PM SHRI KENDRIYA VIDYALAYA GACHIBOWLI,GPRA CAMPUS,HYD-32

SAMPLE PAPER TEST 11 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. A ticket is drawn at random from a bag containing tickets numbered from 1 to 40. The probability that the selected ticket has a number which is a multiple of 5 is

(a) 1/5 (b) 3/5 (c) 4/5 (d) 1

Ans: (a) 1/5

2. If two positive integers p and q can be expressed as $p = ab^3$ and $q = a^3 b$; a, b being prime numbers, then HCF (p, q) is

(a) ab (b) $a^2 b^2$ (c) $a^3 b^2$ (d) $a^3 b^3$

Ans: (a) ab

3. If triangles ABC and DEF are similar and AB=4 cm, DE=6 cm, EF=9 cm and FD=12 cm, the perimeter of triangle ABC is:

(a) 22 cm (b) 20 cm (c) 21 cm (d) 18 cm

Ans: (d) 18 cm

ΔABC ~ ΔDEF

AB=4 cm, DE=6 cm, EF=9 cm and FD=12 cm

⇒ AB/DE = BC/EF = AC/DF

⇒ 4/6 = BC/9 = AC/12

⇒ BC = (4.9)/6 = 6 cm

⇒ AC = (12.4)/6 = 8 cm

⇒ Perimeter of triangle ABC = AB + BC + AC = 4 + 6 + 8 =18 cm

4. If r = 3 is a root of quadratic equation $kr^2 – kr – 3 = 0$, then the value of k is:

(a) 3/2 (b) 1/2 (c) 2 (d) 5/2

Ans: (b) 1/2

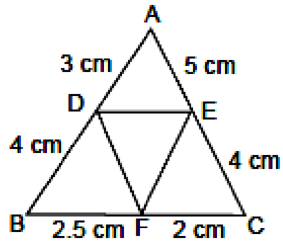
As r = 3 is a root of kr2 – kr – 3 = 0, we have:

9k – 3k – 3 = 0

⇒ 6k − 3 = 0 ⇒ k = 3/6 = 1/2

5. In the below figure, AD = 3 cm, AE = 5 cm, BD = 4 cm, CE = 4 cm, CF = 2 cm, BF = 2.5 cm, then

(a) DE || BC (b) DF || AC (c) EF || AB (d) none of these



Ans: (c) EF || AB

$\because \quad \frac{CF}{FB} = \frac{CE}{AE}$

$\therefore \quad EF \parallel AB.$

6. If for some angle θ, $\cot 2\theta = \frac{1}{\sqrt{3}}$, then the value of $\cos 3\theta$, where $3\theta \le 90^o$, is

(a) $\frac{1}{\sqrt{2}}$ (b) 1 (c) 0 (d) $\frac{\sqrt{3}}{2}$

Ans: (c) 0

7. In ΔABC, right-angled at C, if tan A=1, then the value of 2sin A cos A is

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

Ans: (a) 1

8. Volumes of two spheres are in the ratio 64:27. The ratio of their surface areas is

(a) 3:4 (b) 4:3 (c) 9:16 (d) 16:9

Ans. (d) 16:9

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

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

Ans: (c) 20

10. Find the value of k so that the following system of equations has no solution:

$3x - y - 5 = 0,\ 6x - 2y + k = 0$

(a) $k \neq 10$ (b) $k \neq -10$ (c) $k \neq 12$ (d) $k \neq -12$

Ans: (b) -10

Here $a_1 = 3,\ b_1 = -1,\ c_1 = -5$,

and $a_2 = 6,\ b_2 = -2,\ c_2 = k$.

For no solution,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{3}{6} = \frac{-1}{-2} \neq \frac{-5}{k} \Rightarrow \frac{1}{2} \neq \frac{-5}{k} \Rightarrow k \neq -10$$

11. The mean and median of a distribution are 14 and 15, respectively. The value of the mode is:

(a) 16 (b) 17 (c) 18 (d) 13

Ans. (b) 17

12. If the sum of the circumferences of two circles with radii R_1 and R_2 is equal to the circumference of a circle of radius R, then:

(a) $R_1 + R_2 = R$

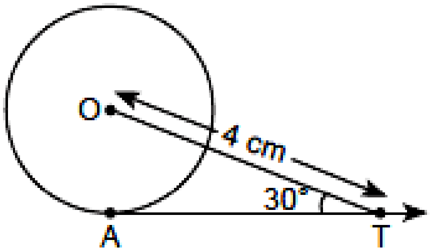
(b) $R_1 + R_2 > R$

(c) $R_1 + R_2 < R$

(d) Nothing definite can be said about the relation among R_1, R_2 and R.

Ans. (a) $R_1 + R_2 = R$

13. In figure AT is a tangent to the circle with centre O such that OT = 4 cm and OTA = 30°. Then AT is equal to



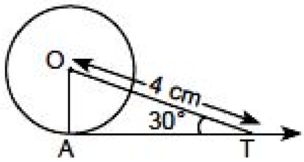
(a) 4 cm (b) 2 cm (c) 2√3 cm (d) 4√3 cm
Ans: (c) 2√3 cm

$\angle OAT = 90°$ [∵ Tangent ⊥ radius]

In right-angled ΔOAT,

$$\frac{AT}{OT} = \cos 30°$$

$$\Rightarrow \frac{AT}{4} = \frac{\sqrt{3}}{2} \Rightarrow AT = 2\sqrt{3} \text{ cm.}$$



14. Mode and mean of a data are 12k and 15k. Median of the data is
(a) 12k (b) 14k (c) 15k (d) 16k
Ans: (b) 14k
∵ Mode = 3 median – 2 mean
⇒ 12k = 3 median – 2 × 15k
⇒ 42k = 3 median ⇒ Median = 14k.

15. $4 \tan^2 A - 4 \sec^2 A$ is equal to:
(a) 2 (b) 3 (c) 4 (d) –4
Ans: (d) –4

16. Which of the following equations has 2 as a root?
(a) $x^2 - 4x + 5 = 0$ (b) $x^2 + 3x - 12 = 0$
(c) $2x^2 - 7x + 6 = 0$ (d) $3x^2 - 6x - 2 = 0$
Ans: (c) $2x^2 - 7x + 6 = 0$

17. The radii of two concentric circles are 4 cm and 5 cm. The difference in the areas of these two circles is:
(a) π (b) 7π (c) 9π (d) 13π
Ans. (c) 9π
Required difference = $\pi(5^2 - 4^2) = 9\pi$

18. If the distance between the points (x, –1) and (3, 2) is 5, then the value of x is
(a) –7 or –1 (b) –7 or 1 (c) 7 or 1 (d) 7 or –1
Ans: (d) 7 or –1

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

19. Assertion (A): The number 6^n, n being a natural number, ends with the digit 5.
Reason (R): The number 9^n cannot end with digit 0 for any natural number n.
Ans: (d) Assertion (A) is false but Reason (R) is true.

20. Assertion (A): The point (3, 0) lies on x -axis.
Reason (R): The x co-ordinate on the point on y -axis is zero.
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. If sin (A + B) = 1 and sin (A – B) = $\frac{1}{2}$, $0 \le A + B \le 90°$ and A > B, then find A and B.
Ans: sin(A + B) = 1 = sin 90°
⇒ A + B = 90° ....(i)
sin (A - B) = 1/2 = sin 30°
⇒ A - B = 30° ....(ii)
Solving eq. (i) and (ii), A = 60° and B = 30°

OR

Prove that: $\frac{1+\tan^2 A}{1+\cot^2 A} = \tan^2 A$

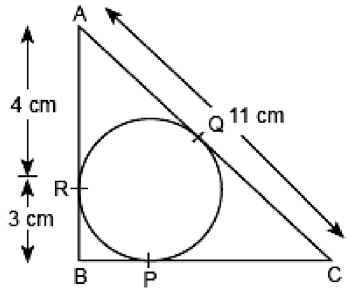
Ans: $\frac{1+\tan^2 A}{1+\cot^2 A} = \frac{\sec^2 A}{\operatorname{cosec}^2 A} = \frac{\frac{1}{\cos^2 A}}{\frac{1}{\sin^2 A}} = \frac{\sin^2 A}{\cos^2 A} = \tan^2 A$

22. The perimeter of a sector of a circle of radius 5.2 cm is 16.4 cm. Find the area of the sector.
Ans: Let AOB be the sector with O as center.
Given: Radius = r = 5.2 cm
Perimeter of sector =16.4 cm
So, OA + AB + OB = 16.4
⇒ 5.2 + 5.2 + AB = 16.4
⇒ AB = 6 cm
Area of sector = $= \frac{1}{2} rl = \frac{1}{2} \times 5.2 \times 6$ =15.6 cm²

OR

If the perimeter of a semi-circular protractor is 108 cm, find the diameter of the protractor. (Take $\pi = 22/7$))
Ans:
Perimeter = 108cm.
$\Rightarrow \frac{1}{2}(2\pi r) + 2r = 108$ ....[∵ Perimeter of a semi circle = $\frac{1}{2}(2\pi r)$]
$\Rightarrow \pi r + 2r = 108 \Rightarrow \frac{22}{7} \times r + 2r = 108 \Rightarrow 36r = 108 \times 7 \Rightarrow r = 3 \times 7 = 21$
∴ Diameter of the protractor = 2r = (2 × 21)cm = 42cm

23. In the below figure, ΔABC is circumscribing a circle. Find the length of BC.



Ans: AR = 4 cm
Also, AR = AQ (Length of tangents from A)
⇒ AQ = 4 cm
Now, QC = AC – AQ = 11 cm – 4 cm = 7 cm ...(i)
Also, BP = BR
∴ BP = 3 cm and PC = QC
⇒ PC = 7 cm [From (i)]
Hence, BC = BP + PC = 3 cm + 7 cm = 10 cm

24. Determine the values of a and b for which the following system of linear equations has infinite solutions: 2x – (a – 4) y = 2b + 1; 4x – (a – 1) y = 5b – 1
Ans:
For infinite numbers of solution,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\therefore \frac{2}{4} = \frac{-(a-4)}{-(a-1)} = \frac{2b+1}{5b-1}$$

Considering $\frac{a-4}{a-1} = \frac{1}{2}$

⇒ 2a – 8 = a – 1, ∴ a = 7

And now for 'b'

$\frac{2b+1}{5b-1} = \frac{1}{2}$ ⇒ 4b + 2 = 5b – 1

∴ b = 3

25. In Δ ABC, DE || AB. If AD = 2x, DC = x + 3 , BE = 2x − 1 and CE = x, then find the value of 'x'

Ans: $\frac{CD}{AD} = \frac{CE}{BE}$ by BPT

⇒ $\frac{x+3}{2x} = \frac{x}{2x-1}$

⇒ $2x^2 + 6x - x - 3 = 2x^2$ ⇒ $5x - 3 = 0$ ⇒ $x = \frac{3}{5}$

SECTION-C
Questions 26 to 31 carry 3 marks each

26. A man wished to give Rs. 12 to each person and found that he fell short of Rs. 6 when he wanted to give to all the persons present. He, therefore, distributed Rs. 9 to each person and found that Rs. 9 were left over. How much money did he have and how many persons were there?
Ans. Let, number of persons = x

Money share per person = y
Therefore, total money = Rs. xy
According to the question, 12 × x = xy + 6 ⇒ 12x – 6 = xy ...(i)
and 9x = xy – 9
9x + 9 = xy ...(ii)
Equating (i) and (ii), we get
12x – 6 = 9x + 9 ⇒ 3x = 15
Put the value of x in equation (i). Then
12 × 5 – 6 = x × y ⇒ xy = 54
So, he have Rs. 54 and there were 5 persons.

OR

A father's age is three times the sum of the ages of his children. After 5 years, his age will be two times the sum of their ages. Find the present age of the father.
Ans. Let the sum of the ages of two children be 'x' years and father's age be 'y' years.
According to the given condition: y = 3x
or y – 3x = 0 ...(i)
After 5 years, Father's age = (y + 5) years
Sum of the ages of children = (x + 5 + 5) years.
Then, y + 5 = 2(x + 10)
or y – 2x – 15 = 0 ...(ii)
On subtracting equation (i) from equation (ii), we get x = 15
If we put the value of x in equation (i), we get
y – 3 × 15 = 0
⇒ y = 45
Hence, the present age of the father is 45 years.

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

Ans: $LHS=\frac{\sin\theta-\cos\theta+1}{\cos\theta+\sin\theta-1}=\frac{\tan\theta-1+\sec\theta}{1+\tan\theta-\sec\theta}$ [Dividng Nr and Dr by cosθ]

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

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

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

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

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

28. Find the zeroes of the quadratic polynomial $2x^2 - x - 6$ and verify the relationship between the zeroes and the coefficients of the polynomial.
Ans: $2x^2 - x - 6 = 2x^2 - 4x + 3x - 6$
$= 2x(x - 2) + 3(x - 2)$
$x = 2, \frac{3}{2}$
Sum of zeroes = $2 + (\frac{-3}{2}) = \frac{4-3}{2} = \frac{1}{2} = \frac{(\ \ 1)}{2} = \frac{-b}{a} = \frac{\text{coefficient of } x}{\text{coefficient of } x^2}$
Product of zeroes = $2 \times \frac{-3}{2} = \frac{-6}{2} = \frac{constant}{\text{coefficient of } x^2}$

29. Given that $\sqrt{3}$ is irrational, prove that $5 + 2\sqrt{3}$ is irrational.

Ans: Let us assume $5 + 2\sqrt{3}$ is rational, then it must be in the form of p/q where p and q are co-prime integers and $q \neq 0$

i.e $5 + 2\sqrt{3} = p/q$

So $\sqrt{3} = \frac{p-5q}{2q}$ …(i)

Since p, q, 5 and 2 are integers and $q \neq 0$,

RHS of equation (i) is rational.

But LHS of (i) is $\sqrt{3}$ which is irrational. This is not possible.

This contradiction has arisen due to our wrong assumption that $5 + 2\sqrt{3}$ is rational

So, $5 + 2\sqrt{3}$ is irrational.

30. Cards numbered 1 to 30 are put in a bag. A card is drawn at random from this bag. Find the probability that the number on the drawn card is

(i) not divisible by 3.

(ii) a prime number greater than 7.

(iii) not a perfect square number.

Ans : Total possible outcomes of drawing a card from a bag out of 30 cards = 30.

(i) Favourable outcomes for a card numbered not divisible by 3 = 20 (i.e. 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 19, 20, 22, 23, 25, 26, 28 and 29).

Probability of drawing a card numbered not divisible by 3 = 20/30 = 2/3

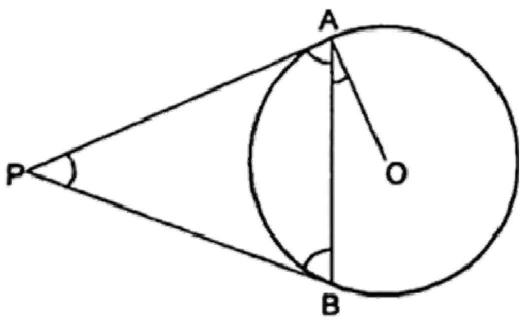
(ii) Favourable outcomes for a prime numbered card greater than 7 = 6 (i.e. 11, 13, 17, 19, 23 and 29)

Probability of drawing a prime number card, greater than 7 = 6/30 = 1/5

(iii) Favourable outcomes for not a perfect square numbered card = 25 (leaving 1, 4, 9, 16 and 25)

Probability of drawing a card which is not a perfect square = 25/30 = 5/6

31. Two tangents PA and PB are drawn to a circle with centre O from an external point P. Prove that $\angle APB = 2\angle OAB$.



PA & PB are the tangents to a circle, with Centre O from a point P outside it.

PA= PB. (The tangents to a circle from an external point are equal in length)

$\angle PBA = \angle PAB$ [Angles opposite to the equal sides of a triangle are equal.]

$\angle APB + \angle PBA + \angle PAB = 180°$ [Sum of the angles of a triangle is 180°]

$x° + \angle PAB + \angle PAB = 180°$ ($\angle PBA = \angle PAB$)

$\Rightarrow x° + 2\angle PAB = 180°$

$\Rightarrow \angle PAB = \frac{1}{2}(180° - x°)$

$\Rightarrow \angle PAB = 90° - x°/2$

$\Rightarrow \angle OAB + \angle PAB = 90°$

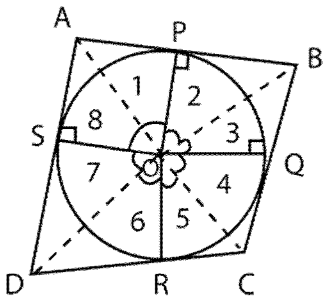
$\Rightarrow \angle OAB = 90° - (90° - x°/2)$

$\Rightarrow \angle OAB = x°/2 \Rightarrow \angle OAB = \angle APB/2 \Rightarrow \angle APB = 2\angle OAB$

OR

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)

∴ ∠POA=∠AOS (CPCT) ⇒ ∠1=∠8

Similarly, ∠2=∠3, ∠4=∠5 and ∠6=∠7

$\angle 1+\angle 2+\angle 3+\angle 4+\angle 5+\angle 6+\angle 7+\angle 8 = 360^o$

$\Rightarrow (\angle 1+\angle 8)+(\angle 2+\angle 3)+(\angle 4+\angle 5)+(\angle 6+\angle 7) = 360^o$

$\Rightarrow 2(\angle 1)+2(\angle 2)+2(\angle 5)+2(\angle 6) = 360^o$

$\Rightarrow (\angle 1)+(\angle 2)+(\angle 5)+(\angle 6) = 180^o$

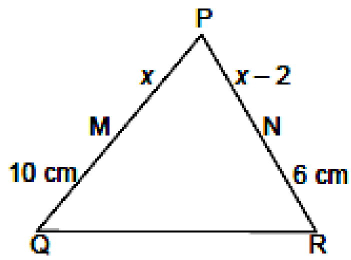
$\therefore \angle AOD + \angle COD = 180^o$

Similarly, $\angle BOC + \angle DOA = 180^o$

SECTION-D

Questions 32 to 35 carry 5M each

32. If a line is drawn parallel to one side of a triangle, prove that the other two sides are divided in the same ratio. Using this theorem, find x in below figure, if MN || QR, PM = x cm, MQ = 10 cm, PN = (x – 2) cm, NR = 6 cm



Ans: Given, To Prove, Constructions and Figure – 1½ marks

Proof – 1½ marks

1 marks to find x = 5 cm

$\because$ MN || QR

$\therefore \frac{PM}{MQ} = \frac{PN}{NR}$

$\Rightarrow \frac{x}{10} = \frac{x-2}{6} \Rightarrow 6x = 10x - 20 \Rightarrow x = 5$ cm.

33. A train travels at a certain average speed for a distance of 63 km and then travels at a distance of 72 km at an average speed of 6 km/hr more than its original speed. If it takes 3 hours to complete total journey, what is the original average speed?

Ans : Let original average speed of the train be x km/h

New average speed be (x + 6) km/h

Time taken for a distance of 63 km = $\frac{63}{x}$ hours

Time taken for a distance of 72 km = $\frac{72}{x+6}$ hours

According to the question, $\frac{63}{x}+\frac{72}{x+6}=3 \Rightarrow \frac{63(x+6)+72x}{x(x+6)}=3$

$\Rightarrow \frac{63x+378+72x}{x^2+6x}=3 \Rightarrow \frac{135x+378}{x^2+6x}=3$

$\Rightarrow 3(x^2 + 6x) = 135x + 378 = 3(45x + 126)$

$\Rightarrow x^2 + 6x = 45x + 126$ $\Rightarrow x^2 + 6x - 45x - 126 = 0$ $\Rightarrow x^2 - 39x - 126 = 0$

$\Rightarrow x^2 - 42x + 3x - 126 = 0$ $\Rightarrow x(x - 42) + 3(x - 42) = 0$ $\Rightarrow (x - 42)(x + 3) = 0$

$\therefore$ x – 42 = 0 or x + 3 = 0

$\Rightarrow$ x = 42 or x = – 3 (rejected)

Therefore, original average speed of the train is 42 km/h.

OR

In a flight of 600 km, an aircraft was slowed due to bad weather. Its average speed for the trip was reduced by 200 km/hr and time of flight increased by 30 minutes. Find the original duration of flight.

Ans : Let original speed of the aircraft be x km/hr

Reduced speed = (x – 200) km/hr

According to given condition, $\frac{600}{x-200}-\frac{600}{x}=\frac{1}{2} \Rightarrow \frac{600x-600x+120000}{x(x-200)}=\frac{1}{2}$

$\Rightarrow \frac{120000}{x^2-200x}=\frac{1}{2} \Rightarrow x^2 - 200x = 240000$

$\Rightarrow x^2 - 200x - 240000 = 0 \Rightarrow x^2 - 600x + 400x - 240000 = 0$

$\Rightarrow x(x - 600) + 400(x - 600) = 0 \Rightarrow (x + 400)(x - 600) = 0$

$\Rightarrow x + 400 = 0$ or $x - 600 = 0 \Rightarrow x = -400$ (rejected) or $x = 600$

$\therefore$ original speed = 600 km/hr

$\therefore$ original duration of flight = = 1 hour

34. If the median of the following distribution is 46, find the missing frequencies p and q if the total frequency is 230.

Marks	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
Frequency	12	30	p	65	q	25	18

Ans:

Class	Frequency (f_i)	Cumulative frequency (*c.f.*)
10-20	12	12
20-30	30	42
30-40	p	$42 + p$
40-50	65	$107 + p$
50-60	q	$107 + p + q$
60-70	25	$132 + p + q$
70-80	18	$150 + p + q$
Total	230	

Since, median is 46, so 40-50 is median class.

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h \quad \Rightarrow \quad 46 = 40 + \left(\frac{\frac{230}{2} - (42+p)}{65}\right) \times 10$$

$$\Rightarrow \quad 6 = \frac{(115 - 42 - p)}{65} \times 10 \;\Rightarrow\; 39 = 73 - p \;\Rightarrow\; p = 34$$

Also, $150 + p + q = 230$

$\Rightarrow \quad 150 + 34 + q = 230 \;\Rightarrow\; q = 230 - 184 \;\Rightarrow q = 46$

35. 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 (see below figure). 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. (Take π = 22/7)

Ans: TSA of the toy = CSA of hemisphere + CSA of cone

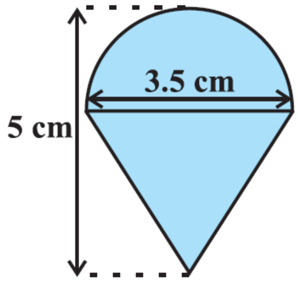
Now, the curved surface area of the hemisphere = $2\pi r^2 = 2\times\frac{22}{7}\times\frac{3.5}{2}\times\frac{3.5}{2}$ cm^2

Also, the height of the cone = height of the top – height (radius) of the hemispherical part

= $\left(5-\frac{3.5}{2}\right)=3.25cm$

So, the slant height of the cone (l) = $\sqrt{r^2+h^2}=\sqrt{\left(\frac{3.5}{2}\right)^2+(3.25)^2}=3.7cm(approx.)$

Therefore, CSA of cone = πrl = $\frac{22}{7}\times\frac{3.5}{2}\times 3.7$ cm^2



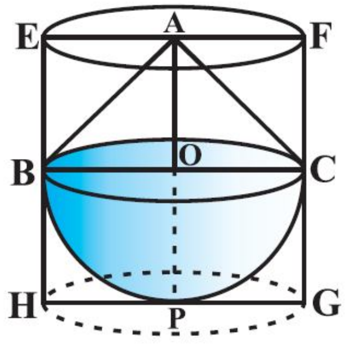
∴ TSA of the toy = $\left(2\times\frac{22}{7}\times\frac{3.5}{2}\times\frac{3.5}{2}\right)+\left(\frac{22}{7}\times\frac{3.5}{2}\times 3.7\right)$

= $\frac{22}{7}\times\frac{3.5}{2}(3.5+3.7)=\frac{11}{2}(3.5+3.7)=39.6cm^2$

OR

A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 2 cm and the diameter of the base is 4 cm. Determine the volume of the toy. If a right circular cylinder circumscribes the toy, find the difference of the volumes of the cylinder and the toy. (Take π = 3.14)

Ans: Let BPC be the hemisphere and ABC be the cone standing on the base of the hemisphere (see below figure).



The radius BO of the hemisphere (as well as of the cone) = $\frac{1}{2}\times 4=2cm$

So, volume of the toy = $\frac{2}{3}\pi r^3+\frac{1}{3}\pi r^2 h=\frac{1}{3}\pi r^2(2r+h)$

$=\frac{1}{3}\times 3.14\times 2\times 2\times(4+2)=\frac{1}{3}\times 3.14\times 2\times 2\times 6$ = 25.12 cm^3

Now, let the right circular cylinder EFGH circumscribe the given solid. The radius of the base of the right circular cylinder = HP = BO = 2 cm, and its height is
EH = AO + OP = (2 + 2) cm = 4 cm
So, the volume required = volume of the right circular cylinder – volume of the toy
= $(3.14 \times 22 \times 4 – 25.12)\ cm^3$
= $25.12\ cm^3$
Hence, the required difference of the two volumes = $25.12\ cm^3$.

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

36. 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.

On the basis of the above information, answer any four of the following questions:
(i) What is the production of first year? (1)
(ii) What is the production of 8th year? (1)
(iii) What is the production during first three years? (2)

OR

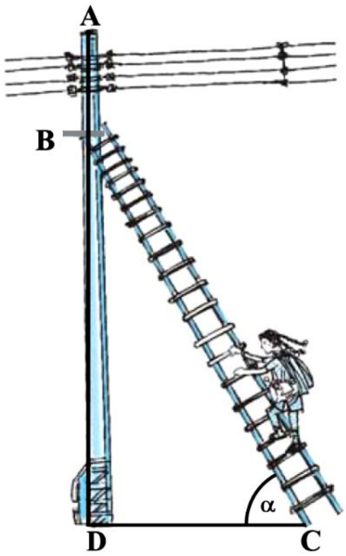
(iii) In which year, the production is 29,200? (2)

Ans: (i) Rs 5000
(ii) Production during 8th year is (a + 7d) = 5000 + 7(2200) = 20400
(iii) Production during first 3 year = 5000 + 7200 + 9400 = 21600

OR

(iii)$a_n = a + (n – 1)d$
$\Rightarrow 29200 = 5000 + (n – 1)2200$
$\Rightarrow (n – 1)2200 = 29200 – 5000 = 24200$
$\Rightarrow n – 1 = 24200/2200 = 11$
$\Rightarrow n = 11 + 1 = 12$

37. Raj is an electrician in a village. One day power was not there in entire village and villagers called Raj to repair the fault. After thorough inspection he found an electric fault in one of the electric pole of height 5 m and he has to repair it. He needs to reach a point 1.3m below the top of the pole to undertake the repair work.



Based on the above information answer the following questions.

(i) When the ladder is inclined at an angle of α such that $\sqrt{3}\tan\alpha + 2 = 5$ to the horizontal, find the angle α. (1)

(ii) In the above situation if BD = 3 cm and BC = 6 cm. Find α (1)

(iii) How far from the foot of the pole should he place the foot of the ladder? (Use $\sqrt{3} = 1.73$) (2)

OR

(iii) Given 15 cot α = 8, find sin α. (2)

Ans: (i) $\sqrt{3}\tan\alpha + 2 = 5$

$\Rightarrow \sqrt{3}\tan\alpha = 5 - 2 = 3$

$\Rightarrow \tan\alpha = \sqrt{3} = \tan 60^0$

$\Rightarrow \alpha = 60^0$

(ii) BD = 3 cm and BC = 6 cm

In ΔBCD, $\sin\alpha = \frac{BD}{BC}$

$\Rightarrow \sin\alpha = \frac{3}{6} = \frac{1}{2} = \sin 30^0 \Rightarrow \alpha = 30^0$

(iii) BD = AD – AC = 5 – 1.3 = 3.7

In ΔBCD, $\tan 60^0 = \frac{BD}{DC}$

$\Rightarrow \sqrt{3} = \frac{3.7}{DC} = 1.73$

$\Rightarrow$ DC = 3.7/1.73 = 2.14 m (approx.)

OR

cot α = 8/15

$\Rightarrow$ DC = 8 and BD = 15

From Pythagoras theorem,

$BC^2 = BD^2 + DC^2$

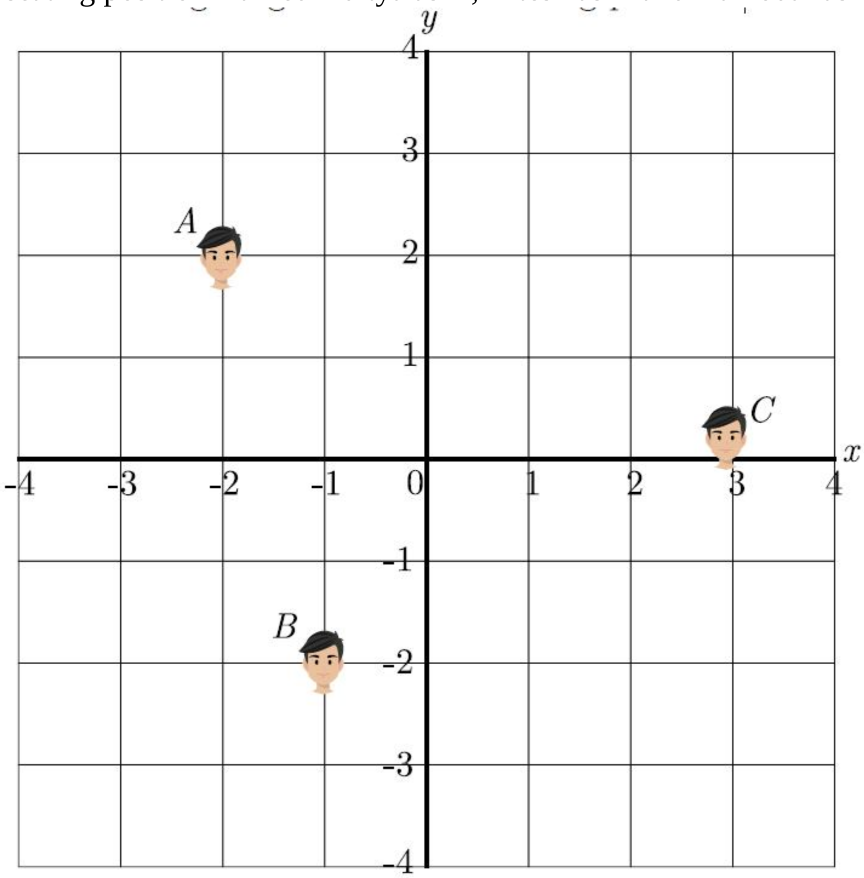
$\Rightarrow BC^2 = 15^2 + 8^2$

$\Rightarrow$ BC = 225 + 64 = 289

$\Rightarrow$ BC = 17

$\Rightarrow$ sin α = BD/BC = 15/17

38. Aditya, Ritesh and Damodar are fast friend since childhood. They always want to sit in a row in the classroom . But teacher doesn't allow them and rotate the seats row-wise everyday. Ritesh is very good in maths and he does distance calculation everyday. He consider the centre of class as origin and marks their position on a paper in a co-ordinate system. One day Ritesh make the following diagram of their seating position marked Aditya as A, Ritesh as B and Damodar as C.



(i) What is the distance between A and B ? [1]
(ii) What is the distance between B and C ? [1]
(iii) A point D lies on the line segment between points A and B such that AD :DB = 4 : 3 . What are the the coordinates of point D ? [2]

OR

(iii) If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then find the value of k [2]

Ans:

(i) It may be seen easily from figure that coordinates of point A are (- 2, 2).

$AB^2 = (-2+1)^2 + (2+2)^2 = 1 + 4^2 = 17$

$\Rightarrow AB = \sqrt{17}$

(ii) It may be seen easily from figure that coordinates of point C are (3, 0).

$BC^2 = (-1-3)^2 + (-2-0)^2 = 4^2 + 4 = 20$

$\Rightarrow BC = 2\sqrt{5}$

(iii) We have A(- 2, 2) and B(- 1,- 2) and $\frac{m_1}{m_2} = \frac{4}{3}$

$$x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2} = \frac{-1(4) + 3(-2)}{4+3} = \frac{-10}{7}$$

$$y = \frac{m_1y_2 + m_2y_1}{m_1 + m_2} = \frac{-2(4) + 3(2)}{4+3} = \frac{-2}{7}$$

Coordinates of D is $\left(\frac{-10}{7}, \frac{-2}{7}\right)$

OR

Using Section Formula, $x = \frac{m_1 x_2 + m_2 x_1}{m_1 + m_2}$ *and* $y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$, we get

$$k = \left[\frac{2 \times 2 - 1 \times 7}{1+2}\right] = \frac{4-7}{3} = \frac{-3}{3} = -1$$