CBSE Sample Question Paper (2023-24)

Mathematics

(Basic)

Class-X

Solved

(with Marking Scheme)

CBSE SAMPLE QUESTION PAPER (2023-24)
with MARKING SCHEME
Mathematics (Basic)

Time Allowed : 3 Hours | **CLASS-X** | *Maximum Marks* : 80

General Instructions :

1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 5 marks each.
6. Section E has 3 sourced based/Case Based/passage based/integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

SECTION 'A'

1. If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$; x, y are prime numbers, then HCF (a, b) is :

(*a*) xy (*b*) xy^2 (*c*) x^3y^3 (*d*) x^2y^2

Ans. (*b*) xy^2 1

2. The LCM of smallest two-digit composite number and smallest composite number is :

(*a*) 12 (*b*) 4 (*c*) 20 (*d*) 44

Ans. (*c*) 20 1

3. If $x = 3$ is one of the roots of the quadratic equation $x^2 - 2kx - 6 = 0$, then the value of k is

(*a*) $-\frac{1}{2}$ (*b*) $\frac{1}{2}$ (*c*) 3 (*d*) 2

Ans. $\frac{1}{2}$ 1

4. The pair of equations $y = 0$ and $y = -7$ has :

(*a*) One solution (*b*) Two solutions

(*c*) Infinitely many solutions (*d*) No solution

Ans. (*d*) No solution 1

5. Value(s) of k for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is :

(*a*) 0 only (*b*) 4 (*c*) 8 only (*d*) 0, 8

Ans. (*d*) 0, 8 1

6. The distance of the point (3, 5) from x-axis is k units, then k equals :

(*a*) 3 (*b*) -3 (*c*) 5 (*d*) -5

Ans. (*c*) 5 1

7. If in ΔABC and ΔPQR, we have $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$ then :

(*a*) $\Delta PQR \sim \Delta CAB$ (*b*) $\Delta PQR \sim \Delta ABC$ (*c*) $\Delta CBA \sim \Delta PQR$ (*d*) $\Delta BCA \sim \Delta PQR$

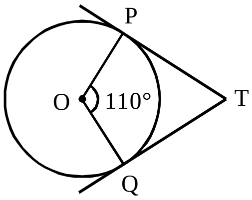
Ans. (*a*) $\Delta PQR \sim \Delta CAB$ 1

8. Which of the following is NOT a similarity criterion ?

(*a*) AA (*b*) SAS (*c*) AAA (*d*) RHS

Ans. (*d*) RHS 1

9. In figure, if TP and TQ are the two tangents to a circle with centre O so that $\angle POQ = 110°$, then $\angle PTQ$ is equal to



(*a*) 60° (*b*) 70° (*c*) 80° (*d*) 90°

Ans. (*b*) 70° 1

10. If cos A = $\frac{4}{5}$ then the value of tan A is :

(*a*) $\frac{3}{5}$ (*b*) $\frac{3}{4}$ (*c*) $\frac{4}{3}$ (*d*) $\frac{1}{8}$

Ans. (*b*) $\frac{3}{4}$ 1

11. If the height of the tower is equal to the length of its shadow, then the angle of elevation of the sun is _________.

(*a*) 30° (*b*) 45° (*c*) 60° (*d*) 90°

Ans. (*b*) 45° 1

12. $1 - \cos^2 A$ is equal to

(*a*) $\sin^2 A$ (*b*) $\tan^2 A$ (*c*) $1 - \sin^2 A$ (*d*) $\sec^2 A$

Ans. (*a*) $\sin^2 A$ 1

13. The radius of a circle is same as the side of a square. Their perimeters are in the ratio

(*a*) 1 : 1 (*b*) 2 : π (*c*) π : 2 (*d*) $\sqrt{\pi} : 2$

Ans. (*c*) π : 2 1

14. The area of the circle is 154cm2. The radius of the circle is

(*a*) 7 cm (*b*) 14 cm (*c*) 3.5 cm (*d*) 17.5 cm

Ans. (*a*) 7 cm

15. When a dice is thrown once, the probability of getting an even number less than 4 is

(*a*) $\frac{1}{4}$ (*b*) 0 (*c*) $\frac{1}{2}$ (*d*) $\frac{1}{6}$

Ans. (*d*) $\frac{1}{6}$ 1

16. For the following distribution :

Class	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency	10	15	12	20	9

The lower limit of modal class is :

(*a*) 15 (*b*) 25 (*c*) 30 (*d*) 35

Ans. (*a*) 15 1

17. A rectangular sheet of paper 40cm × 22 cm, is rolled to form a hollow cylinder of height 40 cm. The radius of the cylinder (in cm) is :

(*a*) 3.5 (*b*) 7 (*c*) 807 (*d*) 5

Ans. (*a*) 3.5 1

18. Consider the following frequency distribution :

Class	**0 – 6**	**6 – 12**	**12 – 18**	**18 – 24**	**24 – 30**
Frequency	**12**	**10**	**15**	**8**	**11**

The median class is :

(*a*) 6 – 12 (*b*) 12 – 18 (*c*) 18 – 24 (*d*) 24 – 30

Ans. (*b*) 12 – 18 1

19. Assertion (A) : The point (0, 4) lies on y-axis.

Reason (R) : The x coordinate of the point on y-axis is zero.

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertions (A) is true but reason (R) is false.

(*d*) Assertions (A) is false but reason (R) is true.

Ans. (*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). 1

20. Assertion (A) : The HCF of two numbers is 5 and their product is 150. Then their LCM is 40.

Reason (R) : For any two positive integers a and b, HCF $(a, b) \times$ LCM $(a, b) = a \times b$.

(*a*) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(*b*) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(*c*) Assertions (A) is true but reason (R) is false.

(*d*) Assertions (A) is false but reason (R) is true.

Ans. (*d*) Assertions (A) is false but reason (R) is true. 1

SECTION 'B'

21. Find whether the following pair of linear equations is consistent or inconsistent :

$$3x + 2y = 8$$
$$6x - 4y = 9$$

Ans. $3x + 2y = 8$

$6x - 4y = 9$

$a_1 = 3,\ b_1 = 2,\ c_1 = 8$

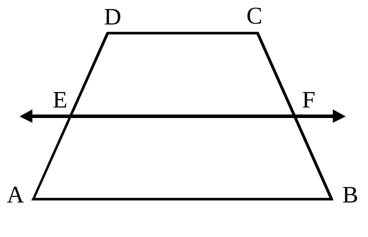
$a_2 = 6,\ b_2 = 4,\ c_2 = 9$ 1

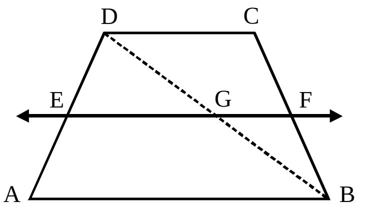
$$\frac{a_1}{a_2} = \frac{3}{6} = \frac{1}{2},\quad \frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2},\quad \frac{c_1}{c_2} = \frac{8}{9}$$ 1/2

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

The given pair of linear equations are consistent. 1/2

22. In the given figure, if ABCD is a trapezium in which AB || CD || EF, then prove that $\frac{AE}{ED} = \frac{BF}{FC}$.





Ans. Given : AB || CD || EF

To prove : $\frac{AE}{ED} = \frac{BF}{FC}$

Construction : Join BD to intersect EF at G. 1/2

Proof : In ΔABD, EG || AB (EF || AB)

$$\frac{AE}{ED} = \frac{BG}{GD} \quad \text{(by BPT)} \quad ...(1)$$ 1/2

In ΔDBC, GF || CD (EF || CD)

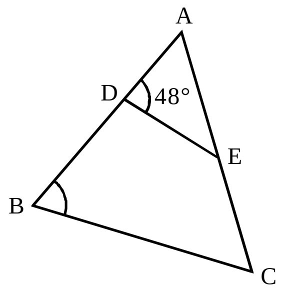
$$\frac{BF}{FC} = \frac{BG}{GD} \quad \text{(by BPT)} \quad ...(2)$$ 1/2

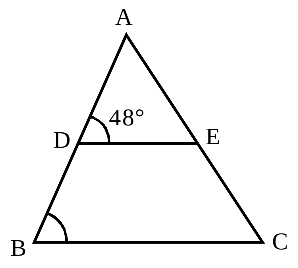
From (1) and (2)

$$\frac{AE}{ED} = \frac{BF}{FC}$$ 1/2

Or

In figure, if AD = 6 cm, DB = 9 cm, AE = 8 cm and EC = 12 cm and ∠ADE = 48°. Find ∠ABC.





Ans. Given : AD = 6 cm, DB = 9 cm
AE = 8 cm, EC = 12 cm, ∠ADE = 48°

To find : ∠ABC = ?

Proof : In ΔABC, $\frac{AD}{DB} = \frac{6}{9} = \frac{2}{3}$ ...(1)

$\frac{AE}{EC} = \frac{8}{12} = \frac{2}{3}$ ...(2)

From (1) and (2), 1

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

DE || BC (Converse of BPT)

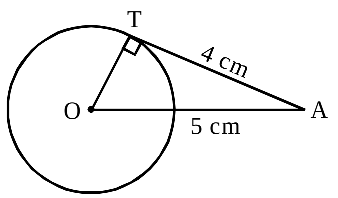
∠ADE = ∠ABC (Corresponding angles)

⇒ ∠ABC = 48. 1

23. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle.

Ans. In ΔOTA, ∠OTA = 90.

By Pythagoras theorem



$OA^2 = OT^2 + AT^2$ 1/2

$(5)^2 = OT^2 + (4)^2$

$25 - 16 = OT^2$

$9 = OT^2$ 1/2

OT = 3 cm

Radius of circle = 3 cm. 1

24. Evaluate : $\sin^2 60° + 2 \tan 45° - \cos^2 30°$.

Ans. $\sin^2 60° + 2 \tan 45° - \cos^2 30°$

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

$$= \frac{3}{4} + 2 - \frac{3}{4}$$

$$= 2 \qquad 1$$

25. What is the diameter of a circle whose area is equal to the sum of the areas of two circles of radii 40 cm and 9 cm ?

Ans. Area of the circle = Sum of areas of 2 circles

$$\pi R^2 = \pi(40)^2 + \pi(9)^2 \qquad 1/2$$

$$\pi R^2 = \pi \times (40^2 + 9)^2 \qquad 1/2$$

$$R^2 = 1600 + 81$$

$$R^2 = 1681$$

$$R = 41 \text{ cm.} \qquad 1/2$$

Diameter of given circle = 41 × 2 = 82 cm 1/2

Or

A chord of a circle of radius 10 cm subtends a right angle at the centre. Find area of minor segment. (Use $\pi = 3.14$)

Ans. Radius of circle = 10 cm, $\theta = 90°$

$$\text{Area of minor segment} = \frac{\theta}{360°}\pi r^2 - \text{Area of } \Delta$$

$$= \frac{\theta}{360°} \times \pi r^2 - \frac{1}{2} \times b \times h \qquad 1/2$$

$$= \frac{90°}{360°} \times 3.14 \times 10 \times 10 - \frac{1}{2} \times 10 \times 10 \qquad 1/2$$

$$= \frac{314}{4} - 50$$

$$= 78.5 - 50 = 28.5 \text{ cm}^2 \qquad 1/2$$

Area of minor segment = 28.5 cm^2 1/2

SECTION 'C'

26. Prove that $\sqrt{3}$ is an irrational number.

Ans. Let us assume that $\sqrt{3}$ be a rational number.

$$\sqrt{3} = \frac{a}{b} \text{ where } a \text{ and } b \text{ are co-prime.} \qquad 1$$

Squaring both sides,

$$(\sqrt{3})^2 = \left(\frac{a}{b}\right)^2 \qquad 1/2$$

$$3 = \frac{a^2}{b^2} \Rightarrow a^2 = 3b^2$$

a^2 is divisible by 3 so a is also divisible by 3. ...(1)

Let $a = 3c$ for any integer c.

$$(3c)^2 = 3b^2 \qquad 1/2$$

$$9c^2 = 3b^2$$

$$b^2 = 3c^2$$

Since a^2 is divisible by 3 so, b is also divisible by 3. ...(2)

From (1) and (2), we can say that 3 in a factor of a and b 1/2

which is contradicting the fact that a and b are co- prime.

Thus, our assumption that $\sqrt{3}$ is a rational number is wrong.

Hence, $\sqrt{3}$ is an irrational number. 1/2

27. Find the zeroes of the quadratic polynomial $4s^2 - 4s + 1$ and verify the relationship between the zeroes and the coefficients.

Ans. $P(S) = 4S^2 - 4S + 1$

$$4S^2 - 2S - 2S + 1 = 0$$

$$2S(2S - 1) -1 (2S - 1) = 0$$

$$(2S - 1)(2S - 1) = 0$$

$$S = \frac{1}{2} \quad S = \frac{1}{2}$$ 1

$a = 4,\ b = -4,\ c = 1,\ \alpha = \frac{1}{2},\ \beta = \frac{1}{2}$

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

LHS $= \alpha + \beta = \frac{1}{2} + \frac{1}{2} = 1$, RHS $= \frac{-b}{a} = \frac{(-4)}{4} = 1$, hence proved. 1

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

LHS $= \alpha\beta = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$, RHS $= \frac{c}{a} = \frac{1}{4}$, hence proved. 1

28. The coach of a cricket team buys 4 bats and 1 ball for ₹ 2050. Later, she buys 3 bats and 2 balls for ₹ 1600. Find the cost of each bat and each ball.

Ans. Let cost of one bat be ₹ x.

Let cost of one ball be ₹ y. 1/2

According to the question,

$$4x + 1y = 2050 \quad ...(1)$$

$$3x + 2y = 1600 \quad ...(2)$$ 1/2

From (1),

$$4x + 1y = 2050$$

$$y = 2050 - 4x$$ 1/2

Substitute value of y in (2),

$$3x + 2(2050 - 4x) = 1600$$

$$3x + 4100 - 8x = 1600$$

$$-5x = -2500$$

$$x = 500$$ 1/2

Substitute value of x in (1),

$$4x + 1y = 2050$$

$$4(500) + y = 2050$$

$$2000 + y = 2050$$

$$y = 50$$ 1/2

Hence, cost of one bat = ₹ 500 1/2

Cost of one ball = ₹ 50

Or

A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid ₹ 27 for a book kept for seven days, while Susy paid ₹ 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Ans. Let the fixed charge for first 3 days = ₹ x

and additional charge after 3 days = ₹ y 1/2

According to the question,

$$x + 4y = 27 \quad ...(1)$$

$$x + 2y = 21 \quad ...(2)$$ 1/2

Subtract eqn. (2) from (1),

$$2y = 6$$

$$y = 3$$ 1

Substitute value of y in (2),

$$x + 2(3) = 21$$

$$x = 21 - 6$$

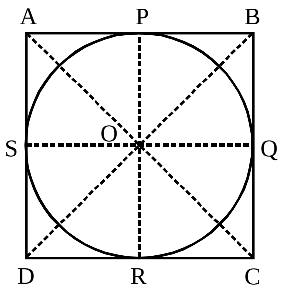
$$x = 15$$ 1

Fixed charge = ₹ 15

Additional charge per day = ₹ 3

29. A circle touches all the four sides of quadrilateral ABCD. Prove that AB + CD = AD + BC.

Ans. Given circle touching sides of ABCD at P, Q, R and S.



To prove : AB + CD = AD + BC

Proof : 1

AP = AS ...(1) tangents from an external point

PB = BQ ...(2) to a circle are equal in length

DR = DS ...(3)

CR = CQ ...(4) 1

Adding eqn. (1), (2), (3) and (4),

AP + BP + DR + CR = AS + DS + BQ + CQ

AB + DC = AD + BC 1

30. Prove that $(\text{cosec}\,\theta - \cot\theta)^2 = \dfrac{1-\cos\theta}{1+\cos\theta}$

Ans. $(\text{cosec}\,\theta - \cot\theta)^2 = \dfrac{1-\cos\theta}{1+\cos\theta}$

$$\text{LHS} = (\text{cosec}\,\theta - \cot\theta)^2$$

$$= \left(\frac{1}{\sin\theta} - \frac{\cos\theta}{\sin\theta}\right)^2$$ 1/2

$$= \left(\frac{1-\cos\theta}{\sin\theta}\right)^2$$ 1/2

$$= \frac{(1-\cos\theta)^2}{\sin^2\theta}$$

$$= \frac{(1-\cos\theta)^2}{1-\cos^2\theta}$$ 1

$$= \frac{(1-\cos\theta)^2}{(1-\cos\theta)(1+\cos\theta)}$$

$$= \frac{1-\cos\theta}{1-\cos\theta} = \text{RHS}$$ 1

LHS = RHS. Hence proved.

Or

Prove that sec A (1 – sin A) (sec A + tan A) = 1.

Ans. sec A (1 – sin A) (sec A + tan A) = 1

$$\text{LHS} = \frac{1}{\cos A}(1-\sin A)\left(\frac{1}{\cos A}+\frac{\sin A}{\cos A}\right)$$ 1

$$= \frac{(1-\sin A)}{\cos A}\,\frac{(1+\sin A)}{\cos A}$$

$$= \frac{(1-\sin A)(1+\sin A)}{\cos^2 A}$$

$$= \frac{1-\sin^2 A}{\cos^2 A} \qquad (1-\sin^2 A = \cos^2 A)$$ 1

$$= \frac{\cos^2 A}{\cos^2 A}$$

= 1 = RHS

LHS = RHS. Hence proved.

31. A bag contains 6 red, 4 black and some white balls.

(*i*) Find the number of white balls in the bag if the probability of drawing a white ball is $\frac{1}{3}$.

(*ii*) How many red balls should be removed from the bag for the probability of drawing a white ball to be $\frac{1}{2}$?

Ans. (*i*) Red balls = 6, Black balls = 4, White balls = x

$$\text{P(white ball)} = \frac{x}{10+x} = \frac{1}{3}$$ 1

$\Rightarrow$ $3x = 10 + x \Rightarrow x = 5$ white balls 1/2

(*ii*) Let y red balls be removed, black balls = 4, white balls = 5

$$\text{P(white balls)} = \frac{5}{(6-y)+4+5} = \frac{1}{2}$$ 1

$\Rightarrow$ $\frac{5}{15-y} = \frac{1}{2} \Rightarrow 10 = 15 - y \Rightarrow y = 5$ 1/2

So, 5 balls should be removed.

SECTION 'D'

32. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

Ans. Let the speed of train be x km/hr. 1/2

Distance = 360 km

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Time} = \frac{360}{x} \qquad 1/2$$

New speed = $(x + 5)$ km/hr

$$\text{Time} = \frac{D}{5}$$

$$x + 5 = \frac{360}{\left(\frac{360}{x} - 1\right)} \qquad 1$$

$$x + 5\left(\frac{360}{x} - 1\right) = 360$$

$$(x + 5)(360 - x) = 360x$$

$$-x^2 - 5x + 1800 = 0$$

$$x^2 - 5x - 1800 = 0 \qquad 1$$

$$x^2 + 45x - 40x - 1800 = 0$$

$$x(x + 45) - 40(x + 45) = 0$$

$$(x + 45)(x - 40) = 0 \qquad 1$$

$$x + 45 = 0 \qquad x - 40 = 0$$

$$x = -45 \qquad x = 40$$

Speed cannot be negative

Speed of train = 40 km/hr 1

Or

A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.

Ans. Let the speed of the stream = x km/hr 1/2

Speed of boat = 18 km/hr

Upstream speed = $(18 - x)$ km/hr

Downstream speed = $(18 + x)$ km/hr 1/2

$$\text{Time taken (upstream)} = \frac{24}{(18 - x)}$$

$$\text{Time taken (downstream)} = \frac{24}{(18 + x)}$$

According to the question,

$$\frac{24}{(18 - x)} = \frac{24}{(18 + x)} + 1 \qquad 1$$

$$\frac{24}{(18 - x)} - \frac{24}{(18 + x)} = 1$$

$$24(18 + x) - 24(18 - x) = (18 - x)(18 + x)$$

$$24(2x) = 324 - x^2$$

$$48x - 324 + x^2 = 0$$

$$x^2 + 48x - 324 = 0 \qquad 1$$

$$x^2 - 6x + 54x - 324 = 0$$

$$x(x - 6) + 54(x - 6) = 0$$

$$(x - 6)(x + 54) = 0 \qquad 1$$

$$x - 6 = 0 \qquad x + 54 = 0$$
$$x = 6 \qquad x = -54$$

Speed cannot be negative 1

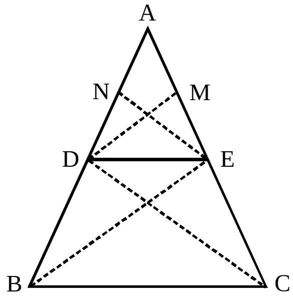
Speed of stream = 6 km/hr

33. Prove that If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

In ΔPQR, S and T are points on PQ and PR respectively. $\frac{PS}{SQ} = \frac{PT}{TR}$ and ΔPST = ΔPRQ. Prove that PQR is an isosceles triangle.

Ans. Given : ΔABC, DE || BC

To prove : $\frac{AD}{DB} = \frac{AE}{EC}$



Construction : Join BE and CD. 1/2

Draw DM ⊥ AC and EN ⊥ AB.

Proof : Area of ΔADE $= \frac{1}{2} \times b \times h$

$$= \frac{1}{2} \times AD \times EN \quad ...(1)$$

Area of (ΔDBE) $= \frac{1}{2} \times DB \times EN \quad ...(2)$

Divide eqn. (1) by (2),

$$\frac{ar\ \Delta ADE}{ar\ \Delta DBE} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB} \quad ...(3)$$ 1

Area of ΔADE $= \frac{1}{2} \times AE \times DM \quad ...(4)$

Area of ΔDEC $= \frac{1}{2} \times EC \times DM \quad ...(5)$

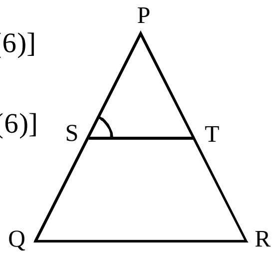
Divide eqn. (4) by (5),

$$\frac{ar\ \Delta ADE}{ar\ \Delta DEC} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC} \quad ...(6)$$ 1

ΔBDE and ΔDEC are on the same base DE and between same parallel lines EC and DE.

∴ ar (ΔDBE) = ar (ΔDEC)

Hence, $\frac{ar\ (\Delta ADE)}{ar\ (\Delta DBE)} = \frac{ar\ (\Delta ADE)}{ar\ (\Delta DEC)}$ [LHS of (3) = RHS of (6)]



$\frac{AD}{DB} = \frac{AE}{EC}$ [RHS of (3) = RHS of (6)] 1/2

Since, $\frac{PS}{SQ} = \frac{PT}{TR}$

∴ ST || QR [By converse of BPT]

∠PST = ∠PQR [Corresponding angles] 1

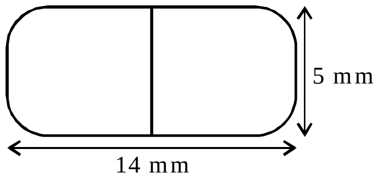
But, ∠PST = ∠PRQ [Given]

∠PQR = ∠PRQ

PR = PQ [Sides opposite to equal angles are equal]

Hence, ΔPQR is isosceles. 1

34. A medicine capsule is in the shape of a cylinder with two hemispheres stuck at each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm. Find its surface area.



Ans. Diameter of cylinder and hemisphere = 5 mm radius, $(r) = \frac{5}{2}$

Total length = 14 mm

Height of cylinder = 14 – 5 = 9 mm 1

CSA of cylinder = $2.rh$

$= 2 \times \frac{22}{7} \times \frac{5}{2} \times 9$

$= \frac{990}{7}$ mm^2 1

CSA of hemispheres = $2 \times r^2$

$= 2 \times \frac{22}{7} \times \left(\frac{5}{2}\right)^2$

$= \frac{275}{7}$ mm^2 1

CSA of 2 hemispheres = $2 \times \frac{275}{7}$

$= \frac{550}{7}$ mm^2 1

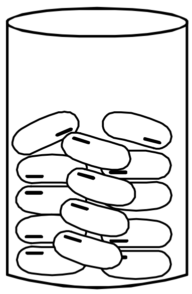
Total area of capsule = $\frac{990}{7} + \frac{550}{7}$

$= \frac{1540}{7}$

= 220 mm^2 1

Or

A gulab jamun, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns, each shaped like cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.



Ans. Diameter of cylinder = 2.8 cm

Radius of cylinder = $\frac{2.8}{2}$ = 1.4 cm

Radius of cylinder = Radius of hemisphere = 1.4 cm

Height of cylinder = 5 – 2.8 1

= 2.2 cm

Volume of 1 gulab jamun = Volume of cylinder + 2 × Volume of hemisphere

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

$= \frac{22}{7} \times (1.4)^2 \times 2.2 + 2 \times \frac{2}{3} \times \frac{22}{7} \times (1.4)^3$

= 13.55 + 11.50

= 25.05 cm^3 1

Volume of 45 gulab jamuns = 45 × 25.05

Syrup in 45 gulab jamuns = 30% × 45 × 25.05

$= \frac{30}{100} \times 45 \times 25.05$ 1

= 338.175 cm^3

= 338 cm^3

35. The following table gives the distribution of the life time of 400 neon lamps :

Life time (in hours)	Number of lamps
1500 – 2000	14
2000 – 2500	56
2500 – 3000	60
3000 – 3500	86
3500 – 4000	74
4000 – 4500	62
4500 – 5000	48

Find the average life time of a lamp.

Ans.

Life time (in hours)	Number of lamps (f)	Mid x	d	fd
1500 – 2000	14	1750	– 1500	– 21000
2000 – 2500	56	2250	– 1000	– 56000
2500 – 3000	60	2750	– 500	– 3000
3000 – 3500	86	3250	0	0
3500 – 4000	74	3750	500	37000
4000 – 4500	62	4250	1000	62000
4500 – 5000	48	4750	1500	72000
	400			64000

2

Mean $= a + \frac{\Sigma fd}{\Sigma f}$ 1/2

a = 3250 1/2

Mean $= 3250 + \frac{64000}{400}$ 1

= 3250 + 160 = 3410

Average life of lamp is 3410 hr. 1

SECTION 'E'

36. CASE STUDY 1

India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.

(*i*) In which year, the production is ₹ 29,200.

(*ii*) Find the production during 8th year.

Or

Find the production during first 3 years.

(*iii*) Find the difference of the production during 7th year and 4th year.

Ans.

$a_6 = 16000$

$a_9 = 22600$

$a + 5d = 16000$ ...(1)

$a + 8d = 22600$ ...(2)

Substitute $a = 1600 - 5d$ from (1),

$16000 - 5d + 8d = 22600$

$3d = 22600 - 16000$

$3d = 6600$

$d = \frac{6600}{3} = 2200$

$a = 16000 - 5(2200)$

$a = 16000 - 11000$

$a = 5000$

(*i*) $a_n = 29200,\ a = 5000,\ d = 2200$

$a_n = a + (n - 1)\ d$

$29200 = 5000 + (n - 1)\ 2200$ 1/2

$29200 - 5000 = 2200n - 2200$

$24200 + 2200 = 2200n$

$26400 = 2200n$

$n = \frac{264}{22}$

$n = 12$ 1/2

In 12th year the production was ₹ 29,200.

(*ii*) $n = 8,\ a = 5000,\ d = 2200$

$a_n = a + (n - 1)\ d$ 1/2

$= 5000 + (8 - 1)\ 2200$ 1/2

$= 5000 + 7 \times 2200$

$= 5000 + 15400$ 1/2

$= 20400$

The production during 8th year is 20,400. 1/2

Or

$n = 8,\ a = 5000,\ d = 2200$

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

$= \frac{3}{2}\ [2(5000) + (3 - 1)\ 2200]$

$S_3 = \frac{3}{2}\ (10000 + 2 \times 2200)$ 1/2

$= \frac{3}{2}\ (10000 + 4400)$ 1/2

$= 3 \times 7200$

$= 21600$ 1/2

The production during first 3 year is 21,600.

(*ii*) $a_4 = a + 3d$

$= 5000 + 3\ (2200)$

$= 5000 + 6600$

$= 11600$ 1/2

$a_7 = a + 6d$

$= 5000 + 6 \times 2200$

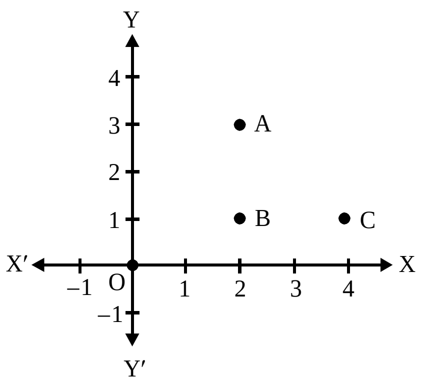
$= 5000 + 13200$

$= 18200$

$a_7 - a_4 = 18200 - 11600 = 6600$ 1/2

37. CASE STUDY 2

Alia and Shagun are friends living on the same street in Patel Nagar. Shagun's house is at the intersection of one street with another street on which there is a library. They both study in the same school and that is not far from Shagun's house. Suppose the school is situated at the point O, *i.e.*, the origin, Alia's house is at A. Shagun's house is at B and library is at C. Based on the above information, answer the following questions.



(*i*) How far is Alia's house from Shagun's house?

(*ii*) How far is the library from Shagun's house?

(*iii*) Show that for Shagun, school is farther compared to Alia's house and library.

Or

Show that Alia's house, Shagun's house and library for an isosceles right triangle.

Ans. Coordinates of A (2, 3) Alia's house

Coordinates of B (2, 1) Shagun's house

Coordinates of C (4, 1) Library

(*i*) $$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{(2-2)^2 + (1-3)^2}$$ 1/2

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

$$AB = \sqrt{0+4} = \sqrt{4} = 2 \text{ units}$$ 1/2

Alia's house from Shagun's house is 2 units.

(*ii*) C(4, 1), B (2, 1)

$$CB = \sqrt{(2-4)^2 - (1-1)^2}$$ 1/2

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

$$= \sqrt{4+0} = \sqrt{4} = 2 \text{ units}$$ 1/2

(*iii*) O(0, 0), B(2, 1)

$$OB = \sqrt{(2-0)^2 + (1-0)^2}$$

$$= \sqrt{2^2 + 1^2} = \sqrt{4+1} = 5 \text{ units}$$ 1

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units 1/2

OB is greater than AB and CB, 1/2

For Shagun, school [O] is farther than Alia's house [A] and Library [C]

Or

C(4, 1), A(2, 3)

$$CA = \sqrt{(2-4)^2 + (3-1)^2}$$

$$= \sqrt{(-2)^2 + 2^2} = \sqrt{4+4} = \sqrt{8}$$

$$= 2\sqrt{2} \text{ units} \quad AC^2 = 8$$ 1

Distance between Alia's house and Shagun's house, AB = 2 units

Distance between Library and Shagun's house, CB = 2 units 1/2

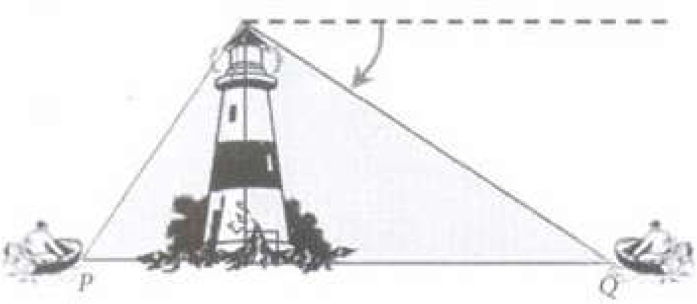
$$AB^2 + BC^2 = 2^2 + 2^2$$

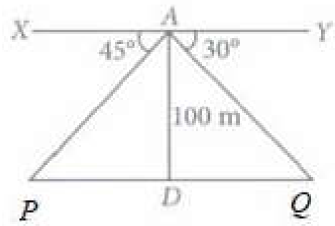
$$= 4 + 4 = 8 = AC^2$$ 1/2

Therefore A, B and C form an isosceles right triangle.

38. CASE STUDY 3

A boy is standing on the top of light house. He observed that boat P and boat Q are approaching the light house from opposite directions. He finds that angle of depression of boat P is 45° and angle of depression of boat Q is 30°. He also knows that height of the light house is 100 m.





Based on the above information, answer the following questions.

(*i*) What is the measure of ∠APD?

(*ii*) If ∠YAQ = 30°, then ∠AQD is also 30°. Why?

(*iii*) How far is boat P from the light house?

Or

How far is the boat Q from the light house?

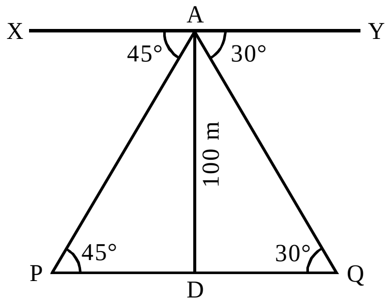
Ans. (*i*) XY ∥ PQ and AP is transversal.

∠APD = ∠PAX (alternative interior angles) 1/2

∠APD = 30° 1/2

(*ii*) ∠YAQ = 30°

∠AQD = 30° 1/2



Because XY ∥ PQ and AQ is a transversal.

So alternate interior angles are equal.

∠YAQ = ∠AQD 1/2

(*iii*) In ΔADP

$$\tan 45° = \frac{100}{PD}$$ 1/2

$$1 = \frac{100}{PD}$$ 1/2

PD = 100 m

Boat P is 100 m from the light house. 1

Or

In ΔADQ

$$\tan 30° = \frac{100}{DQ}$$ 1/2

$$\frac{1}{\sqrt{3}} = \frac{100}{DQ}$$ 1/2

$$DQ = 100\sqrt{3} \text{ m}$$

Boat Q is $100\sqrt{3}$ m from the light house. 1