PM SHRI KENDRIYA VIDYALAYA GACHIBOWLI,GPRA CAMPUS,HYD-32
SAMPLE PAPER TEST 14 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. If the coordinates of one end of a diameter of a circle are (2, 3) and the coordinates of its centre are (-2, 5), then the coordinates of the other end of the diameter are
(a) (0, 8) (b) (0, 4) (c) (6, -7) (d)(-6, 7)
Ans: (d) (-6, 7)

2. The perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0) is
(a) 5 (b) 12 (c) 11 (d) 7 + √5
Ans: (b) 12
Let A(0, 4), B(0, 0), and C(3, 0) be the vertices of a triangle ABC.
Perimeter of the triangle = AB + BC + CA
Using the distance formula,
AB = √[(0)2 + (4)2] = √16 = 4
BC = √[(3)2 + (0)2] = √9 = 3
CA = √[(3)2 + (4)2] = √(9 + 16) = √25 = 5
Therefore, perimeter = 4 + 3 + 5 = 12

3. A bag has 5 white marbles, 8 red marbles and 4 purple marbles. If we take a marble randomly, then what is the probability of not getting purple marble?
(a) 0.5 (b) 0.66 (c) 0.08 (d) 0.77
Ans: (d) 0.77
Total number of purple marbles = 4
Total number of marbles in bag = 5 + 8 + 4 = 17
Probability of getting not purple marbles = 13/17 = 0.77

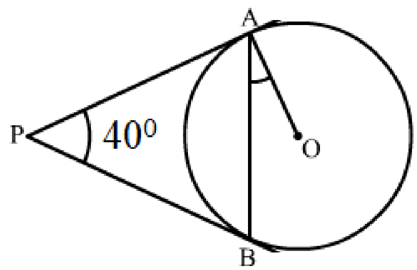
4. In what ratio does the x-axis divide the join of A(2, -3) and B(5, 6)?
(a) 1 : 2 (b) 3 : 5 (c) 2 : 1 (d) 2 : 3
Ans: (a) 1 : 2
Let the x axis cut AB at P(x, 0) in the ratio k : 1

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = 0 \Rightarrow \frac{6k - 3}{k + 1} = 0 \Rightarrow 6k = 3 \Rightarrow k = \frac{1}{2}$$

5. The pairs of equations $9x + 3y + 12 = 0$ and $18x + 6y + 26 = 0$ have
(a) Unique solution (b) Exactly two solutions
(c) Infinitely many solutions (d) No solution
Ans: (d) No solution
Given, $9x + 3y + 12 = 0$ and $18x + 6y + 26 = 0$
$a_1/a_2 = 9/18 = 1/2$
$b_1/b_2 = 3/6 = 1/2$
$c_1/c_2 = 12/26 = 6/13$
Since, $a_1/a_2 = b_1/b_2 \neq c_1/c_2$
So, the pairs of equations are parallel and the lines never intersect each other at any point, therefore there is no possible solution.

6. If the distance between the points A(2, -2) and B(-1, x) is equal to 5, then the value of x is:
(a) 2 (b) -2 (c) 1 (d) -1
Ans: (a) 2

7. If PA and PB are tangents to the circle with centre O such that $\angle APB = 40°$, then $\angle OAB$ is equal to



(a) 40° (b) 30° (c) 20° (d) 25°
Ans: (c) 20°
Let $\angle OAB = \angle OBA = x$ [Opposite angles of equal radii are equal]
And $\angle AOB = 180° - 40° = 140°$
Now, in triangle AOB, $\angle OAB + \angle OBA + \angle AOB = 180°$
$\Rightarrow x + x + 140° = 180°$
$\Rightarrow 2x = 40° \Rightarrow x = 20° \Rightarrow \angle OAB = 20°$

8. The least number that is divisible by all the numbers from 1 to 10 (both inclusive) is:
(a) 10 (b) 100 (c) 504 (d) 2520
Ans. (d) 2520

9. The mode and mean is given by 7 and 8, respectively. Then the median is:
(a) 1/13 (b) 13/3 (c) 23/3 (d) 33
Ans: (c) 23/3
Using Empirical formula, Mode = 3Median – 2 Mean
3Median = Mode + 2Mean
Median = (Mode + 2Mean)/3
Median = [7 + 2(8)]/3 = (7 + 16)/3 = 23/3

10. A sphere of diameter 18 cm is dropped into a cylindrical vessel of diameter 36 cm, partly filled with water. If the sphere is completely submerged then the water level rises by
(a) 4cm (b) 5 cm (c) 3 cm (d) 6 cm
Ans: (c)3 cm
Increase in volume of water = volume of the sphere

$$\therefore \quad \pi R^2 h = \frac{4}{3}\pi r^3 \Rightarrow (18)^2 \times h = \frac{4}{3} \times (9)^3$$

$$\Rightarrow \quad h = \frac{4 \times (9)^3}{3 \times (18)^2} = 3cm$$

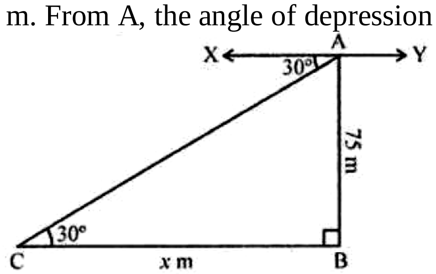
11. If P(E) = 0.07, then what is the probability of 'not E'?
(a) 0.93 (b) 0.95 (c) 0.89 (d) 0.90
Ans: (a) 0.93
P(E) + P(not E) = 1
Since, P(E) = 0.05
So, P(not E) = 1 – P(E)
⇒ P(not E) = 1 – 0.07
∴ P(not E) = 0.93

12. The roots of quadratic equation $2x^2 + x + 4 = 0$ are:
(a) Positive and negative (b) Both Positive (c) Both Negative (d) No real roots
Ans: (d) No real roots
Here, a = 2, b = 1, c = 4
$D = b^2 - 4ac = 1 - 4(2)(4) = 1 - 32 = -31 < 0$
Hence the roots are not real

13. If two dice are thrown in the air, the probability of getting sum as 3 will be
(a) 2/18 (b) 3/18 (c) 1/18 (d) 1/36
Ans: (c) 1/18
Total number of outcome = 6 x 6 = 36
Sum 3 is possible if we get (1,2) or (2,1) in the dices.
Hence, the probability will be = 2/36 = 1/18

14. The value of (sin 30°+cos 60°)-(sin 60° + cos 30°) is equal to:
(a) 0 (b) 1+2√3 (c) 1-√3 (d) 1+√3
Ans: (c) 1-√3
sin 30° = ½, sin 60° = √3/2, cos 30° = √3/2 and cos 60° = ½
Putting these values, we get:
(½ + ½) - (√3/2 + √3/2)
= 1 – [(2√3)/2]
= 1 – √3

15. The angle of depression of a car, standing on the ground, from the top of a 75 m tower, is 30°. The distance of the car from the base of the tower (in metres) is
(a) 25√3 (b) 75√3 (c) 150 (d) 50√3
Ans:
Let AB is as tower and AB = 75 m. From A, the angle of depression of a car C on the ground is 30°



Let distane BC = x
Now in right ΔACB,

$$\tan\theta = \frac{AB}{BC} \Rightarrow \tan 30^0 = \frac{75}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{x} \Rightarrow x = 75\sqrt{3}$$

16. If one equation of a pair of dependent linear equations is -3x+5y-2=0. The second equation will be:
(a) -6x + 10y - 4 = 0 (b) 6x - 10y - 4 = 0 (c) 6x + 10y - 4 = 0 (d) -6x + 10y + 4 = 0
Ans: (a) -6x + 10y - 4 = 0

The condition for dependent linear equations is:
$a_1/a_2 = b_1/b_2 = c_1/c_2$
For option (a),
$a_1/a_2 = b_1/b_2 = c_1/c_2 = ½$

17. HCF of (2^3 x 3^2 x 5), (2^2 x 3^3 x 5^2) and (2^4 x 3 x 5^3 x 7) is
(a) 60 (b) 48 (c) 30 (d) 105
Ans: (a) 60
HCF = Product of smallest power of each common prime factor in the numbers
= 2^2 x 3 x 5 = 60

18. If the equation $9x^2 + 6kx + 4 = 0$ has equal roots then k = ?
(a) -2 or 0 (b) 0 only (c) 2 or 0 (d) 2 or -2
Ans: (d) 2 or -2
Since the roots are equal, we have D = 0.
$\Rightarrow 36k^2 – 4(9)(4) = 0 \Rightarrow 36k^2 = 144 \Rightarrow k^2 = 4 \Rightarrow$ k = 2 or -2.

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 two triangles are similar and have an equal area, then they are congruent.
Reason (R): Corresponding sides of two triangles are equal, then triangles are congruent.
(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 and reason (R) is not the correct explanation of Assertion (A)
(c) Assertion (A) is true but reason(R) is false.
(d) Assertion (A) is false but reason(R) is true.
Ans: (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of Assertion (A)

20. **Assertion :** The HCF of two numbers is 18 and their product is 3072. Then their LCM = 169.
Reason : If *a*, *b* are two positive integers, then HCF x LCM = *a* x *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) Assertion (A) is true but Reason (R) is false.
(d) Assertion (A) is false but Reason (R) is true.
Ans: (d) Assertion (A) is false but Reason (R) is true.

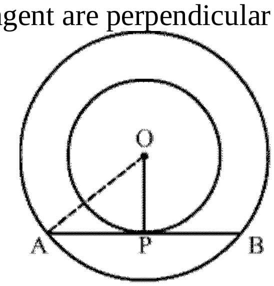
SECTION-B
Questions 21 to 25 carry 2M each

21. Find the quadratic polynomial, sum of whose zeroes is 8 and their product is 12. Hence, find the zeroes of the polynomial.
Ans: Let α and β be the zeroes of the required polynomial f(x).
Then $(\alpha + \beta) = 8$ and $\alpha\beta = 12$
$\therefore f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$
$\Rightarrow f(x) = x^2 - 8x + 12$
Hence, required polynomial $f(x) = x^2 - 8x + 12$
$\therefore f(x) = 0 \Rightarrow x^2 - 8x + 12 = 0$
$\Rightarrow x^2 - (6x + 2x) + 12 = 0$

$\Rightarrow x^2 - 6x - 2x + 12 = 0$
$\Rightarrow x(x - 6) - 2(x - 6) = 0$
$\Rightarrow (x - 2)(x - 6) = 0$
$\Rightarrow (x - 2) = 0$ or $(x - 6) = 0$
$\Rightarrow x = 2$ or $x = 6$

22. A card is drawn at random from a well shuffled pack of 52 cards. Find the probability of getting (i) a red king (ii) a queen or a jack
Ans: Total number of outcomes = 52
(i) Number of red colour kings = 2
$\therefore$ P(getting a red king) = 2/52 = 1/26
(ii) Number of queen or jack in a pack of card = 4 + 4 = 8
$\therefore$ P(getting a queen or a jack) = 8/52 = 2/13

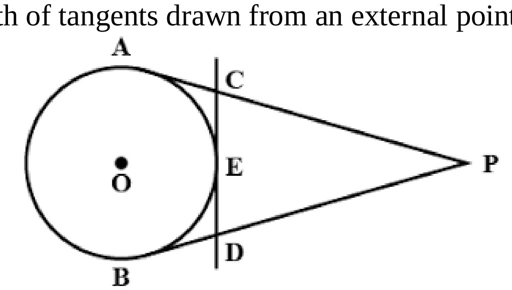
23. Two concentric circles are of radii 6.5 cm and 2.5 cm. Find the length of the chord of the larger circle which touches the smaller circle.
Ans: We know that the radius and tangent are perpendicular at their point of contact



In right triangle AOP, $AO^2 = OP^2 + PA^2$
$\Rightarrow (6.5)^2 = (2.5)^2 + PA^2$
$\Rightarrow PA^2 = 36 \Rightarrow PA = 6$ cm
Since, the perpendicular drawn from the centre bisect the chord.
$\therefore$ PA = PB = 6 cm
Now, AB = AP + PB = 6 + 6 = 12 cm
Hence, the length of the chord of the larger circle is 12 cm.

OR

From an external point P, tangents PA and PB are drawn to a circle with center O. If CD is the tangent to the circle at a point E and PA = 14cm, find the perimeter of ΔPCD.
Ans: We know that the length of tangents drawn from an external point to a circle are equal.



PA = PB= 14 cm (given)
CA = CE and DB = DE
Perimeter of ΔPCD = PC + CD + PD
= PC + (CE + ED) + PD
= PC + (CA + DB) + PD
= (PC + CA) + (DB + PD)
(CA = CE and DB= DE)
= PA + PB
= 14 cm + 14 cm
= 28 cm
Perimeter of ΔPCD. = 28 cm

24. Solve for x and y: 71x + 37y = 253, 37x + 71y = 287

Ans: The given equations are:

71x + 37y = 253 …..(i)

37x + 71y = 287 ……(ii)

On adding (i) and (ii), we get:

108x + 108y = 540

⇒108(x + y) = 540

⇒(x + y) = 5 ……(iii)

On subtracting (ii) from (i), we get:

34x – 34y = -34

⇒34(x – y) = -34

⇒(x – y) = -1 ……(iv)

On adding (iii) from (i), we get:

2x = 5 – 1 = 4

⇒x = 2

On subtracting (iv) from (iii), we get:2y = 5 + 1 = 6 ⇒y = 3

25. Find all possible values of y for which the distance between the points A (2, -3) and B (10, y) is 10 units.

Ans: We know that the distance between two points is given by $d=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

Given d = 10 units and points are A (2, -3) and B (10, y)

$\therefore \sqrt{(10-2)^2+(y+3)^2}=10 \Rightarrow 8^2+(y+3)^2=100$

$\Rightarrow (y+3)^2+64=100 \Rightarrow y^2+6y+9+64-100=0$

$\Rightarrow y^2+6y-27=0 \Rightarrow y^2+9y-3y-27=0$

$\Rightarrow y(y+9)-3(y+9)=0 \Rightarrow (y+9)(y-3)=0 \Rightarrow y=-9,3$

OR

In what ratio does the point P(2,5) divide the join of A (8,2) and B(-6, 9)?

Ans: Let the point P(2,5) divide AB in the ratio k :1.

Then, by section formula, the coordinates of P are $x=\frac{-6k+8}{k+1}, y=\frac{9k+2}{k+1}$

$Now, \frac{9k+2}{k+1}=5 \Rightarrow 9k+2=5k+5$

$\Rightarrow 9k-5k=5-2 \Rightarrow 4k=3 \Rightarrow k=\frac{3}{4}$

Hence the required ratio is 3 : 4.

SECTION-C
Questions 26 to 31 carry 3 marks each

26. Prove that: $\frac{\sin\theta-\cos\theta+1}{\sin\theta+\cos\theta-1}=\sec\theta+\tan\theta$

Ans: LHS = $\frac{\tan\theta-1+\sec\theta}{\tan\theta+1-\sec\theta}$ (Dividing numerator and denominator by cosθ)

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

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

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

27. Prove that √5 is an irrational number.

Ans: Let $\sqrt{5}$ is a rational number then we have $\sqrt{5} = \frac{p}{q}$, where p and q are co-primes.

$\Rightarrow p = \sqrt{5}q$

Squaring both sides, we get $p^2 = 5q^2$

$\Rightarrow$ p^2 is divisible by 5 $\Rightarrow$ p is also divisible by 5

So, assume p = 5m where m is any integer.

Squaring both sides, we get $p^2 = 25m^2$

But $p^2 = 5q^2$

Therefore, $5q^2 = 25m^2 \Rightarrow q^2 = 5m^2$

$\Rightarrow$ q^2 is divisible by 5 $\Rightarrow$ q is also divisible by 5

From above we conclude that p and q have one common factor i.e. 5 which contradicts that p and q are co-primes.

Therefore, our assumption is wrong.

Hence, $\sqrt{5}$ is an irrational number.

OR

If two positive integers p and q are written as $p = a^2b^3$ and $q = a^3b$, a and b are a prime number then. Verify LCM(p, q) x HCF (p, q) = p x q

Ans: $HCF(p,q) = a^2b$

$LCM(p,q) = a^3b^2$

$LCM(\mathrm{p,q}) \times HCF(\mathrm{p,q}) = \mathrm{a}^5\,\mathrm{b}^3$

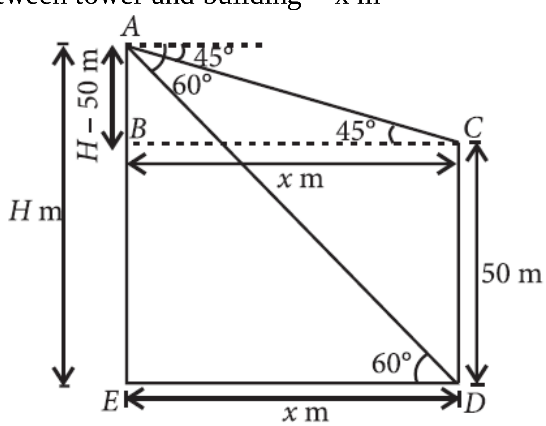
$pq = \mathrm{a}^5\,\mathrm{b}^3$

$Hence, LCM(\mathrm{p,q}) \times HCF(\mathrm{p,q}) = pq$

28. The angles of depression of the top and bottom of a 50 m high building from the top of a tower are 45° and 60° respectively. Find the height of the tower and the horizontal distance between the tower and the building. (Use √3 =1.73)

Ans: Let the height of tower, AE = H m

The horizontal distance between tower and building = x m



In ΔABC, $\frac{H-50}{x} = \tan 45^0 \Rightarrow x = H - 50$ … (i)

In ΔAED, $\frac{H}{x} = \tan 60^0 \Rightarrow \frac{H}{x} = \sqrt{3} \Rightarrow x = \frac{H}{\sqrt{3}}$ ...(ii)

From (i) and (ii), $H-50=\frac{H}{\sqrt{3}} \Rightarrow H-\frac{H}{\sqrt{3}}=50$

$\Rightarrow H=\frac{50\sqrt{3}}{\sqrt{3}-1}=\frac{50(1.73)}{0.73}=118.49$

∴ Height of tower = 118.49 m

Distance between tower and building = $\frac{118.49}{\sqrt{3}}=\frac{118.49}{1.73}=68.49m$

29. A part of monthly hostel charges in a college are fixed and the remaining depends on the number of days one has taken food in the mess. When a student A takes food for 25days, he has to pay Rs. 4550 as hostel charges whereas a student B, who takes food for 30 days, pays Rs. 5200 as hostel charges. Find the fixed charges and the cost of the food per day.

Ans: Let the fixed charges be Rs.x and the cost of food per day be Rs.y.

Then as per the question

x + 25y = 4550 ………(i)

x + 30y = 5200 ……..(ii)

Subtracting (i) from (ii), we get

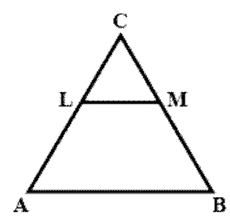
5y = 650 ⇒ y = 650/5 = 130

Now, putting y = 130, we have

x + 25 × 130 = 4550 ⇒x = 4550 – 3250 = 1300

Hence, the fixed charges be Rs. 1300 and the cost of the food per day is Rs.130.

30. In the below figure, LM || AB. If AL = x – 3, AC = 2x, BM = x – 2 and BC = 2x + 3, find the value of x.



Ans: In ΔABC, LM || AB then by Thale's theorem we have $\frac{AL}{LC}=\frac{BM}{MC}$

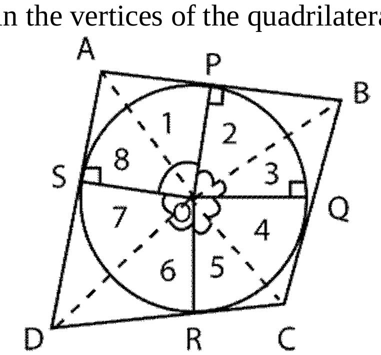
$\Rightarrow \frac{AL}{AC-AL}=\frac{BM}{BC-BM} \Rightarrow \frac{x-3}{2x-(x-3)}=\frac{x-2}{(2x+3)-(x-2)}$

$\Rightarrow \frac{x-3}{x+3}=\frac{x-2}{x+5} \Rightarrow (x-3)(x+5)=(x-2)(x+3)$

$\Rightarrow x^2+2x-15=x^2+x-6 \Rightarrow x=9cm$

31. Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

Ans: Let ABCD be the quadrilateral circumscribing a circle at the center O such that it touches the circle at the point P,Q,R,S. Let join the vertices of the quadrilateral ABCD to the center of the circle



In ΔOAP and ΔOAS
AP=AS (Tangents from to same point A)
PO=OS (Radii of the same circle)
OA=OA (Common side)
so, ΔOAP=ΔOAS (SSS congruence criterion)
$\therefore$ ∠POA=∠AOS (CPCT)
$\Rightarrow$ ∠1=∠8
Similarly, ∠2=∠3, ∠4=∠5 and ∠6=∠7
$\angle 1+\angle 2+\angle 3+\angle 4+\angle 5+\angle 6+\angle 7+\angle 8 = 360^\circ$
$\Rightarrow (\angle 1+\angle 8)+(\angle 2+\angle 3)+(\angle 4+\angle 5)+(\angle 6+\angle 7) = 360^\circ$
$\Rightarrow 2(\angle 1)+2(\angle 2)+2(\angle 5)+2(\angle 6) = 360^\circ$
$\Rightarrow (\angle 1)+(\angle 2)+(\angle 5)+(\angle 6) = 180^\circ$
$\therefore \angle AOD + \angle COD = 180^\circ$
Similarly, $\angle BOC + \angle DOA = 180^\circ$

OR

Prove that the tangent drawn at any point of a circle is perpendicular to the radius through the point of contact.
Ans: Given, To Prove, Constructions and Figure – 1½ marks
Correct Proof – 1½ marks

SECTION-D
Questions 32 to 35 carry 5M each

32. Out of a group of swans, 7/2 times the square root of the total number of swans are playing on the shore of a tank. Remaining two are playing, with amorous fight, in the water. What is the total number of swans?
Ans: Let the total number of swans be x. Then,
Number of swans playing in the shore = $\frac{7}{2}\sqrt{x}$
According to the question, $x = \frac{7}{2}\sqrt{x} + 2$
$\Rightarrow x - \frac{7}{2}\sqrt{x} - 2 = 0 \Rightarrow y^2 - \frac{7}{2}y - 2 = 0$ where $y = \sqrt{x}$
$\Rightarrow 2y^2 - 7y - 4 = 0 \Rightarrow 2y^2 - 8y + y - 4 = 0$
$\Rightarrow 2y(y-4)+(y-4) = 0 \Rightarrow (y-4)(2y+1) = 0 \Rightarrow y = 4, y = -\frac{1}{2}$
Neglecting $y = -\frac{1}{2}$ as $\sqrt{x}$ is never negative, we have $y = 4$
$\therefore x = y^2 = 16$
Hence, the total number of swans is 16.

OR

A plane left 30 minutes late than its scheduled time and in order to reach the destination 1500 km away in time, it had to increase its speed by 100 km/h from the usual speed. Find its usual speed.
Ans: Let the usual speed of the plane be x km/hr.
According to the question, $\frac{1500}{x} - \frac{1500}{x+100} = \frac{1}{2}$
$\Rightarrow \frac{1500(x+100)-1500x}{x(x+100)} = \frac{1}{2} \Rightarrow x^2 + 100x = 1500\times 100\times 2$
$\Rightarrow x^2 + 100x - 300000 = 0 \Rightarrow x^2 + 600x - 500x - 300000 = 0$

$\Rightarrow x(x+600)-500(x-600)=0$
$\Rightarrow (x+600)(x-500)=0 \Rightarrow x=500,-600$
Since speed cannot be negative, x = 500 km/hr
$\therefore$ The usual speed of the plane is 500 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."

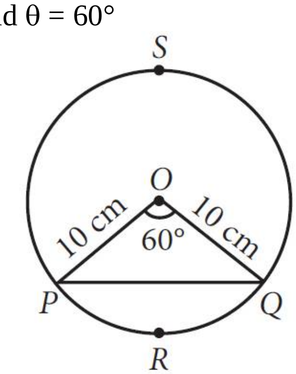
In ΔABC, DE||BC and $\frac{AD}{DB}=\frac{3}{1}$ if EA = 6.6cm, then find AC using the above theorem.

Ans: For Theorem:
Given, To Prove, Constructions and Figure – 1 ½ mark
Proof – 1 ½ mark
To find the value of AC = 8.8 cm – 1 mark

$$\frac{AD}{DB}=\frac{AE}{EC} \Rightarrow \frac{3}{1}=\frac{6.6}{EC} \Rightarrow EC=2.2cm$$
$$\therefore AC=AE+EC=6.6+2.2=8.8cm$$

34. A chord PQ of a circle of radius 10 cm subtends an angle of 60° at the centre of circle. Find the area of major and minor segments of the circle.

Ans: We have, radius (r) = 10 cm and θ = 60°



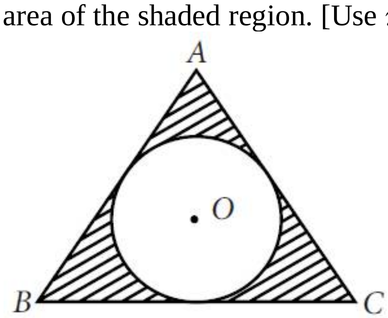
Area of minor segment PQR = Area of sector OPRQ – Area of DOPQ

$$=\frac{\theta}{360^0}\times\pi r^2-\frac{1}{2}r^2\sin\theta$$
$$=\frac{60^0}{360^0}\times\frac{22}{7}\times10\times10-\frac{1}{2}\times10\times10\times\sin 60^0$$
$$=\frac{1100}{21}-25\sqrt{3}=52.38-43.3=9.08cm^2$$

Area of major segment PSQ = Area of circle – Area of minor segment
= $(10)^2 - 9.08 = 314.16 - 9.08 = 305.08$ cm^2

OR

In the given figure, a circle is inscribed in an equilateral triangle ABC of side 12 cm. Find the radius of inscribed circle and the area of the shaded region. [Use π = 3.14 and √3 = 1.73]



Ans: Given, ΔABC is an equilateral triangle of side 12 cm. Join OA, OB and OC.

Also, draw OP ⊥ BC, OQ ⊥ AC, OR ⊥ AB.
Let the radius of the circle be r cm.
Area of ΔAOB + Area of ΔBOC + Area of ΔAOC = Area of ΔABC

$$\Rightarrow \frac{1}{2}\times AB\times OR+\frac{1}{2}\times BC\times OP+\frac{1}{2}\times AC\times OQ=\frac{\sqrt{3}}{4}\times(side)^2$$

$$\Rightarrow \frac{1}{2}\times 12\times r+\frac{1}{2}\times 12\times r+\frac{1}{2}\times 12\times r=\frac{\sqrt{3}}{4}\times 12^2$$

$$\Rightarrow 3\times\frac{1}{2}\times 12\times r=\frac{\sqrt{3}}{4}\times 12\times 12\Rightarrow r=2\sqrt{3}=3.46cm$$

Now, area of the shaded region = Area of ΔABC – Area of the inscribed circle

$$=\frac{\sqrt{3}}{4}\times 12\times 12-\pi(2\sqrt{3})^2=36\sqrt{3}-12\pi$$

$$=36\times 1.73-12\times 3.14=62.28-37.68=24.6cm^2$$

35. The median of the following data is 52.5. Find the values of x and y. if the total frequency is 100

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	2	5	x	12	17	20	y	9	7	4

Ans:

C.I.	f	$c.f.$
0 – 10	2	2
10 – 20	5	7
20 – 30	x	$7 + x$
30 – 40	12	$19 + x$
40 – 50	17	$36 + x$
50 – 60	20	$56 + x$
60 – 70	y	$56 + x + y$
70 – 80	9	$65 + x + y$
80 – 90	7	$72 + x + y$
90 – 100	4	$76 + x + y$
	$\Sigma f_i = 76 + x + y$	

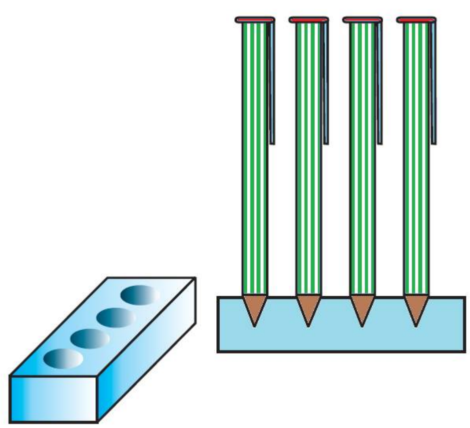
As given $\Sigma f_i = 100$
$\Rightarrow 76 + x + y = 100$
$\Rightarrow x + y = 24$ ...(i)
Median = 52.5, $n = 100 \Rightarrow \frac{n}{2} = 50$
Median class is 50 – 60 (as given median is 52.5.)
$\Rightarrow$ Using formula for the median.

$$52.5 = 50 + \frac{[50-(36+x)]}{20}\times 10 = 50 + \frac{14-x}{2}$$

$\Rightarrow 52.5 - 50 = \frac{14-x}{2} \Rightarrow 2.5\times 2 = 14 - x \Rightarrow 5 = 14 - x$
$\Rightarrow x = 14 - 5 = 9 \Rightarrow y = 24 - 9 = 15$

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

36. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm by 10 cm by 3.5 cm. The radius of each of the depressions is 0.5 cm and the depth is 1.4 cm.



Based on the above information, answer the following questions.
(i) Find the volume of four conical depressions in the entire stand [2]
(ii) Find the volume of wood in the entire stand [2]

OR

(ii) Three cubes each of side 15 cm are joined end to end. Find the total surface area of the resulting cuboid. [2]

Ans: (i) Dimensions of the cuboid are 15 cm, 10 cm and 3.5 cm.
∴ Volume of the cuboid = 15 × 10 × 35/10 cm^3
= 15 × 35 cm^3 = 525 cm^3
Since each depression is conical with base radius (r) = 0.5 cm and depth (h) = 1.4 cm,
∴ Volume of each depression (cone)

$$= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times \left(\frac{5}{10}\right)^2 \times \frac{14}{10} \text{ cm}^3$$

Since there are 4 depressions,
∴ Total volume of 4 depressions

$$= 4 \times \frac{1}{3} \times \frac{22}{7} \times \frac{5}{10} \times \frac{5}{10} \times \frac{14}{10} \text{ cm}^3 = \frac{4}{3} \times \frac{11}{10} \text{ cm}^3 = \frac{44}{30} \text{ cm}^3$$

(ii) Volume of the wood in entire stand
= [Volume of the wooden cuboid] − [Volume of 4 depressions]

$$= 525 \text{ cm}^3 - \frac{44}{30} \text{ cm}^3 = \frac{15750 - 44}{30} \text{ cm}^3 = \frac{15706}{30} \text{ cm}^3 = \mathbf{523.53 \text{ cm}^3}.$$

OR

(ii) New length (l) = 15+15+15 = 45cm,
New breadth (b) = 15cm,
New height (h) = 15cm,
Total surface of the cuboid = 2(lb + bh + hl)
= 2(45 x 15 + 15 x 15 + 15 x 45) = 2 × 1575 = 3,150 cm^2

37. Your elder brother wants to buy a car and plans to take loan from a bank for his car. He repays his total loan of Rs. 1,18,000 by paying every month starting with the first instalment of Rs. 1000. If he increases the instalment by Rs. 100 every month.

On the basis of above information, answer the following questions.
(i) What is the amount paid by him in 20th instalment?
(ii) What is the amount paid by him in 30th instalments?
(iii) What is the amount paid by him upto 20 instalments?

OR

What is the amount paid by him upto 30 instalments?
Ans: (i) Since first installment is of Rs. 1000 and he increases the installment by Rs. 100 every month.
Thus AP is formed
1000, 1100, 1200, ...

$\therefore$ a = 1000, d = 1100 – 1000 = 100
$\therefore$ Amount paid by him in 20th installment, a20 = a + 19d
= 1000 + 19 × 100 = Rs. 2900.
(ii) We have AP 1000, 1100, 1200, ...
$\therefore$ a = 1000, d = 1100 – 1000 = 100
$\therefore$ Amount paid by him in 30th installment, a30 = a + 29d
= 1000 + 29 × 100 = Rs. 3900.
(iii) We have AP 1000, 1100, 1200, ...
$\therefore$ a = 1000, d = 100

$\therefore$ Amount paid upto 20th installments = $S_n = \frac{n}{2}[2a + (n-1)d]$

$$\Rightarrow S_{20} = \frac{20}{2}[2 \times 1000 + (20-1)100] = 10 \times 3900 = Rs.39000$$

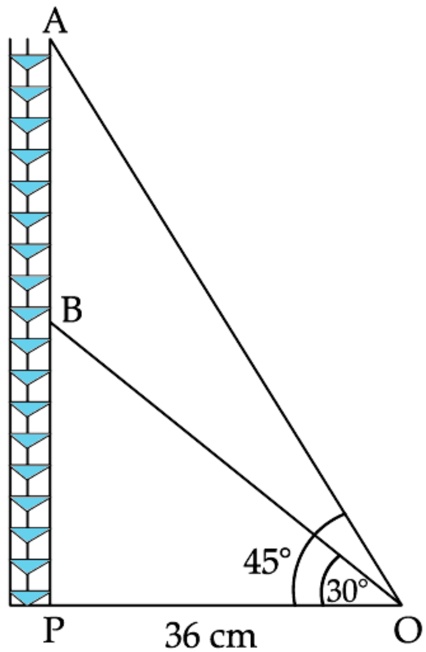
OR

(iii) Amount paid upto 30 installments

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

$$\Rightarrow S_{30} = \frac{30}{2}[2 \times 1000 + (30-1)100] = 15 \times 4900 = Rs.73500$$

38. 37. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two Sections A and B. Tower is supported by wires from a point O.

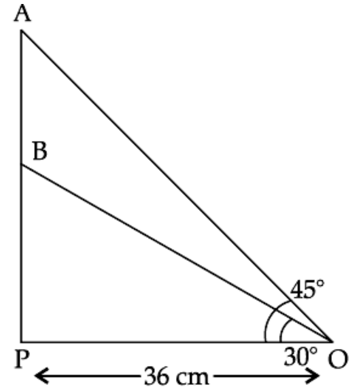


Distance between the base of the tower and point O is 36 cm. From point O, the angle of elevation of the top of the Section B is 30° and the angle of elevation of the top of Section A is 45°.
Based on the above information, answer the following questions:
(i) Find the length of the wire from the point O to the top of section B.
(ii) Find the distance AB.

OR

Find the area of ΔOPB.
(iii) Find the height of the Section A from the base of the tower.

Ans: (i) In ΔBPO, $\cos\theta = \frac{B}{H} \Rightarrow \cos 30^0 = \frac{OP}{OB}$



$\Rightarrow \frac{\sqrt{3}}{2} = \frac{36}{OB} \Rightarrow OB = \frac{72}{\sqrt{3}} = 24\sqrt{3}cm$

Thus, the length of wire from O to top of Section B = 24√3 cm .

(ii) AB = AP – BP

In ΔBPO, $\tan\theta = \frac{P}{B} \Rightarrow \tan 30^0 = \frac{BP}{OP}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{BP}{36} \Rightarrow BP = \frac{36}{\sqrt{3}} = 12\sqrt{3}cm$

In ΔAPO, $\tan 45^0 = \frac{AP}{OP} \Rightarrow 1 = \frac{AP}{36} \Rightarrow AP = 36cm$

Distance AB = 36 − 12√3

= 36 – 20.78 = 15.22 cm (approx)

OR

Area of ΔOPB = $\frac{1}{2}$ × Base × height

= $\frac{1}{2}$ × 36 × 12√3 = 216√3 cm^2

= 374.12 cm^2 (approx)

(iii) Height of Section A from base of tower = AP

In ΔAPO, $\tan 45^0 = \frac{AP}{OP} \Rightarrow 1 = \frac{AP}{36} \Rightarrow AP = 36cm$