5, 6, 11, 21			3, 5, 12, 21	1, 5, 9, 16, 32		
2.	Polynomials	2, 10, 18, 26, 30			3, 21	1, 3, 27 & OR, 28 (OR)	21 & OR	14	14		12, 13, 22	12, 13, 22			6, 13, 25	2, 10, 17		
3.	Pair of Linear Equations in Two Variables	3, 11, 41, 42, 43, 44, 45			4, 27, 36	4, 28	10, 11 & OR	12, 15 & OR, 23 (OR)	8		7, 14, 23, 24	7, 14, 23, 24			9, 16, 22, 28	13, 20, 25, 26, 31		
4.	Quadratic Equations		5, 11 & OR		5, 27 (OR), 29	29	2, 22, 30	2 & OR, 23	1, 16, 23 & OR	5, 11, 21, 22			5, 16, 21, 25, 27	1, 7, 12, 21, 23			9, 15, 25, 30	9, 15, 25, 26
5.	Arithmetic Progressions		3 & OR, 4		6, 7, 28 & OR	6, 7, 21, 36 & OR	3, 29 & OR	4, 8 & OR, 24	4, 9, 24	1, 6, 12, 23			3, 9, 15	8, 11, 22			1, 10, 16, 31	1, 10, 16, 27
6.	Triangles	5, 13, 37, 38, 46, 47, 48, 49, 50			11, 13 & OR, 22 & OR, 31	11, 12,13, 22, 31,32	6 & OR, 14 & OR, 23	5, 19 & OR, 29	6, 17 & OR, 25 & OR		1, 8, 9, 15, 16, 25, 26, 27	1, 8, 15, 16, 17, 25, 26, 27			2, 7, 11, 18, 26, 31	3, 11, 15, 22, 29, 30		
7.	Coordinate Geometry	4, 12, 19, 25, 29, 32, 40			8, 9, 10, 30 & OR	8, 9, 10, 30 & OR	5, 8 & OR, 16	1, 9, 16 & OR	3, 10, 15 & OR	9, 10, 15, 28			6, 8, 13, 28	9, 10, 14, 29			7, 18, 20, 29	7, 19, 20, 32
8.	Introduction to Trigonometry	6, 14, 20, 24, 33, 39			14, 16, 23 & OR, 33	14, 15 & OR, 23, 33	4 & OR, 17, 28 & OR	3 & OR, 17 & OR, 25	5, 19 & OR, 27		2, 3, 17, 18, 28, 29	2, 3, 9, 18, 28, 29			1, 8, 14, 15, 19, 23, 27, 29	4, 6, 7, 12, 18, 19, 23, 27, 33		
9.	Some Applications of Trigonometry		9, 13 case study-I		15, 38	16, 38	24	26 & OR	29	3, 13, 27			2, 19, 26	2, 13, 27			4, 19, 27	4, 18, 30
10.	Circles		2 & OR, 12		12, 32	22 (OR)	15	18	18	2, 7, 8, 24, 25			1, 7, 10, 22, 24	4, 5, 6, 24, 25			2, 3, 11, 12, 26, 32	2, 3, 11, 12, 28, 29
11.	Constructions		10		37 & OR	37	26 & OR	27	26	26			23	26			17	17
12.	Areas Related to Circles	7, 15, 23, 28, 34			17, 34, 39	24	18 & OR	20	20	16, 17, 30			11, 14, 30	16, 30			14, 21, 22	8, 14, 21, 24
13.	Surface Areas and Volumes		1, 14 case study-II		24, 39 (OR)	17, 34, 39	19, 25	21, 28	21 & OR, 28	18, 19, 20, 31			12, 17, 18, 31	17, 18, 19, 20, 31			8, 23, 24, 33, 34	22, 23, 33, 34
14.	Statistics		6, 7, 8 & OR		19, 26, 40 & OR	20, 26 & OR. 40 & OR	12, 20, 27	22, 30 & OR	22, 30 & OR		4, 10, 19, 20, 30, 31	4, 10, 19, 20, 30, 31			4, 10,17, 20, 24, 30	8, 14, 21, 24, 28, 34		
15.	Probability	8, 16, 22, 35			18 & OR, 20, 25	18, 19 & OR, 25	9	10, 11	11, 12	4, 14, 29			4, 20, 29	3, 15, 28			5, 6, 13, 28	5, 6, 13, 31

IMPORTANT POINTS & FORMULAE

1. REAL NUMBERS

Euclid's Division Lemma (E.D.L) : Given two positive integers a and b, there exist unique integers q and r such that

$$a = bq + r, \quad 0 \le r < b$$

Note : Euclid division Lemma can be used to find highest common factor (HCF) of two positive integers.

Euclid's division algorithm : The process of repeated Euclid's Division Lemma on two given positive numbers is called as Euclid's Division Algorithm which is used to find H.C.F of two positive numbers.

2. POLYNOMIALS

Relationship between Zero(ES) and coefficient of a polynomial

(i) Zero of a linear polynomial $ax + b$, is $x = -\frac{b}{a}$

(ii) If quadratic polynomial $ax^2 + bx + c = k(x - \alpha)(x - \beta)$, where k is any real constant; then α and β are zeroes of quadratic polynomial $ax^2 + bx + c$ where $a, b, c \in R$ and $a \ne 0$.

$$\alpha + \beta = -\frac{b}{a}, \text{ i.e., sum of zeroes } = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$$

and $\alpha \cdot \beta = \frac{c}{a}$

$$\text{i.e., product of zeroes} = \frac{\text{constant term}}{\text{coefficient of } x^2}$$

(iii) If cubic polynomial $ax^3 + bx^2 + cx + d = k(x - \alpha)(x - \beta)(x - \gamma)$ where k is any real constant, then α, β and γ are zeroes of cubic polynomial $ax^3 + bx^2 + cx + d$ where $a, b, c, d \in R$ and $a \ne 0$

$$\alpha + \beta + \gamma = -\frac{b}{a}, \quad \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a} \quad \text{and } \alpha\beta\gamma = -\frac{d}{a}$$

Division of Polynomials : On dividing a polynomial $p(x)$ by a polynomial $d(x)$, let the quotient be $q(x)$ and the remainder be $r(x)$, then $p(x) = d(x) \cdot q(x) + r(x)$, where either $r(x) = 0$ or deg. $r(x) <$ deg.$d(x)$

Here , Dividend = $p(x)$, Divisor = $d(x)$, Quotient = $q(x)$ and Remainder = $r(x)$.

3. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Consistent, Dependent and Inconsistent System of Equations

System of a pair of linear equations in two variables :

$$a_1 x + b_1 y + c_1 = 0$$
$$a_2 x + b_2 y + c_2 = 0$$

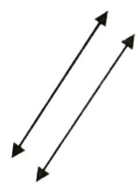
The given system of a pair of linear equations in two variables has either one solution, infinite solutions or no solution.

(i) If $\frac{a_1}{a_2} \ne \frac{b_1}{b_2}$, then the system has one (or unique) solution, and the system is called consistent.
In this case, a pair of straight lines represented by the system intersect each other at only one point.

(ii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$, then the given system has infinite solution and the system is called dependent. In this case, a pair of lines represented by the system coincides with each other.

So the intersect each other at infinite number of points.

(iii) If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \ne \frac{c_1}{c_2}$, then the given system has no solution and hence the system is called inconsistent. In this case, a pair of lines represented by the system are parallel to each other.



So they do not intersect each other at any point.

4. QUADRATIC EQUATIONS

Solutions of Quadratic Equations

Method I : Solution of a Quadratic Equation by Factorisation

Quadratic equation : $ax^2 + bx + c = 0$

By spliting the middle term 'bx' of L.H.S, factorise the L.H.S $(ax^2 + bx + c)$ in to linear factors. Then after equating each factor to zero, we find the values of the variable 'x' of the quadratic equation $ax^2 + bx + c = 0$.

These value of x are the solutions/roots of the given quadratic equation.

Method II : Solution of a Quadratic Equation by Completing the Square

Consider the quadratic equation, $ax^2 + bx + c = 0$

(i) Shift constant term 'c' to the R.H.S.
$ax^2 + bx = -c$

(ii) Divide both sides of the quadratic equation by 'a'.

$$\frac{ax^2 + bx}{a} = -\frac{c}{a} \Rightarrow x^2 + \frac{b}{a}x = -\frac{c}{a}$$

(ii)

(iii) Write coefficient $\frac{b}{a}$ of x as $2\left(\frac{b}{2a}\right) \Rightarrow x^2 + 2\left(\frac{b}{2a}\right)x = -\frac{c}{a}$

(iv) Add $\left(\frac{b}{2a}\right)^2$ on both sides of equal sign (=) and completing the whole square on L.H.S.

$$\Rightarrow \quad x^2 + 2\left(\frac{b}{2a}\right)x + \left(\frac{b}{2a}\right)^2 = \left(\frac{b}{2a}\right)^2 - \frac{c}{a}$$

$$\Rightarrow \quad \left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

$$\Rightarrow \quad \left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

(v) Taking square root on both sides of equal sign (=).

$$\Rightarrow \quad x + \frac{b}{2a} = \pm\frac{\sqrt{b^2 - 4ac}}{2a}$$

(vi) Now, shift $\frac{b}{2a}$ from L.H.S to R.H.S to get the value of x.

$$\Rightarrow \quad x = -\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Method III : Solution of a Quadratic Equation by Using the Quadratic Formula

In the method II we see that solutions/roots of the quadratic equation $ax^2 + bx + c = 0$ $(a \neq 0)$ by completing the square,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{................(i)}$$

We can use this equation (i) as a formula to find the solutions/roots of the quadratic equation $ax^2 + bx + c = 0$.

Nature of Roots : For the quadratic equation: $ax^2 + bx + c = 0$ $(a \neq 0)$, value of $(b^2 - 4ac)$ is called discriminant of the quadratic equation. The value of $(b^2 - 4ac)$ is denoted by D.

$\therefore \quad D = b^2 - 4ac$

The discriminant plays an important role in finding the nature of the roots of the quadratic equation.

(i) If $D = 0$, then roots are real and equal.

(ii) If $D > 0$, then roots are real and unequal.

(iii) If $D < 0$, then roots are not real.

5. ARITHMETIC PROGRESSIONS

The sequence $\langle x_1, x_2, x_3, ..., x_n, ...\rangle$ is called an arithmetic progression (A.P.), if

$x_2 - x_1 = x_3 - x_2 = ... = x_n - x_{n-1} = ...$

In general, $x_{n+1} - x_n$ = Constant (denoted by d), here n is a natural number.

The constant difference d is called the *common difference* of the A.P. First term x_1 of the A.P. is denoted by 'a'. Hence the standard form of A.P. is $a, a+d, a+2d, ...$

Formula for General Term of an A.P.

The n^{th} term of the A.P., is given by $a_n = a + (n-1)d, n \in N$

Here a_n is the n^{th} term of the A.P.

Formula for Sum of First n Terms of an A.P.

$$S_n = \frac{n}{2}\left[2a + (n-1)d\right] = \frac{n}{2}(a + \ell)$$

where ℓ = Last term up to which the sum of the A.P. is to find.

Arithmetic mean(s) between two numbers : Arithmetic mean(s) between two numbers is/are the number(s) which when inserted between the two numbers, then the sequence obtained will be an Arithmetic Progression.

If A be an arithmetic mean between two numbers a and b, then a, A,b will be an A.P.

$$\therefore \quad A - a = b - A \Rightarrow A = \frac{a+b}{2}$$

6. TRIANGLES

Criteria for similarity of triangles

(i) AAA Similarity Criterion or (Equi - angular criterion)
The corresponding angles of two triangles are equal, then their corresponding sides are proportional and hence the triangles are similar.

(ii) SSS Similarity Criterion : In this criterion, the corresponding sides of two triangles are proportional, then their corresponding angles are equal. Hence the triangles are said to be similar.

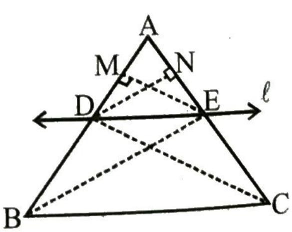
(iii) SAS Similarity Criterion : In this case, if one angle of a triangle is equal to one angle of the other and the sides including these angles are proportional.

Basic Proportionality Theorem or Thale's Theorem

Statement : "If a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio."

In ΔABC, a line parallel to BC intersects AB at D and AC at E

then $\frac{AD}{DB} = \frac{AE}{EC}$



Converse of B.P. Theorem

Statement : "If a line divides any two sides of a triangle in the same ratio, the line parallel to the third side".

In ΔABC, a line intersecting AB in D and AC in E, such that $\frac{AD}{DB} = \frac{AE}{EC}$ then DE || BC.

(iii) Write coefficient $\frac{b}{a}$ of x as $2\left(\frac{b}{2a}\right) \Rightarrow x^2+2\left(\frac{b}{2a}\right)x=-\frac{c}{a}$

(iv) Add $\left(\frac{b}{2a}\right)^2$ on both sides of equal sign (=) and completing the whole square on L.H.S.

$$\Rightarrow \quad x^2+2\left(\frac{b}{2a}\right)x+\left(\frac{b}{2a}\right)^2=\left(\frac{b}{2a}\right)^2-\frac{c}{a}$$

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$$\Rightarrow \quad x=-\frac{b}{2a}\pm\frac{\sqrt{b^2-4ac}}{2a}$$

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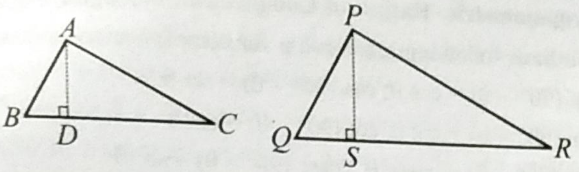
(iii) **SAS Similarity Criterion :** In this case, if one angle of a

Areas of two similar triangles

Theorem 1 : The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.

ΔABC and ΔPQR are two triangles such that, $\Delta ABC \sim \Delta PQR$

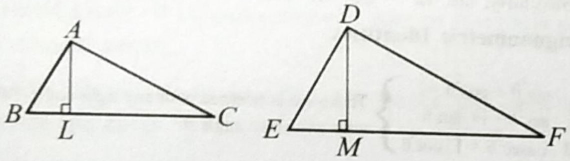
then $\dfrac{ar(\Delta ABC)}{ar(\Delta PQR)} = \dfrac{AB^2}{PQ^2} = \dfrac{BC^2}{QR^2} = \dfrac{CA^2}{RP^2}$



Theorem 2 : The areas of two similar triangles are in the ratio of the square of corresponding altitudes.

$\Delta ABC \sim \Delta DEF$ and $AL \perp BC$ and $DM \perp EF$

then $\dfrac{ar(\Delta ABC)}{ar(\Delta DEF)} = \dfrac{(AL)^2}{(DM)^2}$



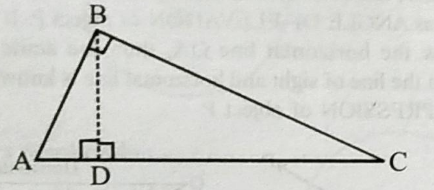
Pythagoras theorem :

Statement : In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

ABC is a right angled triangle in which $\angle B = 90°$

then $AC^2 = AB^2 + BC^2$

$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$



Converse of pythagoras theorem :

Statement : "In a triangle, the square of the longer side is equal to the sum of the squares of the other two sides then the triangle is right angled triangle".

ABC is a triangle such that $BC^2 = AB^2 + AC^2$ then $\angle A = 90°$

7. COORDINATE GEOMETRY

Distance Formula : The distance between two points whose co-ordinates are $P(x_1, y_1)$ and $Q(x_2, y_2)$ is given by the formula

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Distance From Origin

$$\sqrt{(x-0)^2 + (y-0)^2} = \sqrt{x^2 + y^2}$$

Section Formula : The coordinates of the point $p(x, y)$ which divides the line segment joining the points $A(x_1, y_1)$ and $B(x_2, y_2)$ internally in the ratio $m_1 : m_2$ are $x = \dfrac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$

and $y = \dfrac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$ $\quad \overset{m_1}{A(x_1, y_1) \quad P(x, y)} \overset{m_2}{\quad B(x_2, y_2)}$

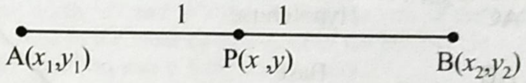
Note : If the ratio in which $P(x, y)$ divides AB is $K : 1$, then the coordinates of the point P will be

$$\left(\frac{kx_2 + x_1}{k+1}, \frac{ky_2 + y_1}{k+1}\right)$$

Coordinates of Mid-Point : The mid-point of a line segment divides the line segment in the ratio 1 : 1

$\therefore$ The coordinates of the mid-point P of the join of the points $A(x_1, y_1)$ and $B(x_2, y_2)$ is

$$\left(\frac{1.x_1 + 1.x_2}{1+1}, \frac{1.y_1 + 1.y_2}{1+1}\right) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$



Area of a triangle : Area of ΔABC, formed by the points $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$ is given by the numerical value of the expression

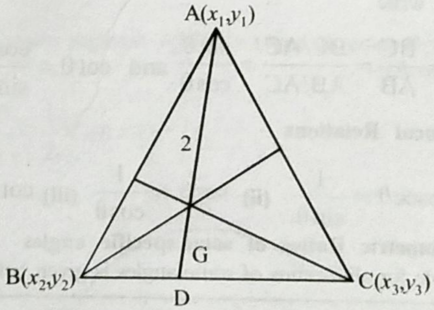
$$\frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

Centroid of a triangle : The point where the medians of a triangle meet is called the centroid of the triangle.

"If AD is a median of the triangle ABC and G is its centroid,

then $\dfrac{AG}{GD} = \dfrac{2}{1}$."

The coordinates of the point G are $\left(\dfrac{x_1 + x_2 + x_3}{3}, \dfrac{y_1 + y_2 + y_3}{3}\right)$



REMARKS

(I) Four points will form :

(i) a **parallelogram** if its opposite sides are equal, but diagonals are unequal.

(ii) a **rectangle** if opposite sides are equal and two diagonals are also equal.

(iii) a **rhombus** if all the four sides are equal, but diagonals unequal,

(iv) a **square** if all sides are equal and diagonals are also equal.

(II) Three points will form:

(i) an equilateral triangle if all the three sides are equal.

(ii) an isosceles triangle if any two sides are equal.

(iii) a right angled triangle if sum of square of any two sides is equal to square of the third side.

(iv) a triangle if sum of any two sides (distances) is greater than the third side (distance).

(III) Three points A, B and C are collinear or lie on a line if one of the following holds

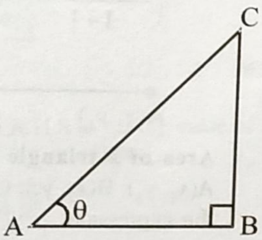
(i) AB + BC = AC (ii) AC + CB = AB

(iii) CA + AB = CB.

8. INTRODUCTION TO TRIGONOMETRY

Trigonometrical Ratios : (T - Ratios)

For right ΔABC, $B = 90°$, $A = \theta$



(i) $\frac{BC}{AC} = \sin\theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$

(ii) $\frac{AB}{AC} = \cos\theta = \frac{\text{Base}}{\text{Hypotenuse}}$

(iii) $\frac{BC}{AB} = \tan\theta = \frac{\text{Perpendicular}}{\text{Base}}$

(iv) $\frac{AC}{BC} = \operatorname{cosec}\theta = \frac{1}{\sin\theta} = \frac{\text{Hypotenuse}}{\text{Perpendicular}}$

v) $\frac{AC}{AB} = \sec\theta = \frac{1}{\cos\theta} = \frac{\text{Hypotenuse}}{\text{Base}}$

vi) $\frac{AB}{BC} = \cot\theta = \frac{1}{\tan\theta} = \frac{\text{Base}}{\text{Perpendicular}}$

These six ratios are called trigonometric-ratios for the angle θ.

We can write

$$\tan\theta = \frac{BC}{AB} = \frac{BC/AC}{AB/AC} = \frac{\sin\theta}{\cos\theta} \text{ and } \cot\theta = \frac{\cos\theta}{\sin\theta}$$

Reciprocal Relations

(i) $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$ (ii) $\sec\theta = \frac{1}{\cos\theta}$ (iii) $\cot\theta = \frac{1}{\tan\theta}$

Trigonometric Ratios of some specific angles

The table for all T-ratios of some angles is given below :

	0°	30°	45°	60°	90°
θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined
cosec θ	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
[illegible]	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined
cot θ	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Trigonometric Ratios of Complementary Angles

We have following relationship for complementary angles:

sin (90° – θ) = cos θ, cos (90° – θ) = sin θ

tan (90° – θ) = cot θ, cot (90° – θ) = tan θ

sec (90° – θ) = cosec θ, cosec (90° – θ) = sec θ

for all values of θ lying between 0° and 90°.

Note : $\tan 0° = 0 = \cot 90°$

$\sec 0° = 1 = \operatorname{cosec} 90°$

and $\sec 90°$, cosec 0°, tan 90° cot 0° are not defined.

So, sin 15° = sin (90° – 75°) = cos 75°

Similarly, tan 42° = cot 48° etc.

Trigonometric Identities

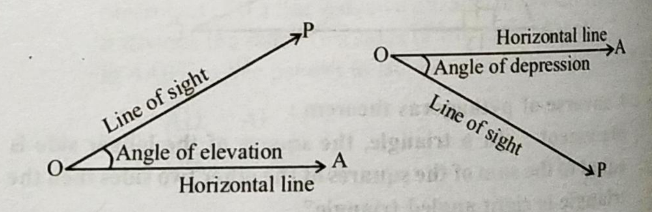
Identity I : $\sin^2\theta + \cos^2\theta = 1$
Identity II : $\sec^2\theta = 1 + \tan^2\theta$
Identity III : $\operatorname{cosec}^2\theta = 1 + \cot^2\theta$

} These are concerned with any right angled triangle with any acute angle θ.

9. APPLICATION OF TRIGONOMETRY

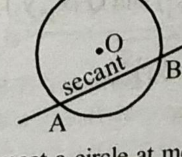
ANGLE OF ELEVATION AND ANGLE OF DEPRESSION

Let an observer at the point O is observing an object at the point P. The line OP is called the LINE OF SIGHT of the point P. Let OA be the horizontal line in the vertical plane passing through OP. If object P be above the horizontal line OA, then the acute angle AOP, between the line of sight and the horizontal line is known as ANGLE OF ELEVATION of object P. If the object P is below the horizontal line OA, then the acute angle AOP, between the line of sight and horizontal line is known as ANGLE OF DEPRESSION of object P.



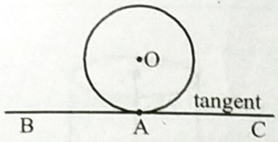
10. CIRCLES

Secant of a circle : A line which intersects a circle in two distinct points is called a secant of the circle.



Note : A line can meet a circle at most in two distinct points.

Tangent to a circle : A line which meets a circle exactly at one point is called a tangent to the circle. In adjoining figure, the line BAC is a tangent to the circle with centre O.



Theorems Related to Tangent to a circle

Theorem 1 : The tangent at any point of a circle is perpendicular to the radius through the point of contact. We have given a circle with centre O and a tangent XY to the circle at a point P then OP is perpendicular to XY.

Theorem 2 : The lengths of tangents drawn from an external point to a circle are equal. We have a circle with centre O, a point P lying outside the circle and two tangents PQ, PR on the circle from P then PQ = PR.

11. CONSTRUCTION

CONSTRUCTION - 1 : To divide a line segment in a given ratio.

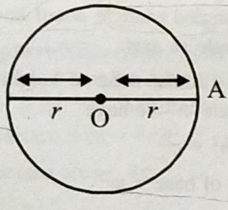
CONSTRUCTION - 2 : To construct a triangle similar to a given triangle as per given scale factor.

CONSTRUCTION - 3 : Construction of a tangent to a circle with or without using its centre.

CONSTRUCTION - 4 : Construction of a tangent to a circle from a point outside the circle.

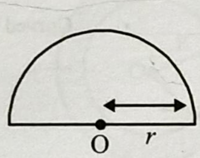
12. AREA RELATED TO CIRCLES

Area of a circle : Area of a circle = πr^2 where 'r' is the radius of the circle.



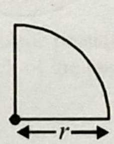
Area of a Semi-circle :

Area of a semi-circle = $\frac{1}{2}\pi r^2$

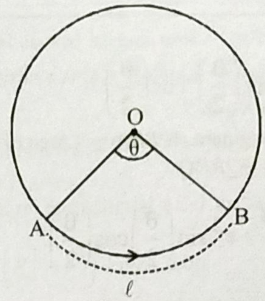


Area of a Quadrant :

Area of a quadrant = $\frac{\pi r^2}{4}$



Perimeter and Area of Sector of a Circle : Two radii OA and OB enclose a portion of the circular region which makes a central angle θ. The region is called a sector of the circle. In fig., AOB is the sector with central angle θ. Let 'ℓ' be the length of arc AB. Then,



$$\ell = 2\pi r.\frac{\theta}{360} = \frac{\pi r\theta}{180}$$

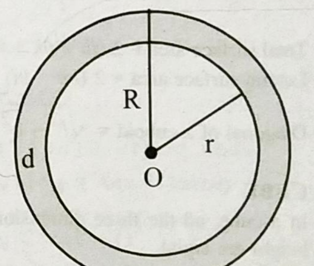
Perimeter of the sector $= OA + OB + AB = 2r + \frac{\pi r\theta}{180}$

Also, area of sector is given by $\frac{\text{Area of sector } AOB}{\text{Area of the circle}} = \frac{\theta}{360}$

Area of sector $AOB = \pi r^2 \frac{\theta}{360}$

Area of Circular Path (RING)

If we have a circular field of radius 'r', surrounded by a path of uniform width 'd' and $r + d = R$ then, the area of the circular path = Area of the outer circle – Area of the inner circle
$= (\pi R^2 - \pi r^2)$ sq unit $= \pi (R^2 - r^2)$ sq unit



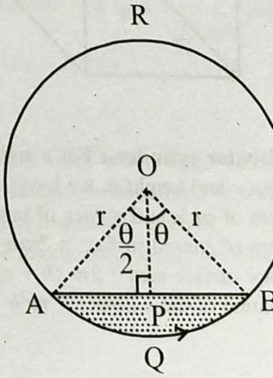
Area of a Segment

In right ΔOPA,

$$AP = r\sin\left(\frac{\theta}{2}\right),\ AB = 2AP = 2r\sin\left(\frac{\theta}{2}\right),\ OP = r\cos\left(\frac{\theta}{2}\right)$$

Area of minor segment $AQBPA$ = (Area of sector OAQBO) – (Area of ΔOAB)

$$= \frac{\pi r^2\theta}{360} - \frac{1}{2} \times AB \times OP$$



$$= \frac{\pi r^2\theta}{360} - r^2 \sin\left(\frac{\theta}{2}\right)\cos\left(\frac{\theta}{2}\right)$$

Area of major segment $APBRA$ = (Area of the circle) – (Area of minor segment $AQBPA$)

$$= \pi r^2 - \frac{\pi r^2\theta}{360} + r^2 \sin\left(\frac{\theta}{2}\right)\cos\left(\frac{\theta}{2}\right).$$

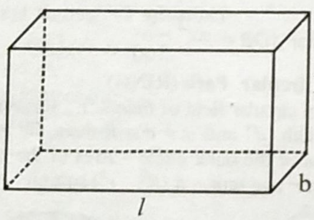
13. SURFACE AREAS AND VOLUMES

Surface Areas and Volumes of Solids

(i) **CUBOID**

If 'l' be the length, 'b' be the breadth and 'h' be the height (or depth) of a cuboid, then

Volume = length × breadth × height = $l \times b \times h$



Total surface area = $2\,(lb + bh + hl)$

Lateral surface area = $2\,(bh + hl)$

Diagonal of a cuboid = $\sqrt{l^2 + b^2 + h^2}$

(ii) **CUBE**

In a cube, all the three dimensions i.e., its length, breadth and height are equal.

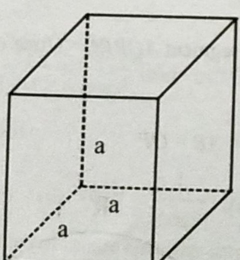
If 'a' be the edge of a cube, then

Volume = a^3

Total surface area = $6a^2$

Lateral surface area = $4a^2$

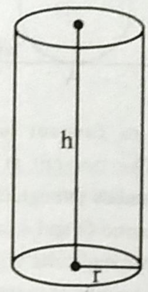
Diagonal of a cube = $\sqrt{3}$ × edge = $\sqrt{3}\,a$



(iii) **CYLINDER**

(a) **Right circular cylinder :** For a right circular cylinder of base radius r and height h, we have

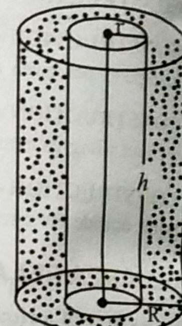
- Area of each end = Area of base = πr^2
- Area of curved surface = $2\pi rh$
- Total surface area = $2\pi r\,(h + r)$
- Volume of the cylinder = $\pi r^2 h$



(b) **Right circular hollow cylinder :** A cylinder from which a smaller cylinder of the same height and of the same axis is cut out is called a hollow cylinder.

If 'r' & 'R' be the internal & external radii respectively of a hollow cylinder of height 'h', then

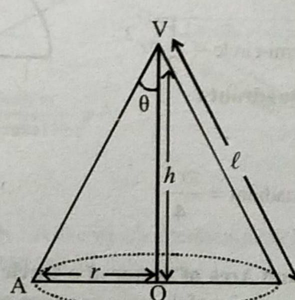
- Volume of the hollow cylinder = $(\pi R^2 - \pi r^2)h$
  $= \pi\,(R^2 - r^2)h$
- Area of the curved surface $= 2\pi Rh + 2\pi rh$
  $= 2\pi(R + r)\,h$
- Total surface area = area of curved surface + 2 (area of a base)
  $= 2\pi\,(R + r)h + 2\pi\,(R^2 - r^2)$
  $= 2\pi\,(R + r)\,(h + R - r)$



(c) **Right circular cone :** It is a solid generated by the revolution of a right angled triangle about one of its sides containing the right angle as axis.

For a right circular cone of height 'h', slant height ℓ and radius of base 'r' we have

- $\ell^2 = h^2 + r^2$
- Area of base = πr^2
- Curved surface area = $\pi r\ell$



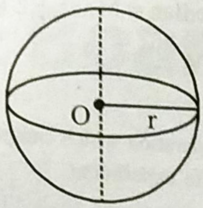
- Total surface area = Curved surface area + Area of the base = $\pi r\ell + \pi r^2$

Volume = $\frac{1}{3}\pi r^2 h$

(iv) SPHERE

(a) Sphere

For a sphere of radius 'r', we have

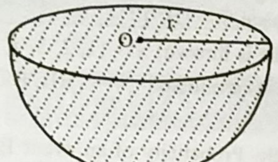


Surface area $= 4\pi r^2$

Volume $= \frac{4}{3}\pi r^3$

(b) Hemisphere

For a hemisphere of radius r, we have



Curved surface area $= 2\pi r^2$

Total surface area $= 3\pi r^2$

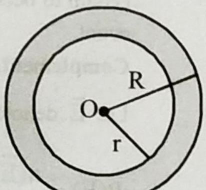
Volume $= \frac{2}{3}\pi r^3$

(c) Hollow Sphere/Spherical Shell

From a sphere, a smaller sphere having the same centre of the sphere, is cut off, then hollow sphere is obtained.

External surface area $= 4\pi R^2$

Internal surface area $= 4\pi r^2$

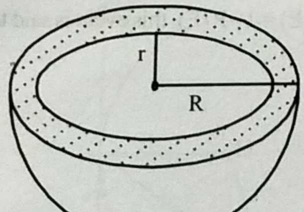


Volume $= \frac{4}{3}\pi\left(R^3 - r^3\right)$

(d) Hemispherical Shell

If a spherical shell is cut into two halves by a plane passing through the centre of spherical shell, then each of the two halves is called a hemispherical shell.

Internal curved surface area $= 2\pi r^2$ sq. units



External curved surface area $= 2\pi R^2$ sq. units

Total surface area $=$ Internal surface area + Ext. surface area + Area of ring

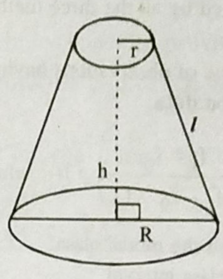
$= 2\pi r^2 + 2\pi R^2 + \pi(R^2 - r^2) = \pi r^2 + 3\pi R^2 = \pi(r^2 + 3R^2)$ units

Volume of the material used to form hemispherical shell

$= \frac{2}{3}\pi\left(R^3 - r^3\right)$ cubic units

(v) FRUSTUM OF A CONE

A cone is cut by a plane parallel to the base of the cone, then the portion between the plane and base is called frustum of the cone



- Volume of frustum of cone $= \frac{\pi h}{3}[R^2 + r^2 + Rr]$ cubic unit
- L. S. A or C. S. A $= \pi\ell(R + r)$ Sq units

  where $\ell^2 = h^2 + (R - r)^2$
- T. S. A $= \pi R^2 + \pi r^2 + \pi\ell(R + r)$ Sq. units.

  (Area of base + Area of top + Area of lateral)
- Slant height $(\ell) = \sqrt{h^2 + (R - r)^2}$

14. STATISTICS

Mean of Grouped data

In frequency distribution with frequencies for the values of $x_1, x_2, x_3 \ldots\ldots\ldots x_n$ are $f_1, f_2, f_3 \ldots\ldots\ldots f_n$, respectively. Then,

$$\text{Mean } (\overline{x}) = \frac{f_1x_1 + f_2x_2 + \ldots\ldots\ldots\ldots + f_nx_n}{f_1 + f_2 + \ldots\ldots\ldots\ldots + f_n} = \sum_{i=1}^{n}\frac{f_ix_i}{\Sigma f_i}$$

Short cut method (Assumed mean Method)

As per this method : $\overline{x} = A + \frac{1}{N}\sum_{i=1}^{n} f_id_i$ where A is assumed mean and $d_i = x_i - A$, $N = \Sigma f_i$

Note :

1. This method is used when large calculation is involved in frequency data calculations and it is tedious to calculate mean value etc. by conventional method.
2. Generally the middle most value is considered as assumed mean.

(viii)

Step Deviation Method

If the deviation **di's** are divisible by any common number **C**, then

$u_i = \frac{x_i - A}{C}$ and we use formula $\bar{x} = A + \left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right)C$ where

'C' is differences between successive x_is.or we can say C = class size.

Note :

1. The step-deviation method will be convenient to apply if all the d_is have a common factor.
2. The mean obtained by all the three methods is the same.

Mode

Mode is that value of observations having maximum frequency.

Mode of grouped data

$$\text{Mode} = \ell + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h \quad \text{where,}$$

ℓ = lower limit of the modal class*

h = size of the class interval

f_1 = frequency of the modal class

f_0 = frequency of the class preceeding the modal class

f_2 = frequency of the class succeeding the modal class.

Note : Modal class is the class having maximum frequency.

Median

Median is the value of the middle-most observation in the data.

Median of ungrouped data

We first put the data values in the ascending order, then the median is the $\left(\frac{n+1}{2}\right)$th observation if n is odd, and if n is even, then the median is $\frac{1}{2}\left[\frac{n}{2}\text{th} + \left(\frac{n}{2}+1\right)\text{th}\right]$ observation.

Median of Grouped Data

Step I : Make cumulative frequency table.

Step II : Choose the median class. Median class is the class whose cumulative frequency is greater than and nearest to $\frac{n}{2}$ where n is the sum of all frequencies.

Step III : Use this formula

$$\text{Median} = \ell + \left[\frac{\frac{n}{2} - c.f}{f}\right] \times h$$

where, ℓ = lower limit of median class

n = sum of all frequencies

c.f = cumulative frequency of class preceding the median class

f = frequency of the median class

h = class size

Note : The relationship between three measures of central tendency.

$$3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$$

15. PROBABILITY

EXPERIMENT : An operation which can produce some well defined outcomes, is known as an experiment.

TRIAL : Performing of an experiment is called Trial. *For example :* Tossing a coin, throwing a dice.

EVENT : The outcomes of an experiment are called events. *For example :* Getting a head or tail tossing a coin is an Event.

SAMPLE SPACE : The set of all possible out comes in a trial is called sample space.

For instance :

(i) If a fair coin is tossed, there are two possible outcomes, namely head (H) & Tail (T).

∴ Sample space S = {H, T}

(ii) In unbaised die is thrown; S = {1, 2, 3, 4, 5, 6}

(iii) When two coins are tossed : S = {HH, HT, TH, TT}

Probability

Mathematically, Probability of an event E, is defined as,

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{No.of outcomes of favourable cases to E}}{\text{Total No. of possible outcomes}}$$

The probability of an event E is a number between 0 and 1 inclusive i.e., $0 \le P(E) \le 1$

(i) If P(E) = 0, then the event cannot possibly occur. An event that cannot occur has 0 probability; Such an event is called impossible event.

(ii) If P(E) = 1, then the event is certain to occur. An event that is certain to occur has probability equal to one and is called a sure event.

Complementary Event

Let $\bar{E}$ denote the event 'E does not occur'. Then

$$P(\bar{E}) = \frac{n(\bar{E})}{n(S)} = \frac{n(S) - n(E)}{n(S)} = 1 - \frac{n(E)}{n(S)}$$

$$\Rightarrow P(\bar{E}) = 1 - P(E) \Rightarrow P(E) + P(\bar{E}) = 1$$

i.e. P(E) + P(not E) = 1

Thus P (not E) = 1 – P (E), this event is said to be a complementary event.

All India 2022

CBSE Board Solved Paper Term-II

Time Allowed : 2 Hours *Maximum Marks : 40*

General Instructions:

(i) This question paper contains **14** questions. **All** questions are compulsory.

(ii) This question paper is divided into **3** Sections - Section - A, B and C.

(iii) **Section - A** comprises of **6** questions (Q. Nos. **1 to 6**) **2** marks each. Internal choice has been provided in two questions.

(iv) **Section - B** comprises of **4** questions (Q. Nos. **7 to 10**) of **3** marks each. Internal choice has been provided in one question.

(v) **Section - C** comprises of **4** questions (Q. Nos. **11 to 14**) of **4** marks each. An internal choice has been provided in one question. It also contains two case study based questions.

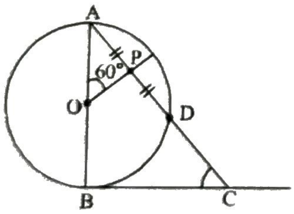
(vi) Use of calculator is not permitted.

SECTION - A

Question Numbers 1 to 6 carry 2 marks each.

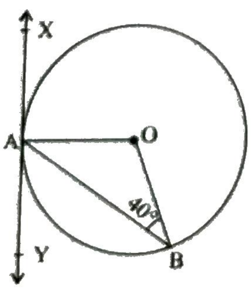
1. A solid piece of metal in the form of a cuboid of dimensions 11 cm × 7 cm × 7 cm is melted to form 'n' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of n.

2. (a) In Fig., AB is diameter of a circle centered at O. BC is tangent to the circle at B. If OP bisects the chord AD and $\angle AOP = 60^\circ$, then find $m\angle C$.



OR

(b) In Fig., XAY is a tangent to the circle centered at O. If $\angle ABO = 40^\circ$, then find $m\angle BAY$ and $m\angle AOB$.



3. (a) Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, \ldots$ is $\frac{49}{2}$?

OR

(b) Find a and b so that the numbers $a, 7, b, 23$ are in A.P.

4. Find the sum of first 20 terms of an A.P. whose n^{th} term is given as $a_n = 5 - 2n$.

5. Solve the quadratic equation: $x^2 - 2ax + (a^2 - b^2) = 0$ for x.

6. If mode of the following frequency distribution is 55, then find the value of x.

Class:	0-15	15-30	30-45	45-60	60-75	75-90
Frequency:	10	7	x	15	10	12

SECTION - B

Question Numbers from 7 to 10 carry 3 marks each.

7. Heights of 50 students of class X of a school are recorded and following data is obtained:

Height (in cm):	130-135	135-140	140-145	145-150	150-155	155-160
Number of students:	4	11	12	7	10	6

Find the median height of the students.

8. (a) The mean of the following frequency distribution is 25. Find the value of f.

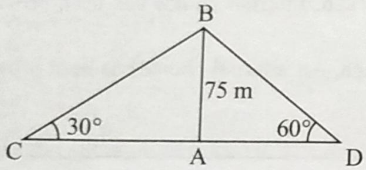
Class:	0-10	10-20	20-30	30-40	40-50
Frequency:	5	18	15	f	6

OR

(b) Find the mean of the following data using assumed mean method:

Class:	0-5	5-10	10-15	15-20	20-25
Frequency:	8	7	10	13	12

9. Two men on either side of a cliff 75 m high observe the angles of elevation of the top of the cliff to be 30° and 60°. Find the distance between the two men.



10. Construct a pair of tangents to a circle of radius 3 cm which are inclined to each other at an angle of 60°.

SECTION - C

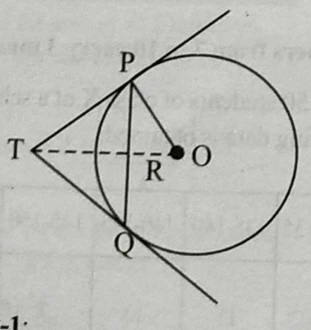
Question Numbers from 11 to 14 carry 4 marks each.

11. (a) The sum of two numbers is 34. If 3 is subtracted from one number and 2 is added to another, the product of these two numbers becomes 260. Find the numbers.

OR

(b) The hypotenuse (in cm) of a right angled triangle is 6 cm more than twice the length of the shortest side. If the length of third side is 6 cm less than thrice the length of shortest side, then find the dimensions of the triangle.

12. In Fig., PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q meet at a point T. Find the length of TP.

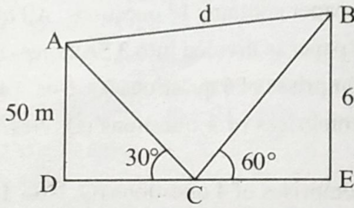


13. **Case Study-1**:

Kite Festival

Kite festival is celebrated in many countries at different times of the year. In India, every year 14th January is celebrated as International Kite Day. On this day many people visit India and participate in the festival by flying various kinds of kites.

The picture given below, shows three kites flying together.



In Fig., the angles of elevation of two kites (Points A and B) from the hands of a man (Point C) are found to be 30° and 60° respectively. Taking AD = 50 m and BE = 60 m, find

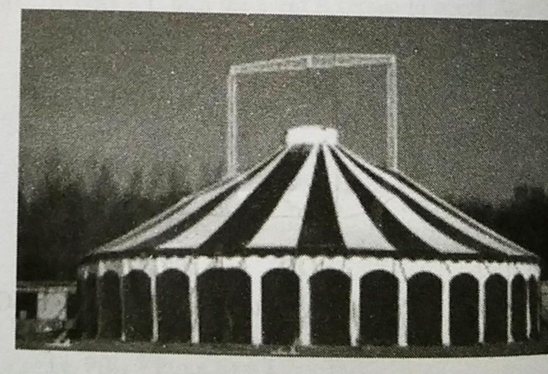
(1) the lengths of strings used (take them straight) for kites A and B as shown in the figure.

(2) the distance 'd' between these two kites.

14. **Case Study-2**

A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents.

One such 'Circus tent' is shown below.



The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find

(1) the area of the canvas used in making the tent;

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq. m, if 30 sq m canvas was wasted during stitching.

Solutions

1. Given, the length = 11 cm, breadth = 7cm, height = 7 cm

and radius of sphere = $\frac{7}{2}$ cm.

According to question,

Volume of cuboid = n × volume of sphere

$$l \times b \times h = n \times \frac{4}{3}\pi r^3$$ [1 Mark]

$$11 \times 7 \times 7 = n \times \frac{4}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{7}{2}$$

$n = 3$ [1 Mark]

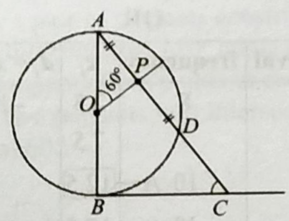
Therefore, the value of n is 3.

Note

When one solid is converted into another solid then their volume will be equal.

2(a). Since, OP bisects the chord AD.

So OP will be perpendicular to AD.



In ΔAOP

Thus $\angle OAP = 180° - 60° - 90° = 30°$ [1 Mark]

Now In ΔABC

$\angle A = 30°$

$\angle B = 90°$ (∴ BC is tangent to AB)

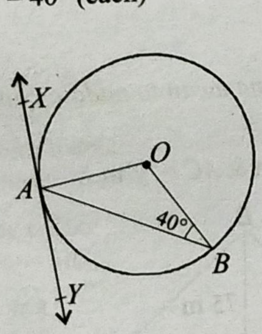
Thus $\angle ACB = 180 - 90 - 30 = 60°$ [1 Mark]

OR

2(b). From the given figure

$OA = OB$ (Radii of a circle)

so $\angle A = \angle B = 40°$ (each)



Hence $\angle A + \angle B + \angle AOB = 180°$

$M\angle AOB = 180° - 40° - 40°$

$= 100°$ [1 Mark]

Here, $\angle OAY = 90°$ (∵ XAY is tangent of OA)

and $M\angle BAY = \angle OAY - \angle OAB$

$= 90° - 40° = 50°$ [1 Mark]

3(a). Given, AP = $-\frac{11}{2}, -3, -\frac{1}{2}, \ldots\ldots\ldots$, Let $a_n = \frac{49}{2}$

where, $a = -\frac{11}{2}$, $d = -3 + \frac{11}{2} = \frac{5}{2}$

Apply a_n term formula,

$a_n = a + (n-1) \times d$ [1 Mark]

$$\frac{49}{2} = -\frac{11}{2} + (n-1) \times \frac{5}{2}$$

$n = 12 + 1 = 13.$ [1 Mark]

OR

3(b). Given a, 7, b, 23 are in A.P.

Then, there common difference will be equal.

$d = 7 - a = b - 7$

$7 - a = b - 7$

$a + b = 14$ .... (i) [1 Mark]

Similarly,

$b - 7 = 23 - b$

$2b = 30$

$b = 15$

From (i)

$a + 15 = 14$

$\boxed{a = -1}$ [1 Mark]

Required A.P = –1, 7, 15, 23

4. Given, $a_n = 5 - 2n$

Put $n = 1$

$a_1 = 5 - 2 \times 1 = 5 - 2 = 3$

Put $n = 20$

$a_{20} = 5 - 2 \times 20 = 5 - 40 = -35$

$$S_n = \frac{n}{2}[a + a_n]$$ [1 Mark]

Here, $n = 20$

$$S_{20} = \frac{20}{2}[3 - 35]$$

$$= \frac{20}{2} \times (-32) = -320$$

$S_{20} = -320$ [1 Mark]

$5^2 = 4^2 + RO^2$
$25 = 16 + RO^2$
$RO^2 = 9.$
$RO = 3$ cm. [2 Marks]

Let $TP = x$ cm, $TR = y$ cm.
In ΔPRT
$TP^2 = TR^2 + PR^2$
$x^2 = y^2 + 16$ ... (i)
In ΔTPO
$TO^2 = TP^2 + OP^2$
$(y + 3)^2 = x^2 + 25$
$y^2 + 9 + by = y^2 + 16 + 25$ {from (i)}
$6y = 32$

$y = \frac{16}{3}$

From (i)
$x^2 = y^2 + 16$

$x^2 = \frac{256}{9} + 16 = \frac{256+144}{9}$

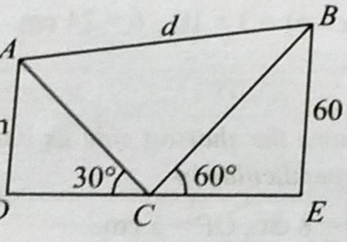
$x^2 = \frac{400}{9}$

$x = \frac{20}{3}$ cm. [2 Marks]

Therefore, the length of TP is $\frac{20}{3}$ cm.

e Study-1:

1). Given, figure of two flying kites is represented as:



[2 Marks]

n ΔADC

n $30° = \frac{P}{H} = \frac{AD}{AC}$

$\frac{1}{2} = \frac{50}{AC}$

$AC = 100$ cm

In ΔBEC

$\sin 60° = \frac{P}{H} = \frac{BE}{BC}$

$\frac{\sqrt{3}}{2} = \frac{60}{BC}$

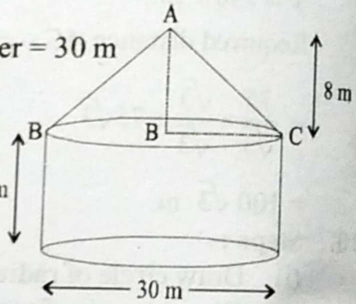
$BC = \frac{120}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

Hence $BC = 40\sqrt{3}$m.

13(2). In the above figure $\angle ACB = 180 - (60 + 30) = 90°$
In ΔACB
$AB^2 = AC^2 + BC^2$
$d^2 = (100)^2 + (40\sqrt{3})^2$
$d^2 = 10000 + 1600 \times 3$
$d^2 = 10000 + 4800$
$d^2 = 14800$ [2 Marks]
$d = 20\sqrt{37}$m.

Case Study-2:

14(1). Given diameter of cylinder = 30 m



hence, $r = \frac{30}{2} = 15$cm.

In ΔABC
$AC^2 = AB^2 + BC^2$
$AC^2 = (8)^2 + (15)^2$
$= 64 + 225$
or $AC = 17$ m. (say, 'l') [1 Mark]

Area of canvas used = C.S.A of cone + C.S.A of cylinder.
$= \pi rl + 2\pi rh$
$= \pi r (l + 2h)$

$= \frac{22}{7} \times 15 (17 + 2 \times 9)$

$= \frac{22}{7} \times 15 \times 35 = 110 \times 15 = 1650\text{m}^2$ [2 Marks]

14(2). Cost of the canvas bought of $1\text{m}^2 \rightarrow$ ₹ 200
Total area of canvas bought = $(1650 + 30)$ m^2
$= 1680$ m^2

Cost of total canvas = 1680×200
= ₹ 3,36,000 [1 Mark]

Note

Wasted area of canvas will be included in the area of canvas used in the tent to find the total cost of canvas bought.

All India 2022

CBSE Board Solved Paper Term-I

Time Allowed : 90 Minutes | ***Maximum Marks : 40***

General Instructions:

(i) This question paper contains **50** questions out of which **40** questions are to be attempted. **All questions carry equal** marks.
(ii) The question paper consists of **three** Sections – Section A, B and C.
(iii) **Section - A** contains of **20** questions. Attempt any **16** questions from Q. No. **01** to **20**.
(iv) **Section - B** also contains of **20** questions. Attempt any **16** questions from Q. No. **21** to **40**.
(v) **Section - C** contains of two Case Studies containing **5** questions in each case. Attempt any **4** questions from Q. No. **41** to **45** and another **4** from Q. No. **46** to **50**.
(vi) There is only one correct option for every Multiple Choice Question (MCQ). Marks will not be awarded for answering more than one option.
(vii) There is no negative marking.

SECTION - A

Q. No. 1 to 20 are of 1 mark each. Attempt any 16 from Q. 1 to 20

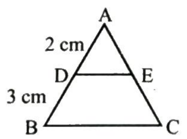
1. The exponent of 5 in the prime factorisation of 3750 is
(a) 3 (b) 4 (c) 5 (d) 6

2. The graph of a polynomial P(x) cuts the x-axis at 3 points and touches it at 2 other points. The number of zeroes of P(x) is
(a) 1 (b) 2 (c) 3 (d) 5

3. The values of x and y satisfying the two equations $32x+33y=34$, $33x+32y=31$ respectively are:
(a) $-1, 2$ (b) $-1, 4$ (c) $1, -2$ (d) $-1, -4$

4. If A(3, $\sqrt{3}$); B(0, 0) and C(3, k) are the three vertices of an equilateral triangle ABC, then the value of k is
(a) 2 (b) -3 (c) $-\sqrt{3}$ (d) $-\sqrt{2}$

5. In figure, DE || BC, AD = 2 cm and BD = 3 cm, then ar (ΔABC) : ar (ΔADE) is equal to



(a) 4:25 (b) 2:3 (c) 9:4 (d) 25:4

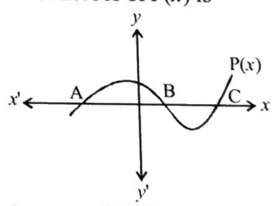
6. If $\cot\theta = \frac{1}{\sqrt{3}}$, then value of $\sec^2\theta + \text{cosec}^2\theta$ is
(a) 1 (b) $\frac{40}{9}$ (c) $\frac{38}{9}$ (d) $5\frac{1}{3}$

7. The area of a quadrant of a circle where the circumference of circle is 176 m, is
(a) 2464 m^2 (b) 1232 m^2 (c) 616 m^2 (d) 308 m^2

8. For an event E, $P(E)+P(\bar{E})=x$, then the valur of x^3-3 is
(a) -2 (b) 2 (c) 1 (d) -1

9. What is the greatest possible speed at which a girl can walk 95 m and 171 m in an exact number of minutes ?
(a) 17 m/min (b) 19 m/min
(c) 23 m/min (d) 13 m/min

10. In figure, the graph of a polynomial P(x) is shown. The number of zeroes of P(x) is



(a) 1 (b) 2 (c) 3 (d) 4

11. Two lines are given to be parallel. The equation of one of the lines is $3x-2y=5$. The equation of the second line can be
(a) $9x+8y=7$ (b) $-12x-8y=7$
(c) $-12x+8y=7$ (d) $12x+8y=7$

12. Three vertices of a parallelogram ABCD are A(1, 4), B(−2, 3) and C(5, 8). The ordinate of the fourth vertex D is
(a) 8 (b) 9 (c) 7 (d) 6

13. In ΔABC and ΔDEF, $\angle F = \angle C$, $\angle B = \angle E$ and $AB = \frac{1}{2}DE$.

Then the two triangles are
(a) Congruent, but not similar
(b) Similar but not congruent
(c) Neither congruent nor similar
(d) Congruent as well as similar

14. In ΔABC right angled at B, $\sin A = \frac{7}{25}$, then the value of $\cos C$ is

(a) $\frac{7}{25}$ (b) $\frac{24}{25}$ (c) $\frac{7}{24}$ (d) $\frac{24}{7}$

15. The minute hand of a clock is 84 cm long. The distance covered by the tip of minute hand from 10:10 am to 10:25 am is
(a) 44 cm (b) 88 cm (c) 132 cm (d) 176 cm

16. The probability that the drawn card from a pack of 52 cards is neither an ace nor a spade is

(a) $\frac{9}{13}$ (b) $\frac{35}{52}$ (c) $\frac{10}{13}$ (d) $\frac{19}{26}$

17. Three alarm clocks ring their alarms at regular intervals of 20 min, 25 min and 30 min respectively. If they first beep together at 12 noon, at what time will they beep again for the first time?
(a) 4:00 pm (b) 4:30 pm
(c) 5:00 pm (d) 5:30 pm

18. A quadratic polynomial, the product and sum of whose zeroes are 5 and 8 respectively is
(a) $k[x^2-8x+5]$ (b) $k[x^2+8x+5]$
(c) $k[x^2-5x+8]$ (d) $k[x^2+5x+8]$

19. Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y). The values of y are
(a) 1, –7 (b) –1, 7 (c) 2, 7 (d) –2, –7

20. Given that $\sec\theta = \sqrt{2}$, the value of $\frac{1+\tan\theta}{\sin\theta}$ is

(a) $2\sqrt{2}$ (b) $\sqrt{2}$ (c) $3\sqrt{2}$ (d) 2

SECTION - B

Q. No. 21 to 40 are of 1 mark each. Attempt any 16 from Q. 21 to 40

21. The greatest number which when divides 1251, 9377 and 15628 leaves remainder 1, 2 and 3 respectively is
(a) 575 (b) 450 (c) 750 (d) 625

22. Which of the following cannot be the probability of an event?

(a) 0.01 (b) 3% (c) $\frac{16}{17}$ (d) $\frac{17}{16}$

23. The diameter of a car wheel is 42 cm. The number of complete revolutions it will make in moving 132 km is
(a) 10^4 (b) 10^5 (c) 10^6 (d) 10^3

24. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\sin^3\theta + \cos^3\theta$ is

(a) 1 (b) $\frac{1}{2}$ (c) $\frac{\sqrt{2}}{2}$ (d) $\sqrt{2}$

25. The ratio in which the line $3x+y-9=0$ divides the line segment joining the points (1, 3) and (2, 7) is
(a) 3:2 (b) 2:3 (c) 3:4 (d) 4:3

26. If $x-1$ is a factor of the polynomial $p(x)=x^3+ax^2+2b$ and $a+b=4$, then
(a) $a=5, b=-1$ (b) $a=9, b=-5$
(c) $a=7, b=-3$ (d) $a=3, b=1$

27. If a and b are two coprime numbers, then a^3 and b^3 are
(a) Coprime (b) Not coprime
(c) Even (d) Odd

28. The area of a square that can be inscribed in a circle of area $\frac{1408}{7}$ cm^2 is

(a) 321 cm^2 (b) 642 cm^2 (c) 128 cm^2 (d) 256 cm^2

29. If A(4, –2), B(7, –2) and C(7, 9) are the vertices of a ΔABC, then ΔABC is
(a) equilateral triangle
(b) isosceles triangle
(c) right angled triangle
(d) isosceles right angled triangle

30. If α, β are the zeroes of the quadratic polynomial $p(x)=x^2-(k+6)x+2(2k-1)$, then the value of k, if $\alpha+\beta = \frac{1}{2}\alpha\beta$, is

(a) –7 (b) 7 (c) –3 (d) 3

31. If n is a natural number, then $2(5^n+6^n)$ always ends with
(a) 1 (b) 4 (c) 3 (d) 2

32. The line segment joining the points P(–3, 2) and Q(5, 7) is divided by the y-axis in the ratio
(a) 3:1 (b) 3:4 (c) 3:2 (d) 3:5

33. If $a\cot\theta + b\,\mathrm{cosec}\,\theta = p$ and $b\cot\theta + a\,\mathrm{cosec}\,\theta = q$, then $p^2-q^2=$
(a) a^2-b^2 (b) b^2-a^2 (c) a^2+b^2 (d) $b-a$

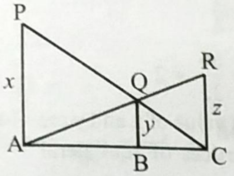
34. If the perimeter of a circle is half to that of a square, then the ratio of the area of the circle to the area of the square is
(a) 22:7 (b) 11:7 (c) 7:11 (d) 7:22

35. A dice is rolled twice. The probability that 5 will not come up either time is

(a) $\frac{11}{36}$ (b) $\frac{1}{3}$ (c) $\frac{13}{36}$ (d) $\frac{25}{36}$

36. The LCM of two numbers is 2400. Which of the following cannot be their HCF?
(a) 300 (b) 400 (c) 500 (d) 600

37. In fig., PA, QB and RC are each perpendicular to AC. If $x = 8$ cm and $z = 6$ cm, then y is equal to



(a) $\frac{56}{7}$ cm (b) $\frac{7}{56}$ cm (c) $\frac{25}{7}$ cm (d) $\frac{24}{7}$ cm

38. In a ΔABC, $\angle A = x°$, $\angle B = (3x - 2°)$, $\angle C = y°$. Also $\angle C - \angle B = 9°$, The sum of the greatest and the smallest angles of this triangle is

(a) 107° (b) 135° (c) 155° (d) 145°

39. If $\sec\theta + \tan\theta = p$, then $\tan\theta$ is

(a) $\frac{p^2+1}{2p}$ (b) $\frac{p^2-1}{2p}$ (c) $\frac{p^2-1}{p^2+1}$ (d) $\frac{p^2+1}{p^2-1}$

40. The base BC of an equilateral ΔABC lies on the y-axis. The co-ordinates of C are $(0, -3)$. If the origin is the mid-point of the base BC, what are the co-ordinates of A and B?

(a) $A(\sqrt{3}, 0)$; $B(0, 3)$ (b) $A(\pm 3\sqrt{3}, 0)$; $B(3, 0)$

(c) $A(\pm 3\sqrt{3}, 0)$; $B(0, 3)$ (d) $A(-\sqrt{3}, 0)$; $B(3, 0)$

SECTION - C

Q. No. 41 to 45 are based on Case Study-I, you have to answer any (4) four questions. Q. No. 46-50 are based on Case Study-II, you have to answer any (4) four questions.

Case Study-I

A book store shopkeeper gives books on rent for reading. He has variety of books in his store related to fiction, stories and quizzes etc. He takes a fixed charge for the first two days and an additional charge for subsequent day. Amruta paid ₹ 22 for a book and kept for 6 days, while Radhika paid ₹ 16 for keeping the book for 4 days.

Assume that the fixed charge be ₹ x and additional charge (per day) be ₹ y.

Based on the above information, answer any four of the following questions.

41. The situation of amount paid by Radhika, is algebraically represented by

(a) $x - 4y = 16$ (b) $x + 4y = 16$

(c) $x - 2y = 16$ (d) $x + 2y = 16$

42. The situation of amount paid by Amruta, is algebraically represented by

(a) $x - 2y = 11$ (b) $x - 2y = 22$

(c) $x + 4y = 22$ (d) $x - 4y = 11$

43. What are the fixed charges for a book?

(a) ₹ 9 (b) ₹ 10 (c) ₹ 13 (d) ₹ 15

44. What ar=e the additional charges for each subsequent day for a book ?

(a) ₹ 6 (b) ₹ 5 (c) ₹ 4 (d) ₹ 3

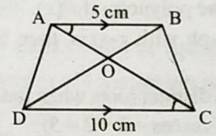
45. What is the total amount paid by both, if both of them have kept the book for 2 more days ?

(a) ₹ 35 (b) ₹ 52 (c) ₹ 50 (d) ₹ 58

Case Study-II

A farmer has a field in the shape of trapezium. whose map with scale 1 cm = 20 m, is given below :

The field is divided into four parts by joining the opposite vertices.



Based on the above information, answer any four of the following questions.

46. The two triangular regions AOB and COD are

(a) Similar by AA criterion

(b) Similar by SAS criterion

(c) Similar by RHS criterion

(d) Not similar

47. The ratio of the area of the ΔAOB to the area of ΔCOD, is

(a) 4 : 1 (b) 1 : 4 (c) 1 : 2 (d) 2 : 1

48. If the ratio of the perimeter of ΔAOB to the perimeter of ΔCOD would have been 1 : 4, then

(a) AB = 2 CD (b) AB = 4 CD

(c) CD = 2 AB (d) CD = 4 AB

49. If in Δs AOD and BOC, $\frac{AO}{BC} = \frac{AD}{BO} = \frac{OD}{OC}$, then

(a) $\Delta AOD \sim \Delta BOC$ (b) $\Delta AOD \sim \Delta BCO$

(c) $\Delta ADO \sim \Delta BCO$ (d) $\Delta ODA \sim \Delta OBC$

50. If the ratio of areas of two similar triangles AOB and COD is 1 : 4, then which of the following statements is true?

(a) The ratio of their perimeters is 3 : 4.

(b) The corresponding altitudes have a ratio 1 : 2.

(c) The medians have a ratio 1 : 4.

(d) The angle bisectors have a ratio 1 : 16.

Solutions

1. **(b)** Given number is 3750. [1 Mark]

Prime factorisation of 3750 = $5 \times 5 \times 5 \times 5 \times 2 \times 3$

$= 5^4 \times 2^1 \times 3^1$

5	3750
5	750
5	150
5	30
2	6
3	3
	1

Exponent of 5 = 4.

Note

a^m, a = base

m = exponent

2. **(d)** When polynomial $P(x)$ cuts the x-axis at 3 points and touches the x-axis at 2 points, then there are two pairs of equal roots of the polynomial $P(x)$.

Intersecting graph with x-axis, then the total number of roots = 3.

Total number of distinct roots when touches the x-axis = 2.

Total number of zeroes = 3 + 2 = 5. [1 Mark]

Note

When graph cuts the x-axis then it is considered as one zero & when touches it considered as two equal zeroes.

3. **(a)** $32x+33y=34$ ...(i)

$33x+32y=31$ ...(ii)

Apply substitution method.

$32x+33y=34$ {from (i)}

$33y=34-32x$

$$y=\frac{34}{33}-\frac{32}{33}x \quad ...(iii)$$

Substitute the value of y in eq. (ii)

$33x+32y=31$

$$33x+32\left(\frac{34}{33}-\frac{32}{33}x\right)=31$$

$$33x+\frac{1088-1024x}{33}=31$$

$1089x+1088-1024x=1023$

$65x=-65$

$x=-1$

From (iii)

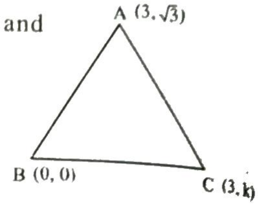
$$y=\frac{34}{33}-\frac{32}{33}\times(-1)$$

$$y=\frac{34+32}{33}=\frac{66}{33}=2$$

[1 Mark]

Therefore, the value of x and y are −1 and 2 respectively.

4. **(c)** Given, vertices of equilateral triangle $A(3,\sqrt{3})$; B(0, 0) and C(3, k).



So, AC = CB

$$\sqrt{(3-3)^2+(k-\sqrt{3})^2}$$

$$=\sqrt{(0-3)^2+(0-k)^2}$$

$$\sqrt{(k-\sqrt{3})^2}=\sqrt{9+k^2}$$

Take square both sides,

$k^2+3-2\sqrt{3}k=9+k^2$

$-2\sqrt{3}k=6$

$-\sqrt{3}k=3$

$$k=\frac{-3}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}$$

$k=-\sqrt{3}$

Therefore, the value of k is $-\sqrt{3}$. [1 Mark]

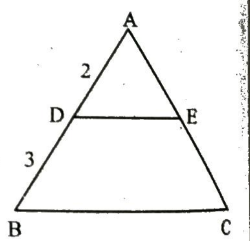
Note

All three sides of equilateral triangle are equal.

5. **(d)** Given, DE ∥ BC

Then, $\Delta ADE \sim \Delta ABC$

Apply ratio of area theorem



$$\frac{ar(\Delta ABC)}{ar(\Delta ADE)}=\left(\frac{AB}{AD}\right)^2=\frac{(2+3)^2}{(2)^2}$$

$$\frac{ar(\Delta ABC)}{ar(\Delta ADE)}=\frac{25}{4}$$

Therefere, $ar(\Delta ABC) : ar(\Delta ADE) = 25 : 4$. [1 Mark]

6. **(d)** Given, $\cot\theta=\frac{1}{\sqrt{3}}$

$\cot\theta=\cot 60°$

$\theta=60°$

$\sec^2\theta+\text{cosec}^2\theta=\sec^2 60+\text{cosec}^2 60$

$$=(2)^2+\left(\frac{2}{\sqrt{3}}\right)^2$$

$$=4+\frac{4}{3}=\frac{12+4}{3}=\frac{16}{3}=5\frac{1}{3}$$

[1 Mark]

7. (c) Given, circumference of circle = 176

$2\pi r = 176$

$2 \times \frac{22}{7} \times r = 176$

$r = 28$ m

Area of quadrant $= \frac{\theta}{360} \times \pi r^2$

$= \frac{90}{360} \times \frac{22}{7} \times 28 \times 28$

$= 616$ m^2. [1 Mark]

8. (a) Given, $P(E) + P(\bar{E}) = x$

Sum of probabilities is 1.

so, $P(E) + P(\bar{E}) = 1$

$x^3 - 3 = (1)^3 - 3 = 1 - 3 = -2.$ [1 Mark]

Note

Sum of all probabilities is 1.

Then, x = 1.

9. (b) Given, distances covered by girl are 95m and 171m.

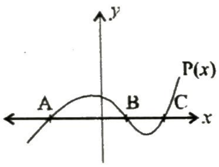
$95 = 5 \times 19$

$171 = 3 \times 3 \times 19$

H.C.F of $(95, 171) = 19$

Girl can cover maximum distance 19m in 1 min. Therefore, the speed is 19m/min. [1 Mark]

10. (c)



Graphs intersects at three points A, B and C. Then, the number of zeroes are 3. [1 Mark]

11. (c) Given, line is $3x - 2y = 5$

Take line $-12x + 8y = 7$

$-4(3x - 2y) = 7$

$3x - 2y = -\frac{7}{4}$

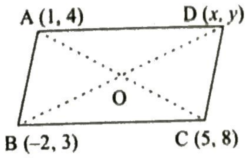
$\left\{\begin{array}{l}\text{General form} \\ ax + by = c \\ ax + by = c'\end{array}\right.$ [1 Mark]

Therefore, the other parallel line is $-12x + 8y = 7$.

12. (b) Let $D(x, y)$

Mid point $O = \left(\frac{1+5}{2}, \frac{4+8}{2}\right)$

$= \left(\frac{6}{2}, \frac{12}{2}\right) = (3, 6)$



Coordinate O will also the midpoint of BD.

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

$6 = x - 2$

$x = 8$

$\frac{x+3}{2} = 6$

$x + 3 = 12$

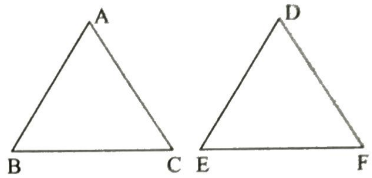
$x = 9$ [1 Mark]

Coordinate $D(x, y) \rightarrow D(8, 9)$, ordinate = 9.

Note

Ordinate stands for 'y' coordinate of the ordered pair.

13. (b)



Given, $\angle F = \angle C$

$\angle B = \angle E$

Then $\Delta ABC \sim \Delta DEF$ (by AA criterion)

Then, $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = \frac{1}{2}$

For congruent sides should be equal. [1 Mark]

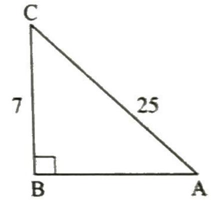
Therefore, triangles are similar but not congruent.

14. (a) $\sin A = \frac{7}{25} = \frac{P}{H}$

Apply pythagoras theorem

$\cos C = \frac{B}{H} = \frac{BC}{AC}$

$= \frac{7}{25}$



[1 Mark]

15. (a) Angle of 1 division $= \frac{360}{12} = 30°$

Angle between 10 : 10 am to 10 : 25 am $= 30 \times 3 = 90°$

Distance covered by minute tip $= \frac{\theta}{360} \times 2\pi r$

$= \frac{30}{360} \times 2 \times \frac{22}{7} \times 84$

$= 44$ cm [1 Mark]

Note

There are 3 divisions in the given time interval.

16. (a) There are total 4 ace and 13 spade in a well shuffled card.

Number of cards other than ace and spade

$= 52 - (4 + 12) = 52 - 16 = 36$

Probability $\overline{(\text{ace and spade})} = \frac{36}{52} = \frac{9}{13}$ [1 Mark]

17. **(c)** Given, regular intervals are 20 min, 25 min and 30 min.

L.C.M of (20, 25, 30) $= 2 \times 5 \times 2 \times 3 \times 5$
$= 300$ min.

2	20, 25, 30
5	10, 25, 15
2	2, 5, 3
3	1, 5, 3
5	1, 5, 2
	1, 1, 1

They beep together at 12 noon, then they beep after 300 minutes again.

$$300 \text{ min} = \frac{300}{60} = 5 \text{ h}$$

All clocks will beep again together at 5 : 00 pm. [1 Mark]

18. **(c)** Given product and sum of zeroes are 5 and 8 respectively.

$P(x) = x^2 - Sx + P$

Here, $S = 5, P = 8$

$P(x) = x^2 - 5x + 8$ [1 Mark]

Therefore, $k[x^2 - 5x + 8]$ is the required polynomial.

Note

When we multiply the quadratic polynomial with 'k' then it will also considered as quadratic polynomial.

19. **(b)** Centre $O(2, -3y)$ and point $A(-1, y)$ and $B(5, 7)$.

OA and OB are radii of circle.

$OA = OB$

$$\sqrt{(-1-2)^2 + (y+3y)^2} = \sqrt{(5-2)^2 + (7+3y)^2}$$

Take square both sides.

$9 + 16y^2 = 9 + 49 + 9y^2 + 42y$

$7y^2 - 42y - 49 = 0$

$7(y^2 - 6y - 7) = 0$

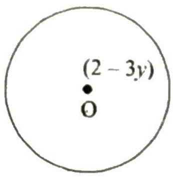
$y^2 - 6y - 7 = 0$

$y^2 - 7y + y - 7 = 0$

$y(y-7) + 1(y-7) = 0$

$(y-7)(y+1) = 0$

$y = 7, -1$ [1 Mark]



Therefore, the values of y are 7 and –1.

20. **(a)** $\sec\theta = \sqrt{2}$

$\sec\theta = \sec 45°$

$\theta = 45°$

Put $\theta = 45°$ in the given expression,

$$\frac{1+\tan\theta}{\sin\theta} = \frac{1+\tan 45°}{\sin 45°} = \frac{1+1}{\frac{1}{\sqrt{2}}} = 2\sqrt{2}$$ [1 Mark]

21. **(d)** Three numbers are 1251, 9377, 15628 and the respective remainders are 1, 2 & 3.

$(1251 - 1) = 1250$

$(9377 - 2) = 9375$

$(15628 - 3) = 15625$

H.C.F of (1250, 9375, 15625) is shown below.

$1250 = 2 \times 5 \times 5 \times 5 \times 5$

$9375 = 3 \times 5 \times 5 \times 5 \times 5 \times 5$

$15625 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$

H.C.F of (1250, 9375, 15625) $= 5 \times 5 \times 5 \times 5 = 625$

Therefore, the greatest no. is 625. [1 Mark]

22. **(b)** Probability of an event cannot be in the percentage and cannot be greater than one. [1 Mark]

23. **(b)** Diameter of car wheel = 42 cm

$$\text{radius} = \frac{42}{2} = 21 \text{ cm.}$$

Let the number of revolutions is n

$n \times 2\pi r = 10^5 \times 132$ cm

$$n \times 2 \times \frac{22}{7} \times 21 = 10^5 \times 132$$

$n = 10^5$ [1 Mark]

Therefore, the number of revolutions are 10^5.

24. **(c)** $\tan\theta + \cot\theta = 2$

$$\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = 2$$

$$\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta} = 2$$

$$\frac{1}{2\sin\theta\cos\theta} = 1$$

$\Rightarrow \sin 2\theta = 1$

$\sin 2\theta = \sin 90°$

$2\theta = 90°$

$\theta = 45°$

$$\sin^3\theta + \cos^3\theta = (\sin 45°)^3 + (\cos 45°)^3$$

$$= \left(\frac{1}{\sqrt{2}}\right)^3 + \left(\frac{1}{\sqrt{2}}\right)^3$$

$$= \frac{1}{2\sqrt{2}} + \frac{1}{2\sqrt{2}} = \frac{2}{2\sqrt{2}} = \frac{\sqrt{2}}{2}$$ [1 Mark]

25. **(c)**

Let the ratio be $k : 1$

Apply section formula,

$$x = \frac{2k+1}{k+1}, \quad y = \frac{7k+3}{k+1}$$

These two coordinates also satisfied the line $3x + y - 9 = 0$

$$3\left(\frac{2k+1}{k+1}\right) + \left(\frac{7k+3}{k+1}\right) - 9 = 0$$

$6k + 3 + 7k + 3 - 9k - 9 = 0$

$4k = 3$

$$k = \frac{3}{4}$$

Therefore, the required ratio is 3 : 4. [1 Mark]

26. **(b)** $p(x) = x^3 + ax^2 + 2b$

If $(x-1)$ is the factor of the polynomial $p(x)$

then $x = 1$ is the zero of the polynomial & $p(1) = 0$

put $x = 1$ in the polynomial $p(x)$.

$p(1) = 1 + a + 2b = 0$

$a + 2b = -1$ ....(i)

$a + b = 4$ ....(ii)

Subtract (ii) from (i)

$$\begin{array}{l} a + 2b = -1 \\ \underline{a + \ \ b = 4} \\ \quad b = -5 \end{array}$$

From (ii)

$a + b = 4$

$a - 5 = 4$

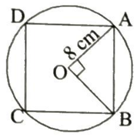
$\boxed{a = 9}$ [1 Mark]

27. **(a)** Given a and b are coprime, whose H.C.F is 1.

Then, a^3 & b^3 also the coprime numbers.

Whose H.C.F is 1. [1 Mark]

28. **(c)** Area of circle $= \frac{1408}{7}$ cm^2



$\pi r^2 = \frac{1408}{7}$

$\frac{22}{7} \times r^2 = \frac{1408}{7}$

$r = 8$cm

In ΔAOB

Apply pythagoras theorem,

$AB^2 = OA^2 + OB^2$

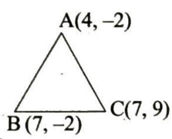
$AB^2 = 8^2 + 8^2 = 64 + 64 = 128$

$AB = 8\sqrt{2}$ cm

Area of square = (side)$^2 = \left(8\sqrt{2}\right)^2$

$= 128$ cm^2 [1 Mark]

29. **(c)** Given vertices of triangle ABC is $A(4, -2)$; $B(7, -2)$ and $C(7, 9)$



$AB = \sqrt{(-2+2)^2 + (7-4)^2} = 3$

$BC = \sqrt{(7-7)^2 + (9+2)^2} = 11$

$AC = \sqrt{(7-4)^2 + (9+2)^2} = \sqrt{130}$

Apply pythagoras theorem,

$AC^2 = AB^2 + BC^2$

$\left(\sqrt{130}\right)^2 = (3)^2 + (11)^2$

$130 = 9 + 121$

$130 = 130$ [1 Mark]

So, these vertices forms the right angle triangle.

Note

We cannot say anything about triangle by coordinates. So, we need to find distances by using the coordinates.

30. **(b)** $p(x) = x^2 - (k+6)x + 2(2k-1)$

$\alpha + \beta = \frac{-b}{a}$

$\alpha + \beta = \frac{(k+6)}{1} = k + 6$

$\alpha\beta = \frac{c}{a} = 2(2k-1)$

$\alpha + \beta = \frac{1}{2}\alpha\beta$

$(k+6) = \frac{1}{2} \times 2(2k-1)$

$k + 6 = 2k - 1$

$\boxed{7 = k}$

Therefore, the value of k is 7. [1 Mark]

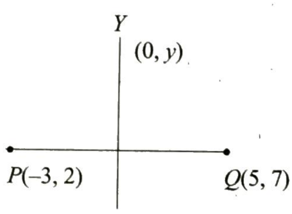
31. **(d)** Number $2(5^n + 6^n)$ contains power n to the base 5 and 6.

For every $n \in N$ 5^n ends with 5 and 6^n ends with 6.

Sum of 5 & 6 is 11, then $2 \times 11 = 22$. [1 Mark]

Therefore, the number always ends with 2.

32. **(d)** Given points of the line PQ is $P(-3, 2)$ & $Q(5, 7)$



Let the ratio be $k : 1$

$x = \frac{k \times 5 + 1 \times (-3)}{k+1}$

$0 = \frac{5k - 3}{k+1}$

$5k - 3 = 0$

$5k = 3$

$k = \frac{3}{5}$

Therefore, the ratio is 3 : 5 [1 Mark]

33. **(b)** $a \cot\theta + b \operatorname{cosec}\theta = p$ ..... (i)

$b \cot\theta + a \operatorname{cosec}\theta = q$ ..... (ii)

$p^2 - q^2 = (p-q)(p+q)$ .....(iii)

Add (i) & (ii)

$p + q = (a+b)\cot\theta + (a+b)\operatorname{cosec}\theta$

$p + q = (a+b)(\cot\theta - \operatorname{cosec}\theta)$

Subtract (i) & (ii)

$p - q = (a-b)(\cot\theta - \operatorname{cosec}\theta)$

Substitute the values in eq. (iii)

$(p^2 - q^2) = (p-q)(p+q)$

$= [(a-b)(\cot\theta - \operatorname{cosec}\theta)][(a+b)(\cot\theta + \operatorname{cosec}\theta)]$

$= (a^2 - b^2)(\cot^2\theta - \operatorname{cosec}^2\theta)$

$p^2 - q^2 = -(a^2 - b^2) = b^2 - a^2$ [1 Mark]

34. **(d)** Perimeter of circle $= \frac{1}{2}$(Perimeter of square)

$$2\pi r = \frac{1}{2} \times a \times 4$$

$$\frac{a}{r} = \frac{22}{7} \Rightarrow \frac{r}{a} = \frac{7}{22} \quad \text{......(i)}$$

$$\frac{\text{area of circle}}{\text{area of square}} = \frac{\pi r^2}{a^2}$$

$$= \frac{22}{7} \times \frac{7}{22} \times \frac{7}{22} \quad \text{[from (i)]}$$

$$= \frac{7}{22}$$

Required ratio is 7 : 22 [1 Mark]

35. **(d)** Total sample space $= 6^2 = 36$

$$S = \begin{cases} (1,1)\ (1,2)\ (1,3)\ (1,4)\ (1,5)\ (1,6) \\ (2,1)\ (2,2)\ (2,3)\ (2,4)\ (2,5)\ (2,6) \\ (3,1)\ (3,2)\ (3,3)\ (3,4)\ (3,5)\ (3,6) \\ (4,1)\ (4,2)\ (4,3)\ (4,4)\ (4,5)\ (4,6) \\ (5,1)\ (5,2)\ (5,3)\ (5,4)\ (5,5)\ (5,6) \\ (6,1)\ (6,2)\ (6,3)\ (6,4)\ (6,5)\ (6,6) \end{cases}$$

P(5 not come either time) $= \frac{25}{36}$ [1 Mark]

36. **(c)** LCM = 2400

HCF of two numbers will always divide the LCM of two numbers.

Factors of 2400 $= 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5 \times 5$

$2 \times 2 \times 5 \times 5 \times 3 = 300$

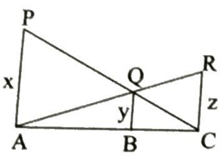
$2 \times 2 \times 5 \times 5 \times 3 \times 2 = 600$

$2 \times 2 \times 5 \times 5 \times 2 \times 2 = 400$

As per options, it will give all numbers except 500.

[1 Mark]

37. **(d)**



Here, AP ⊥ AC, QB ⊥ AC, RC ⊥ AC

Then AP ∥ BQ, BQ ∥ RC, AP ∥ RC.

Given, $x = 8$ cm, $z = 6$ cm.

In ΔAQP & ΔRQC.

∠PQA = ∠RQC [vertically opp. angle]

∠QPA = ∠QCR [alternate interior angle]

ΔAQP ~ ΔRQC [by AA criterion]

So, $\frac{AP}{CR} = \frac{AQ}{RQ}$

$$\frac{x}{z} = \frac{AQ}{RQ}$$

$$\frac{8}{6} = \frac{AQ}{RQ} \quad \text{..... (i)}$$

In ΔABQ & ΔACR.

∠A = ∠A [common]

∠AQB = ∠ARC [corresponding angle]

ΔABQ ~ ΔACR [by AA criterion]

$$\frac{BQ}{CR} = \frac{AQ}{AR} \quad \text{..... (ii)}$$

from (i)

$$\frac{8}{6} = \frac{AQ}{RQ} \Rightarrow \frac{RQ}{AQ} = \frac{6}{8}$$

Add both side 1

$$\frac{8+6}{8} = \frac{AQ+RQ}{AQ}$$

$$\frac{14}{8} = \frac{AR}{AQ} \Rightarrow \frac{AQ}{AR} = \frac{8}{14}$$

Substitute the value in eq. (ii)

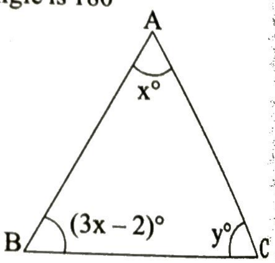
$$\frac{y}{z} = \frac{8}{14}$$

$$\frac{y}{6} = \frac{8}{14}$$

$$y = \frac{24}{7} \text{ cm.}$$

[1 Mark]

38. **(a)** Sum of all angles of triangle is 180°



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

$x + 3x - 2 + y = 180°$

$4x + y = 182$ .... (i)

$\angle C - \angle B = 9°$ (Given)

$y - 3x + 2 = 9$

$-3x + y = 7$

$3x - y = -7$ .... (ii)

Add (i) and (ii)

$4x + y = 182$

$3x - y = -7$

$7x = 175$

$x = 25$

From (ii)

$3x - y = -7$

$3 \times 25 - y = -7$

$75 + 7 = y$

$y = 82°$

$\angle A = x° = 25° \rightarrow$ Smallest angle

$\angle B = (3x - 2)° = 3 \times 25 - 2 = 75 - 2 = 73°$

$\angle C = y° = 82° \rightarrow$ Greatest angle

Sum of $\angle A + \angle C = x + y$

$= 25 + 82$

$= 107°$

[1 Mark]

39. **(b)** $\sec\theta + \tan\theta = p$ ...(i)

$$\frac{1}{\sec\theta + \tan\theta} = \frac{1}{p}$$

$$\frac{1}{\sec\theta + \tan\theta} \times \frac{\sec\theta - \tan\theta}{\sec\theta - \tan\theta} = \frac{1}{p}$$

$$\frac{\sec\theta - \tan\theta}{\sec^2\theta - \tan^2\theta} = \frac{1}{p} \quad \therefore \{\sec^2\theta - \tan^2\theta = 1\}$$

$\sec\theta - \tan\theta = \frac{1}{p}$ ...(ii)

Subtract (ii) from (i)

$\sec\theta + \tan\theta = p$

$\sec\theta - \tan\theta = \frac{1}{p}$

$-\quad + \quad -$

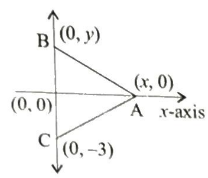
$2\tan\theta = p - \frac{1}{p}$

$\tan\theta = \left(\frac{p^2-1}{2p}\right)$ [1 Mark]

40. **(c)** Given origin is the midpoint of the line BC.

Let B(0, y) and A(x, 0).

Apply midpoint formula.



$0 = \frac{y-3}{2} \Rightarrow y = 3$

$\Rightarrow B \to (0, 3)$

ΔABC is an equilateral triangle.

AB = BC

$\sqrt{(x-0)^2 + (0-3)^2} = \sqrt{(0-0)^2 + (-3-3)^2}$

$\sqrt{x^2+9} = \sqrt{36}$

Take square both sides,

$x^2 + 9 = 36$

$x^2 = 27 \Rightarrow x \pm 3\sqrt{3}$

$A = (\pm 3\sqrt{3}, 0)$ [1 Mark]

Case Study - I

41. **(d)** Let the fixed charge for first two days be ₹ x and additional charges be ₹ y per day.

Radhika situation algebraically represented as

$x + 2y = 16$. [1 Mark]

42. **(c)** According to question, Amruta situation represented as $x + 4y = 22$. [1 Mark]

43. **(b)** System of linear equations are represented as:

$x + 4y = 22$ ...(i)

$x + 2y = 16$ ...(ii)

Subtract (ii) from (i) by using elimination method,

$x + 4y = 22$

$x + 2y = 16$

$- \quad -$

$2y = 6$

$y = 3$

From (ii)

$x + 2y = 16$

$x + 2 \times 3 = 16$

$x + 6 = 16$

$x = 10$

Fixed charges is ₹ 10. [1 Mark]

44. **(d)** From solution Q. 43, the value of additional charges $y = 3$. [1 Mark]

45. **(c)** If both of them kept book for 2 more day at ₹ 3 per day then the total amount paid by both is represented as.

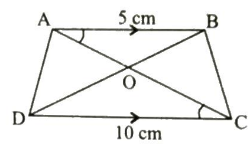
Amount of 2 more days for Amruta = 2×3 = ₹ 6

Amount of 2 more days for Radhika = 2×3 = ₹ 6

Total amount paid by both = 22 + 16 + 6 + 6

= ₹ 50. [1 Mark]

Case Study - II



Common solution:

In ΔAOB and ΔCOD

$\angle$AOB = $\angle$COD (Vertically opposite angle)

$\angle$OAB = $\angle$OCD (Alternate interior angle)

$\Delta AOB \sim \Delta COD$ (by AA criterion)

So, $\frac{AB}{CD} = \frac{AO}{CO} = \frac{OB}{OD}, \frac{AB}{CD} = \frac{5}{10} = \frac{1}{2}$.

46. **(a)** Given ΔAOB and ΔCOD are similar by AA criterion. [1 Mark]

47. **(b)** As ΔAOB and ΔCOD are similar, then the ratio their corresponding sides will also equal.

So, $\frac{AO}{CO} = \frac{OB}{OD} = \frac{AB}{CD} = \frac{5}{10} = \frac{1}{2}$

By ratio of area of similar triangle theorem,

$\frac{ar(\Delta AOB)}{ar(\Delta COD)} = \left(\frac{AB}{CD}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

ar(ΔAOB) : ar (ΔCOD) = 1 : 4 [1 Mark]

48. **(d)** Given $\frac{OA+OB+AB}{OC+OD+CD} = \frac{1}{4}$, then the ratio of their corresponding sides also be 1 : 4.

So, $\frac{AB}{CD} = \frac{1}{4}$ {If we add numerator and denominator. individually of the ratio of sides then, it will give the same ratio of the perimeter.}

CD = 4AB [1 Mark]

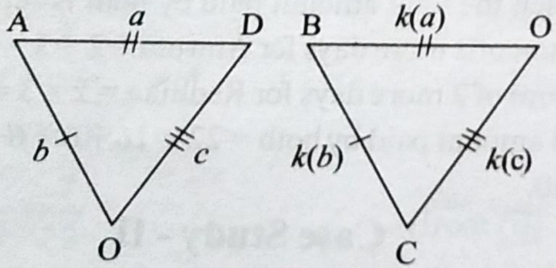
Note

Ratio of corresponding sides of two similar triangles will also equal to the ratio of their perimeters.

49. **(b)** In ΔAOD and ΔBOC,

$$\frac{AO}{BC}=\frac{AD}{BO}=\frac{OD}{OC} \text{ (Given)}$$

So, the representation of triangles would be:



Therefore, $\Delta AOD \sim \Delta BCO$

(by SSS proportional criterion). [1 Mark]

50. **(b)** Given, ratio of areas of two similar triangles is 1 : 4.

$$\frac{ar(\Delta AOB)}{ar(\Delta COD)}=\left(\frac{AB}{CD}\right)^2$$

$$\frac{1}{4}=\left(\frac{AB}{CD}\right)^2$$

$$\frac{AB}{CD}=\frac{1}{2}=\frac{\text{alt. of } \Delta AOB}{\text{alt. of } \Delta COD}$$

[1 Mark]

Note

The ratio of sides of two similar triangles will also equal to the ratio of their corresponding altitudes.