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SAMPLE PAPER TEST 01 FOR BOARD EXAM 2024
(ANSWERS)

SUBJECT: MATHEMATICS — **MAX. MARKS : 80**
CLASS : X — **DURATION : 3 HRS**

General Instruction:
1. This Question Paper has 5 Sections A-E.
2. **Section A** has 20 MCQs carrying 1 mark each.
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 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 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A
Questions 1 to 20 carry 1 mark each.

1. In a formula racing competition, the time taken by two racing cars A and B to complete 1 round of the track is 30 minutes and p minutes respectively. If the cars meet again at the starting point for the first time after 90 minutes and the HCF (30, p) = 15, then the value of p is
(a)45 minutes (b)60 minutes (c)75 minutes (d)180 minutes
Ans: (a)45 minutes
LCM = 90 and HCF = 15
We know that HCF x LCM = Product of two numbers
$\Rightarrow$ 15 x 90 = 30 x p
$\Rightarrow$ p = 45

2. The solution of the following pair of equation is:
$x – 3y = 2$, $3x – y = 14$
(a) x = 5, y = 1 (b) x = 2, y = 3 (c) x = 1, y = 2 (d) x = 1, y = 4
Ans: (a) x = 5, y = 1
Given, equations are $x – 3y = 2$ …(i)
and $3x – y = 14$ …(ii)
Solving equations (i) and (ii), we get y = 1
$x = 2 + 3y = 2 + 3 \times 1 = 5$
Hence, x = 5 and y = 1

3. If two positive integers a and b are written as $a = x^3y^2$ and $b = xy^3$, where x and y are prime numbers, then the HCF (a, b) is:
(a) xy (b) xy^2 (c) x^3y^3 (d) x^2y^2
Ans: (b) Here, $a = x^3y^2$ and $b = xy^3$
$\Rightarrow a = x \times x \times x \times y \times y$ and $b = xy \times y \times y$
$\therefore$ HCF(a, b) $= x \times y \times y = x \times y^2 = xy^2$

4. The ratio in which x-axis divides the join of (2, -3) and (5, 6) is:
(a) 1: 2 (b) 3 : 4 (c) 1: 3 (d) 1: 5
Ans: (a) 1 : 2

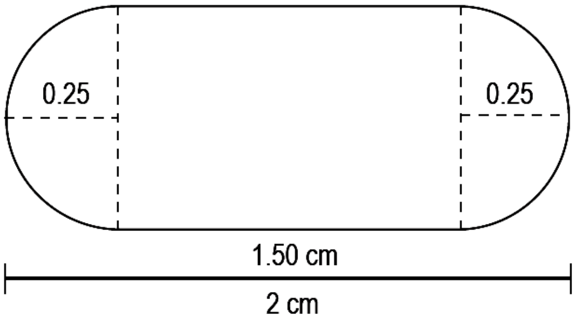
Let P(x, 0) be the point on x-axis which divides the join of (2, -3) and (5, 6) in the ratio k : 1.
∴ By section formula,

$$P(x, 0) = \left(\frac{5k+2}{k+1}, \frac{6k-3}{k+1}\right)$$

$$\Rightarrow y = 0 \Rightarrow \frac{6k-3}{k+1} = 0 \Rightarrow 6k - 3 = 0 \Rightarrow k = \frac{1}{2}$$

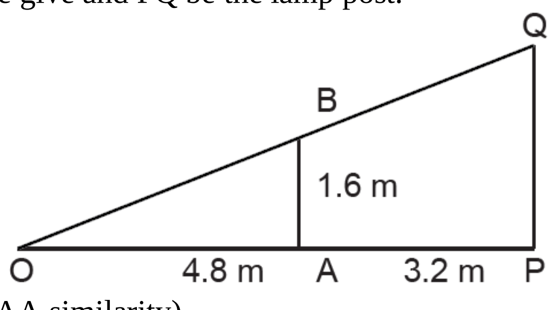
5. The 11th and 13th terms of an AP are 35 and 41 respectively, its common difference is
(a) 38 (b) 32 (c) 6 (d) 3
Ans: (d) 3
Given, $a_{11} = 35 \Rightarrow a + 10d = 35$ ...(i)
and, $a_{13} = 41 \Rightarrow a + 12d = 41$ ...(ii)
Subtracting (i) from (ii), we get
$2d = 6 \Rightarrow d = 3$

6. A medicine-capsule is in the shape of a cylinder of radius 0.25 cm with two hemispheres stuck to each of its ends. The length of the entire capsule is 2 cm. What is the total surface area of the capsule? (Take π as 3.14)



(a) 0.785 cm^2 (b) 0.98125 cm^2 (c) 2.7475 cm^2 (d) 3.14 cm^2
Ans: (d) 3.14 cm^2
Total surface area of the capsule = curved surface area of cylindrical portion + 2 × curved surface area of hemispherical portion
$= 2\pi rh + 2 \times 2\pi r^2 = 2\pi rh + 4\pi r^2$
$= 2\pi r(h + 2r)$
$= 2\pi r(1.50 + 0.50) = 4\pi r$
$= 4 \times 3.14 \times 0.25 = 3.14\ cm^2$

7. A 1.6 m tall girl stands at distance of 3.2 m from a lamp post and casts shadow of 4.8 m on the ground, then the height of the lamp post is
(a) 8 m (b) 4 m (c) 6 m (d) 8/3 m
Ans: (d) 8/3 m
Let AB be the position of the give and PQ be the lamp post.



Now, Δ OAB ~ ΔOPQ (by AA similarity)

$$\therefore \frac{OA}{OP} = \frac{AB}{PQ} \Rightarrow \frac{4.8}{4.8+3.2} = \frac{1.6}{PQ} \Rightarrow \frac{4.8}{8} = \frac{1.6}{PQ} \Rightarrow PQ = \frac{16\times 8}{48} = \frac{8}{3} m$$

8. A tangent is drawn from a point at a distance of 17 cm of circle (O, r) of radius 8 cm. The length of tangent is

(a) 5 cm (b) 9 cm (c) 15 cm (d) 23 cm

Ans: (c) 15 cm

9. The runs scored by a batsman in 35 different matches are given below:

Runs Scored	0-15	15-30	30-45	45-60	60-75	75-90
Frequency	5	7	4	8	8	3

The lower limit of the median class is

(a) 15 (b) 30 (c) 45 (d) 60

Ans: (c) 45

Runs Scored	0-15	15-30	30-45	45-60	60-75	75-90
Frequency	5	7	4	8	8	3
cf	5	12	16	24	32	35

Here, n = 35 ⇒ n/2 = 17.5

Median class is 45 – 60

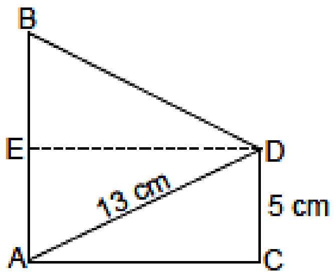
Hence, lower limit is 45

10. If in two triangles, DEF and PQR, $\angle D=\angle Q$ and $\angle R=\angle E$, then which of the following is not true?

(a) $\frac{EF}{PR}=\frac{DF}{PQ}$ (b) $\frac{EF}{RP}=\frac{DE}{PQ}$ (c) $\frac{DE}{QR}=\frac{DF}{PQ}$ (d) $\frac{EF}{RP}=\frac{DE}{QR}$

Ans: (b) $\frac{EF}{RP}=\frac{DE}{PQ}$

11. In the given figure, if AB = 14 cm, then the value of tan B is:



(a) $\frac{4}{3}$ (b) $\frac{14}{3}$ (c) $\frac{5}{3}$ (d) $\frac{13}{3}$

Ans: (a) $\frac{4}{3}$

$AC = \sqrt{13^2-5^2} = 12$

DE = AC = 12 cm, BE = 14 cm – 5 cm = 9 cm

In ΔBED, $\tan B = \frac{DE}{BE} = \frac{12}{9} = \frac{4}{3}$.

12. Two cubes each with 6 cm edge are joined end to end. The surface area of the resulting cuboid is

(a) 180 cm^2 (b) 360 cm^2 (c) 300 cm^2 (d) 260 cm^2

Ans: (b) 360 cm^2

If two cubes of edges 6 cm are joined face to face it will take the shape of a cuboid whose length, breadth and height are (6 + 6) cm, 6cm and 6cm i.e. 12 cm, 6cm and 6cm respectively.

Thus, total surface area of the cuboid = 2 (lb + bh + lh)

= 2 (12× 6 + 6× 6 + 12× 6)

= 2 (72 + 36 + 72)

= 2 ×180 cm^2 = 360 cm^2

13. A cone, a hemisphere and cylinder are of the same base and of the same height. The ratio of their volumes is

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

Ans: (a) 1 : 2 : 3

Let the base radii of them be r and height h.

Then ratio of volumes

cone : hemisphere : cylinder

$$= \frac{1}{3}\pi r^2 h : \frac{2}{3}\pi r^3 : \pi r^2 h = \frac{1}{3}\pi r^2 r : \frac{2}{3}\pi r^3 : \pi r^2 r \ (\because r = h)$$

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

14. The probability of getting a bad egg in a lot of 400 is 0.035. The number of bad eggs in the lot is

(a) 7 (b) 14 (c) 21 (d) 28

Ans: (b) 14

Total number of eggs = 400

Probability of getting a bad egg P(E) = 0.035

Consider x as the number of bad eggs

P(E) = Number of bad eggs/ Total number of eggs

Substituting the values

$0.035 = x/400 \Rightarrow 35/1000 = x/400 \Rightarrow x = 35/1000 \times 400$

$\Rightarrow x = 140/10 \Rightarrow x = 14$

15. If $\sqrt{3}\ \sin\theta - \cos\theta = 0$ and $0° < \theta < 90°$, find the value of θ.

(a) 30° (b) 45° (c) 60° (d) 90°

Ans: (a) 30°

$\sqrt{3}\ \sin\theta - \cos\theta = 0 \Rightarrow \sqrt{3}\ \sin\theta = \cos\theta$

$$\Rightarrow \sqrt{3} = \frac{\cos\theta}{\sin\theta} \Rightarrow \cot\theta = \sqrt{3} = \cot 30^0 \Rightarrow \theta = 30°$$

16. Find the value of k for which the equation $x^2 + k(2x + k - 1) + 2 = 0$ has real and equal roots.

(a) 2 (b) 3 (c) 4 (d) 5

Ans: (a) 2

Given quadratic equation: $x^2 + k(2x + k - 1) + 2 = 0$

$\Rightarrow x^2 + 2kx + (k^2 - k + 2) = 0$

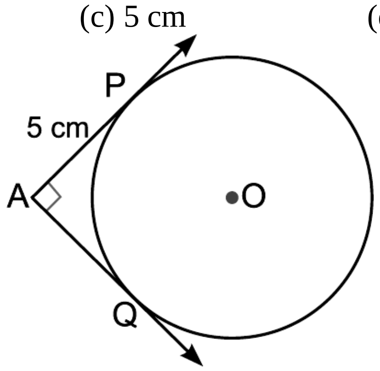
For equal roots, $b^2 - 4ac = 0$

$\Rightarrow 4k^2 - 4k^2 + 4k - 8 = 0$

$\Rightarrow 4k = 8 \Rightarrow k = 2$

17. In the below figure, the pair of tangents AP and AQ drawn from an external point A to a circle with centre O are perpendicular to each other and length of each tangent is 5 cm. Then radius of the circle is

(a) 10 cm (b) 7.5 cm (c) 5 cm (d) 2.5 cm



Ans: (c) 5 cm
we know that radius of a circle is perpendicular to the tangent at the point of contact
$\Rightarrow OP \perp AP$ and $OQ \perp AQ$
Also sum of all angles of a quadrilateral is 360°
$\Rightarrow \angle O + \angle P + \angle A + \angle Q = 360°$
$\Rightarrow \angle O + 90° + 90° + 90° = 360°$
$\Rightarrow \angle O = 360° - 270° = 90°$
Thus $\angle O = \angle P = \angle A = \angle Q = 90°$ and OP = OQ (radii)
$\Rightarrow$ OPAQ is a square
$\Rightarrow$ radius = OP = OQ = AP = AQ = 5 cm

18. The radii of two cylinders are in the ratio 5 : 7 and their heights are in the ratio 3 : 5. The ratio of their curved surface area is
(a) 3 : 7 (b) 7 : 3 (c) 5 : 7 (d) 3 : 5
Ans: (a) 3 : 7
Ratio of their curved surface area $= \dfrac{2\pi r_1 h_1}{2\pi r_2 h_2} = \dfrac{r_1}{r_2} \times \dfrac{h_1}{h_2} = \dfrac{5}{7} \times \dfrac{3}{5} = \dfrac{3}{7}$

Direction : In the question number 19 & 20 , A statement of Assertion (A) is followed by a statement of Reason(R) . Choose the correct option

19. Assertion (A): If x = 2 $\sin^2\theta$ and y = 2 $\cos^2\theta$ + 1 then the value of x + y = 3.
Reason (R): For any value of θ, $\sin^2\theta + \cos^2\theta = 1$
Ans: We know that for any value of θ, $\sin^2\theta + \cos^2\theta = 1$
So, Reason is correct.
For assertion: We have x = 2 $\sin^2\theta$ and y = 2 $\cos^2\theta$ + 1
Then, x + y = 2 $\sin^2\theta$ + 2 $\cos^2\theta$ + 1
= 2($\sin^2\theta + \cos^2\theta$) + 1
= 2 x 1 + 1 [$\because$ $\sin^2\theta + \cos^2\theta = 1$]
= 2 + 1 = 3.
Hence, Assertion is also correct.
Correct option is (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

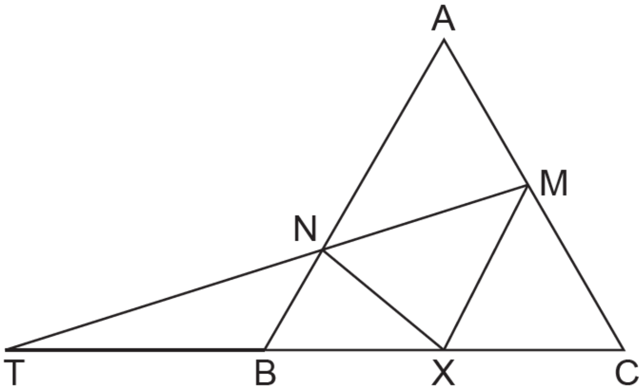
20. Assertion (A): The length of the minute hand of a clock is 7 cm. Then the area swept by the minute hand in 5 minute is 77/6 cm^2.
Reason (R): The length of an arc of a sector of angle q and radius r is given by $l = \dfrac{\theta}{360^0} \times 2\pi r$
Ans: (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of Assertion (A)

SECTION-B
Questions 21 to 25 carry 2M each

21. Find the point on *y*-axis which is equidistant from the points (5, – 2) and (–3, 2).
Ans: Let point on *y*-axis be (0, *a*)
Now distance of this point from (5, –2) is equal to distance from point (–3, 2)
i.e., $\sqrt{5^2 + (-2-a)^2} = \sqrt{3^2 + (a-2)^2}$
Squaring and simplifying, we get
$25 + 4 + a^2 + 4a = 9 + a^2 + 4 - 4a \Rightarrow 8a = -16 \Rightarrow a = -2$
Hence, the required point is (0, –2)

22. X is a point on the side BC of ΔABC. XM and XN are drawn parallel to AB and AC respectively meeting AB in N and AC in M. MN produced meets CB produced at T. Prove that $TX^2 = TB \times TC$.

Ans: In △TXM, $XM \parallel BN \Rightarrow \frac{TB}{TX} = \frac{TN}{TM}$ ......(1)



In △TMC, $\frac{TX}{TC} = \frac{TN}{TM}$ ....(2)

From 1 and 2, we have $\frac{TB}{TX} = \frac{TX}{TC} \Rightarrow TX^2 = TB \times TC$

23. The probability of selecting a blue marble at random from a jar that contains only blue, black and green marbles is 1/5. The probability of selecting a black marble at random from the same jar is 1/4. If the jar contains 11 green marbles, find the total number of marbles in the jar.

Ans: Let A be the event of getting blue marbles, B be the event of getting black marbles and C be the event of getting green marbles.

P(A) = 1/5 , P(B) = 1/4

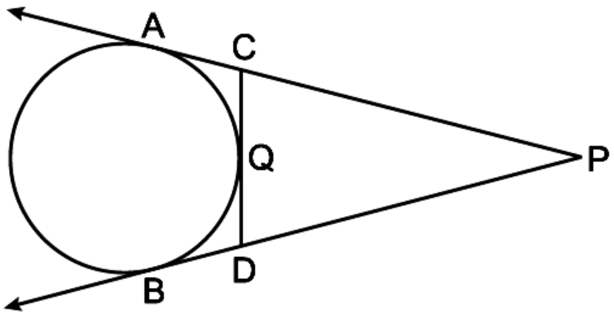
P(C) = 1 – [P(A) + P(B)] = $1 - \left(\frac{1}{5} + \frac{1}{4}\right) = 1 - \frac{4+5}{20} = 1 - \frac{9}{20} = \frac{11}{20}$

$\Rightarrow \frac{11}{x} = \frac{11}{20}$ (Assume x be the total number of marbles)

⇒ x = 20

Hence, Total number of marbles in the jar = 20.

24. In figure PA and PB are tangents to the circle drawn from an external point P. CD is the third tangent touching the circle at Q. If PA = 15 cm, find the perimeter of ΔPCD.



Ans: Since, PA and PB are tangent from same external point.

∴ PA = PB = 15 cm

Now, perimeter of ΔPCD = PC + CD + DP

= PC + CQ + QD+ DP

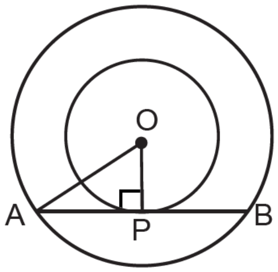
= PC + CA + DB + DP

= PA + PB = 15 + 15 = 30 cm

OR

Two concentric circles are of radii 8 cm and 5 cm. Find the length of the chord of the larger circle which touches the smaller circle.

Ans: Let O be the center of the concentric circle.



Let AB be the chord of larger circle touching the smaller circle at P.

Here, OA = 8 cm, OP = 5 cm

Since AB is tangent of P to the smaller circle and OP is the radius of the smaller circle.

$\therefore$ OP $\perp$ AB.

In right triangle APO, we have

$OA^2 = AP^2 + OP^2 \Rightarrow (8)^2 = AP^2 + (5)^2 \Rightarrow AP^2 = 64 - 25 = 39$

$\Rightarrow AP = \sqrt{39}$ cm

Hence, Length of the chord of largest circle AB = 2× AP = $2\sqrt{39}$ cm

25. For what value of k, the following system of equations have infinite solutions:

$$2x - 3y = 7,\ (k + 2)x - (2k + 1)y = 3\,(2k - 1)?$$

Ans: Here, $a_1 = 2$, $b_1 = -3$, $c_1 = -7$

$a_2 = (k + 2)$, $b_2 = -(2k + 1)$, $c_2 = -3(2k - 1)$

We know that the condition of infinite solution, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$$\Rightarrow \frac{2}{k+2} = \frac{3}{2k+1} = \frac{7}{3(2k-1)} \Rightarrow 4k + 2 = 3k + 6 \Rightarrow k = 4$$

OR

Sumit is 3 times as old as his son. Five years later, he shall be two and a half time as old as his son. How old is Sumit at present?

Ans: Let present age of Sumit be x years and present age of his son be y years.

$\therefore x = 3y \Rightarrow x - 3y = 0$ ...(i)

After 5 years, Age of Sumit = (x + 5) years

Age of his son = (y + 5) years

According to the question,

$(x + 5) = 2\frac{1}{2}(y + 5)$

$\Rightarrow (x + 5) = \frac{5}{2}(y + 5)$

$\Rightarrow 2x + 10 = 5y + 25 \Rightarrow 2x - 5y = 15$ ...(ii)

From equation (i) and (ii), we get y = 15

Putting y = 15 in equation (i), we get x = 3 × 15 = 45 years

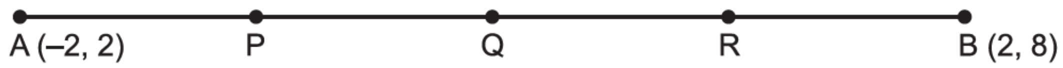
$\therefore$ Sumit is 45 years old at present.

SECTION-C

Questions 26 to 31 carry 3 marks each

26. Find the coordinates of the points which divide the line segment joining A (–2, 2) and B (2, 8) into four equal parts.

Ans: Let P, Q, R be the points that divide the line segment joining A(–2, 2) and B(2, 8) into four equal parts.



Since, Q divides the line segment AB into two equal parts, i.e., Q is the mid-point of AB.

$\therefore$ Coordinates of Q are $\left(\frac{-2+2}{2}, \frac{2+8}{2}\right) = (0, 5)$

Now, P divides AQ into two equal parts i.e., P is the mid-point of AQ.

$\therefore$ Coordinates of P are $\left(\frac{-2+0}{2}, \frac{2+5}{2}\right) = \left(-1, \frac{7}{2}\right)$

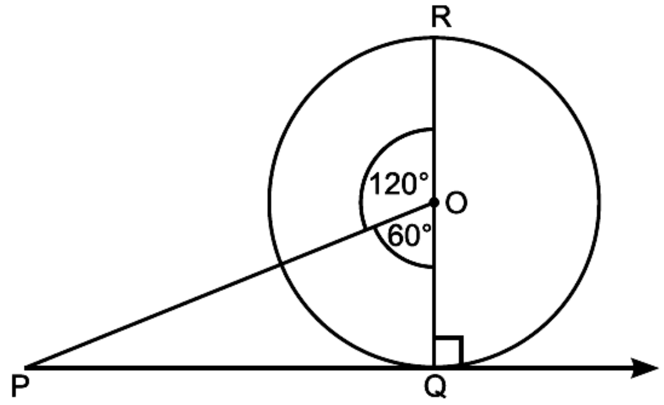
Again, R is the mid-point of QB.

Coordinates of R are $\left(\frac{0+2}{2}, \frac{5+8}{2}\right) = \left(1, \frac{13}{2}\right)$

27. If PQ is a tangent drawn from an external point P to a circle with centre O and QOR is a diameter where length of QOR is 8 cm such that ∠POR = 120°, then find OP and PQ.

Ans: Let O be the centre and QOR = 8 cm is diameter of a circle.

PQ is tangent such that ∠POR = 120°.



Now, OQ = OR = 8/2 = 4 cm

∠POQ = 180° – 120° = 60° (Linear pair)

Also OQ ⊥ PQ

Now, in right ΔPOQ,

cos 60° = OQ/PO ⇒ 1/2 = OQ/PO

⇒ 1/2 = 4/PO ⇒ PO = 8 cm

Again, tan 60° = PQ/OQ ⇒ √3 = PQ/4

⇒ PQ = 4√3 cm.

28. If sec θ + tan θ = p, prove that sin θ = $\frac{p^2-1}{p^2+1}$.

Ans: $\frac{p^2-1}{p^2+1} = \frac{(\sec\theta+\tan\theta)^2-1}{(\sec\theta+\tan\theta)^2+1}$

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

$= \frac{2\tan^2\theta+2\sec\theta\tan\theta}{2\sec^2\theta+2\sec\theta\tan\theta} = \frac{2\tan\theta(\tan\theta+\sec\theta)}{2\sec\theta(\sec\theta+\tan\theta)}$

$= \frac{2\tan\theta}{2\sec\theta} = \tan\theta\times\cos\theta = \frac{\sin\theta}{\cos\theta}\times\cos\theta = \sin\theta$

OR

If sin θ + cos θ = √3 , then prove that tan θ + cot θ = 1.

Ans: $\sin\theta+\cos\theta = \sqrt{3} \Rightarrow (\sin\theta+\cos\theta)^2 = 3$

$\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$
$\Rightarrow 1 + 2\sin\theta\cos\theta = 3 \Rightarrow 2\sin\theta\cos\theta = 2$
$\Rightarrow \sin\theta\cos\theta = 1 = \sin^2\theta + \cos^2\theta$
$\Rightarrow 1 = \dfrac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta} = \dfrac{\sin\theta}{\cos\theta} + \dfrac{\cos\theta}{\sin\theta} = \tan\theta + \cot\theta$
$\Rightarrow \tan\theta + \cot\theta = 1$

29. Daily wages of 110 workers, obtained in a survey, are tabulated below:

***Daily Wages* (*in Rs.*)**	100-120	120-140	140-160	160-180	180-200	200-220	220-240
Number of Workers	10	15	20	22	18	12	13

Compute the mean daily wages and modal daily wages of these workers.
Ans:

Daily Wages (*in* ₹)	*Number of Workers* (f_i)	x_i	u_i	f_iu_i
100–120	10	110	–3	–30
120–140	15	130	–2	–30
140–160	20	150	–1	–20
160–180	22	170	0	0
180–200	18	190	1	18
200–220	12	210	2	24
220–240	13	230	3	39
Total	110			1

Mean daily wages

$= 170 + \dfrac{1}{110} \times 20$

= ₹170.19 (approx.)

Mode $= 160 + \dfrac{22 - 20}{44 - 20 - 18} \times 20$

= ₹166.67 (approx.)

30. Solve the following linear equations:
152x – 378y = –74 and –378x + 152y = –604
Ans: We have, 152x – 378y = –74 ...(i)
–378x + 152y = –604 ...(ii)
Adding equation (i) and (ii), we get
⇒ –226(x +y) = –678
⇒ x + y = 3 …(iii)
Subtracting equation (ii) from (i), we get
530x – 530y = 530
⇒ x – y = 1 …(iv)
Adding equations (iii) and (iv), we get 2x = 4 ⇒ x = 2
Putting the value of x in (iii), we get
2 + y = 3 ⇒ y = 1
Hence, the solution of given system of equations is x = 2, y = 1.

31. The sum of the 5th and the 9th terms of an AP is 30. If its 25th term is three times its 8th term, find the AP.
Ans: According to question, a5 + a9 = 30
⇒ (a + 4d) + (a + 8d) = 30
⇒ 2a + 12d = 30 ⇒ a + 6d = 15
⇒ a = 15 – 6d ...(i)
Also, a25 = 3a8 ⇒ a + 24d = 3(a + 7d)
⇒ a + 24d = 3a + 21d ⇒ 2a = 3d
Putting the value of a form (i), we have
2 (15 – 6d) = 3d ⇒ 30 – 12d = 3d

⇒ 15d = 30 ⇒ d = 2
So, a = 15 – 6 × 2 = 15 – 12 [From equation (i)]
⇒ a = 3
The AP will be 3, 5, 7, 9....

OR

If the ratio of the sum of first n terms of two AP's is (7n + 1) : (4n + 27), find the ratio of their mth terms.
Ans:

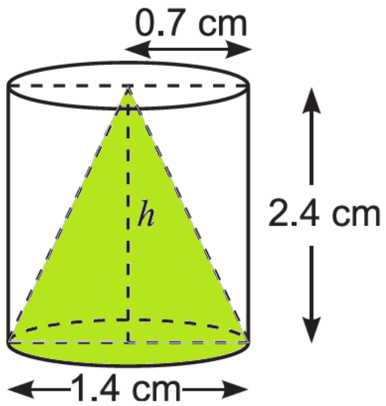
$$\frac{S_n}{S'_n} = \frac{\frac{n}{2}(2a + (n-1)d}{\frac{n}{2}(2a' + (n-1)d')} = \frac{7n+1}{4n+27} \Rightarrow \frac{a + \frac{n-1}{2}d}{a' + \frac{n-1}{2}d'} = \frac{7n+1}{4n+27}$$

Since $\frac{t_m}{t'_m} = \frac{a + (m-1)d}{a' + (m-1)d'}$, So replacing $\frac{n-1}{2}$ by $m - 1 \Rightarrow n$ by $2m - 1$ in (i)

$$= \frac{a + (m-1)d}{a' + (m-1)d'} = \frac{7(2m-1)+1}{4(2m-1)+27} \quad \Rightarrow \quad \frac{t_m}{t'_m} = \frac{14m-6}{8m+23}$$

SECTION-D
Questions 32 to 35 carry 5M each

32. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid to the nearest cm^2.
Ans: We have, Radius of the cylinder = 1.4/2 = 0.7 cm
Height of the cylinder = 2.4 cm
Also, radius of the cone = 0.7 cm
and height of the cone = 2.4 cm



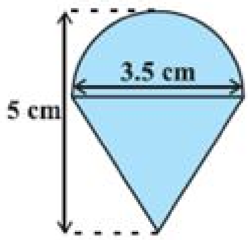
Now, slant height of the cone = l
Now, $l^2 = (0.7)^2+(2.4)^2$
⇒ $l^2 = 0.49 + 5.76 = 6.25 \Rightarrow l = 2.5$ cm
∴ Total surface area of the remaining solid
= CSA of cylinder + CSA of the cone + area of upper circular base of cylinder
= $2\pi rh + \pi rl + \pi r^2 = \pi r(2h + l + r)$
= $\frac{22}{7} \times 0.7 \times [2 \times 2.4 + 2.5 + 0.7] = 22 \times 0.1 \times (4.8 + 2.5 + 0.7)$
= $2.2 \times 8.0 = 17.6\ cm^2 = 18\ cm^2$ (approx.)

OR

Rasheed got a playing top (lattu) as his birthday present, which surprisingly had no colour on it. He wanted to colour it with his crayons. The top is shaped like a cone surmounted by a hemisphere.

The entire top is 5 cm in height and the diameter of the top is 3.5 cm. Find the area he has to colour.

Ans: Radius of hemispherical portion of the lattu = Radius of the conical portion, $r = \frac{3.5}{2} = \frac{7}{4} cm$



Height of the conical portion, $\text{h} = \left(5 - \frac{3.5}{2}\right) = \frac{13}{4} cm$

Slant height of the conical part, $l = \sqrt{r^2 + h^2}$

$\Rightarrow l = \sqrt{\left(\frac{7}{4}\right)^2 + \left(\frac{13}{4}\right)^2} = \sqrt{\frac{218}{4}} = 3.69 cm \approx 3.7 cm$

Total surface area of the top = $2\pi r^2 + \pi rl = \pi r(2r + l) = \frac{22}{7} \times \frac{7}{4}\left(2 \times \frac{7}{4} + 3.7\right) = 39.6 cm^2$

33. A motor boat whose speed is 15 km/hr in still water goes 30 km downstream and comes back in 4 hours 30 minutes. Find the speed of the stream.
Ans: Let the speed of the stream be x km/hr
Then Speed of boat downstream = (15 + x) km/hr
Speed of boat upstream = (15 − x) km/hr

According to the question, $\frac{30}{15+x} + \frac{30}{15-x} = 4\frac{1}{2} = \frac{9}{2}$

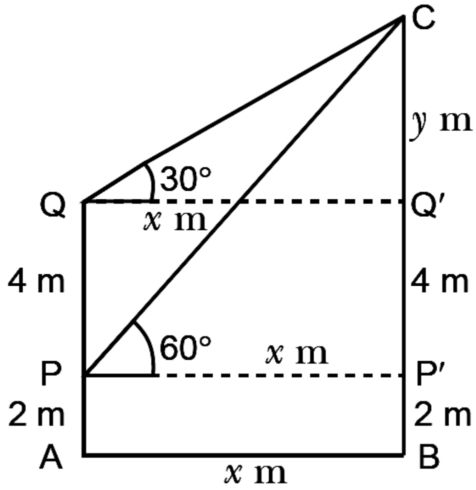
$\Rightarrow \frac{30(15-x) + 30(15+x)}{(15+x)(15-x)} = \frac{9}{2}$

$\Rightarrow \frac{900}{225-x^2} = \frac{9}{2} \Rightarrow 200 = 225 - x^2 \Rightarrow x^2 = 25$

$\Rightarrow x = 5$ (x is the speed of the stream and thus cannot have negative value)
Thus, the speed of the stream is 5 km/hr.

34. State and prove Basic Proportional Theorem.
Ans: Statement – 1 mark
Given, To Prove, Construction and Figure – 2 marks
Correct Proof – 2 marks

35. The lower window of a house is at a height of 2 m above the ground and its upper window is 4 m vertically above the lower window. At certain instant, the angles of elevation of a balloon from these windows are observed to be 60° and 30°, respectively. Find the height of the balloon above the ground.
Ans: Let P and Q be the position of windows respectively.
Let AB = x m and CQ = y m



Now, in ΔQQ'C, we have $\tan 30^0 = \frac{CQ'}{QQ'} \Rightarrow \frac{1}{\sqrt{3}} = \frac{y}{x}$

$\Rightarrow x = \sqrt{3}y$ ...(i)

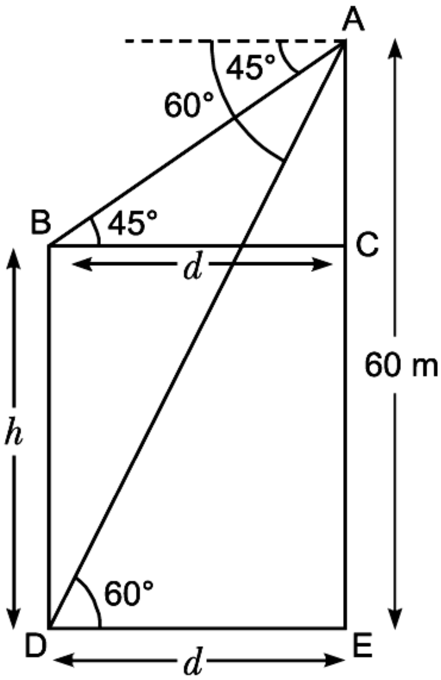
Also, in ΔCP'P we have $\tan 60^0 = \frac{CP'}{PP'} \Rightarrow \sqrt{3} = \frac{y+4}{\sqrt{3}y}$

⇒ 3y = y+ 4 & 2y = 4
⇒ y = 2m
⇒ Height of the balloon = (y + 4 + 2) m = (2 + 4 + 2) m = 8m

OR

From the top of a 60 m high building, the angles of depression of the top and the bottom of a tower are 45° and 60° respectively. Find the height of the tower. [Take √3 = 1.73]

Ans: Let the height of the building be AE = 60 m, the height of the tower is 'h'. The distance between the base of the building and the tower be 'd'.



In ΔADE, $\tan 60^0 = \frac{AE}{DE} \Rightarrow \sqrt{3} = \frac{60}{d} \Rightarrow d = \frac{60}{\sqrt{3}} = 20\sqrt{3}$

BC = 20√3 = 20 × 1.73 = 34.60 m

In ΔABC, $\tan 45^0 = \frac{AC}{BC} \Rightarrow 1 = \frac{AC}{34.60}$

⇒ AC = 34.60 m

Now, height of tower = AE – AC = 60 – 34.60 = 25.4 m

SECTION-E (Case Study Based Questions)
Questions 36 to 38 carry 4M each

36. Shivani took a pack of 52 cards. She kept aside all the black face cards and shuffled the remaining cards well.

Based on the above information answer the following questions.
(i) Write the number of total possible outcomes.
(ii) She draws a card from the well-shuffled pack of remaining cards. What is the probability that the card is a face card?
(iii) Write the probability of drawing a black card.

OR

(iii) What is the probability of getting neither a black card nor an ace card?
Ans: (i) Total possible outcomes = 52 – 6 = 46
(ii) Number of favourable outcomes = 6
P(face card) = 6/46 = 3/23
(iii) Number of black cards in the shuffled cards = 13 + 7 = 20
P(black card) = 20/46 = 10/23

OR

Number of black cards and ace = 20 + 2 = 22
∴ Number of favourable outcomes = 46 – 22 = 24
P(neither a black card nor an ace) = 24/46 = 12/23

37. In the month of April to June 2022, the exports of passenger cars from India increased by 26% in the corresponding quarter of 2021–22, as per a report. A car manufacturing company planned to produce 1800 cars in 4th year and 2600 cars in 8th year. Assuming that the production increases uniformly by a fixed number every year.

Based on the above information answer the following questions.
(i) Find the production in the 1st year. (1)
(ii) Find the production in the 12th year. (1)

(iii) Find the total production in first 10 years. (2)

OR

(iii) In how many years will the total production reach 31200 cars? (2)

Ans: (i) Since the production increases uniformly by a fixed number every year, the number of Cars manufactured in 1st, 2nd, 3rd, . . .,years will form an AP.

So, a + 3d = 1800 & a + 7d = 2600

So d = 200 & a = 1200

(ii) $a_{12} = a + 11d \Rightarrow a_{30} = 1200 + 11 \times 200$

$\Rightarrow a_{12} = 3400$

(iii) $S_n = \frac{n}{2}[2a + (n-1)d] \Rightarrow S_{10} = \frac{10}{2}[2\times1200 + (10-1)\times 200]$

$\Rightarrow S_{10} = 5[2400 + 1800] = 5\times 4200 = 21000$

OR

$S_n = \frac{n}{2}[2a + (n-1)d] = 31200$

$\Rightarrow \frac{n}{2}[2\times1200 + (n-1)\times 200] = 31200$

$\Rightarrow \frac{n}{2}\times 200[12 + (n-1)] = 31200$

$\Rightarrow n[12 + (n - 1)] = 312$

$\Rightarrow n^2 + 11n - 312 = 0$

$\Rightarrow n^2 + 24n - 13n - 312 = 0$

$\Rightarrow (n+24)(n-13) = 0$

$\Rightarrow n = 13$ or -24.

As n can't be negative. So n = 13

38. Aditya plantations have two rectangular fields of the same width but different lengths. They are required to plant 168 trees in the smaller field and 462 trees in the larger field. In both fields, the trees will be planted in the same number of rows but in different number of columns.

(i) What is the maximum number of rows in which the trees can be planted in each of the fields? (2)

(ii) If the trees are planted in the number of rows obtained in part (i), how many columns will each field have?

(iii) If total cost of planted trees in one column is Rs. 500, then find the cost to plant the trees in smaller field.

OR

If the total cost of planted trees in one column is Rs. 500, the find the cost to plant the trees in larger field.

Ans: (i) The maximum number of rows for two field is HCF of 168 and 462.

Now $168 = 2^3 \times 3 \times 7$

$462 = 2 \times 3 \times 7 \times 11$

$\therefore$ HCF (168, 462) = $2 \times 3 \times 7 = 42$

$\therefore$ Number of rows = 42

(ii) Number of columns in smaller field = $\frac{168}{42} = 4$

Number of columns in larger field = $\frac{462}{42} = 11$

(iii) Number of columns in smaller field = 4

$\therefore$ cost = Rs. 4 × 500 = Rs. 2000.

OR

Number of columns in larger field = 11

$\therefore$ Required cost = 11 × 500 = Rs. 5500