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SAMPLE PAPER TEST 08 FOR BOARD EXAM 2024

(ANWERS)

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. The pair of linear equations 2x + 3y = 5 and 4x + 6y = 10 is

(a) inconsistent (b) consistent (c) dependent consistent (d) none of these

Ans: (c)

$$\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{-5}{-10} = \frac{1}{2}$$

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

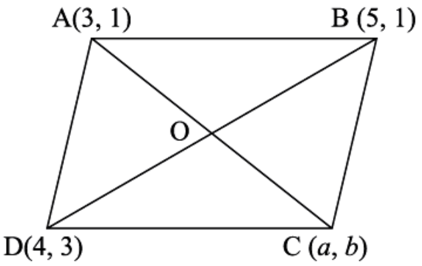
Therefore, the pair of linear equations has infinity many solutions and hence dependent consistent

2. Points A(3, 1), B(5, 1), C(a, b) and D(4, 3) are vertices of a parallelogram ABCD. The values of a and b are respectively

(a) a = 6, b = 3 (b) a = 2, b = 1 (c) a = 4, b = 2 (d) None of these

Ans: (a) a = 6, b = 3

ABCD is a parallelogram.



Since, the diagonals of a parallelogram bisect each other.

$$\therefore \left(\frac{3+a}{2}, \frac{1+b}{2}\right) = \left(\frac{4+5}{2}, \frac{3+1}{2}\right)$$

$$\Rightarrow \frac{3+a}{2} = \frac{9}{2} \Rightarrow 3 + a = 9$$

$$\Rightarrow a = 6$$

and $\frac{1+b}{2} = \frac{4}{2} \Rightarrow 1 + b = 4 \Rightarrow b = 3$

Hence, $a = 6$ and $b = 3$.

3. If ΔABC ~ ΔEDF and ΔABC is not similar to ΔDEF, then which of the following is not true?

(a) BC · EF = AC · FD (b) AB · EF = AC · DE

(c) BC · DE = AB · EF (d) BC · DE = AB · FD

Ans: (c) BC · DE = AB · EF

4. If sec A = 15/7 and A + B = 90°, find the value of cosec B.

(a) 8/7 (b) 12/7 (c) 7/15 (d) 15/7

Ans: (d)

5. The LCM of two numbers is 14 times their HCF. The sum of LCM and HCF is 600. If one number is 280, then the other number is

(a) 20 (b) 28 (c) 60 (d) 80

Ans: (d) According to the question, LCM + HCF = 600

Since LCM = 14 × HCF

⇒ 14 × HCF + HCF = 600 ⇒ 15 × HCF = 600 ⇒ HCF = 600 ÷ 15 = 40

⇒ LCM = 600 – HCF = 600 – 40 = 560

We know that HCF (a, b) × LCM (a, b) = a × b

⇒ Other number = 40 x 560 /280 = 80

6. When 2120 is expressed as the product of its prime factors we get

(a) $2 \times 5^3 \times 53$ (b) $2^3 \times 5 \times 53$ (c) $5 \times 7^2 \times 31$ (d) $5^2 \times 7 \times 33$

Ans: (b) $2120 = 2 \times 2 \times 2 \times 5 \times 53 = 2^3 \times 5 \times 53$

7. If p and q are the zeroes of the quadratic polynomial $f(x) = 2x^2 - 7x + 3$, find the value of p + q – pq is

(a) 1 (b) 2 (c) 3 (d) None of these

Ans: (b) 2

8. ABCD is a trapezium with AD ∥ BC and AD = 4cm. If the diagonals AC and BD intersect each other at O such that AO/OC = DO/OB =1/2, then BC =

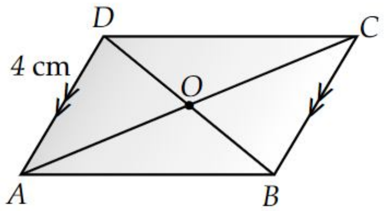
(a) 6cm (b) 7cm (c) 8cm (d) 9cm

Ans: (c) 8cm

$AD \parallel BC$

and $\dfrac{AO}{OC} = \dfrac{DO}{OB} = \dfrac{1}{2}$

$\therefore \dfrac{AD}{BC} = \dfrac{AO}{OC} \Rightarrow \dfrac{4}{BC} = \dfrac{1}{2} \Rightarrow BC = 8 \text{ cm}$



9. If the angle between two radii of a circle is 140°, then the angle between the tangents at the ends of the radii is

(a) 90° (b) 50° (c) 70° (d) 40°

Ans: (d) 40°

10. The number of revolutions made by a circular wheel of radius 0.7 m in rolling a distance of 176 m is

(a) 22 (b) 24 (c) 75 (d) 40

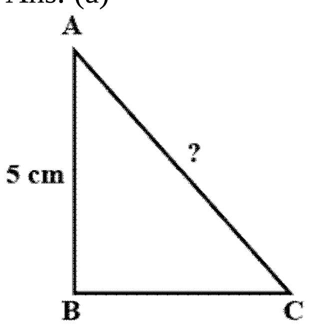
Ans: (d) 40

$$\text{Number of revolutions} = \frac{\text{total distance}}{\text{circumference}} = \frac{176}{2 \times \frac{22}{7} \times 0.7} = 40$$

11. In ΔABC, right angled at B, AB = 5 cm and sin C = 1/2. Determine the length of side AC.

(a) 10 cm (b) 15 cm (c) 20 cm (d) none of these

Ans: (a)



$$\sin C = \frac{AB}{AC} \Rightarrow \frac{1}{2} = \frac{5}{AC} \Rightarrow AC = 10cm$$

12. In the ΔABC, D and E are points on side AB and AC respectively such that DE || BC. If AE = 2 cm, AD = 3 cm and BD = 4.5 cm, then CE equals

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

Ans: (c) 3 cm

$$\frac{AD}{BD} = \frac{AE}{CE} \Rightarrow \frac{3}{4.5} = \frac{2}{CE} \Rightarrow CE = 3cm$$

13. The median class of the following data is:

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of students	8	10	12	22	30	18

(a) 20 – 30 (b) 30 – 40 (c) 40 – 50 (d) 50 – 60

Ans: (b)

14. Two dice are thrown simultaneously. What is the probability of getting doublet?

(a) 1/36 (b) 1/6 (c) 5/6 (d) 11/36

Ans: (b) 1/6

Number of Possible outcomes are 36

Number of favourable outcomes = 6

Probability = 6/36 = 1/6

15. If 4 tan θ = 3, then the value of $\frac{4\sin\theta - \cos\theta}{4\sin\theta + \cos\theta}$ is

(a) 1/2 (b) 1/3 (c) 1/4 (d) 1/5

Ans: (a) 1/2

Dividing Numerator and Denominator by cos θ, we get

$$\frac{4\sin\theta - \cos\theta}{4\sin\theta + \cos\theta} = \frac{4\tan\theta - 1}{4\tan\theta + 1} = \frac{4\times\frac{3}{4} - 1}{4\times\frac{3}{4} + 1} = \frac{3-1}{3+1} = \frac{2}{4} = \frac{1}{2}$$

16. The area of the square that can be inscribed in a circle of radius 8 cm is

(a) 256 cm² (b) 128 cm² (c) 64√2 cm² (d) 64 cm²

Ans: (b) 128 cm²

17. The ratio of the total surface area to the lateral surface area of a cylinder with base radius 80 cm and height 20 cm is

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

Ans: (d) 5 : 1

$$\frac{\text{Total surface area}}{\text{Lateral surface area}} = \frac{2\pi r(h+r)}{2\pi rh} = \frac{h+r}{h} = \frac{(20+80)}{20} = \frac{100}{20} = \frac{5}{1}$$

18. The mean and mode of a frequency distribution are 28 and 16 respectively. The median is

(a) 22 (b) 23.5 (c) 24 (d) 24.5

Ans: (c) 24

We know that, Mode = 3 Median – 2 Mean

⇒ 3 Median = Mode + 2 Mean

⇒ 3 Median = 16 + 2 × 28 ⇒ Median = 72/3 = 24

DIRECTION: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**.

Choose the correct option

19. Statement A (Assertion): The value of y is –6, for which the distance between the points P(2, –3) and Q(10, y) is 10.

Statement R(Reason) : Distance between two given points A (x_1, y_1) and B (x_2, y_2) is given by AB = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

(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: (d) Assertion (A) is false but reason (R) is true.

20. Statement A (Assertion): The number 6^n never end with digit 0 for any natural number n..

Statement R(Reason) : The number 9^n never end with digit 0 for any natural number n.

(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.

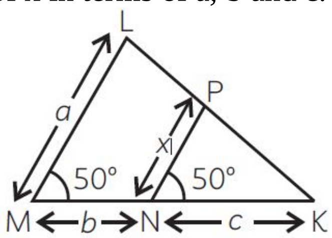
(d) Assertion (A) is false but reason (R) is true.

Ans: (b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)

SECTION – B

Questions 21 to 25 carry 2 marks each.

21. In the given figure, find the value of x in terms of a, b and c.



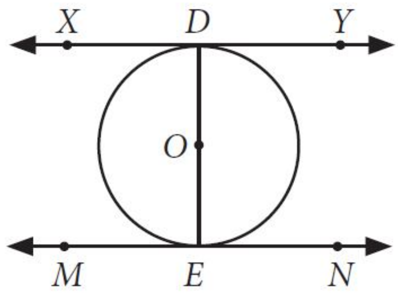
Ans: In Δs LMK and PNK, we have

∠M = ∠N = 50º and ∠K = ∠K

So, by AA similarity criterion, ΔLMK ~ ΔPNK

Thus, $\frac{LM}{PN} = \frac{KM}{KN} \Rightarrow \frac{a}{x} = \frac{b+c}{c} \Rightarrow x = \frac{ac}{b+c}$

22. XY and MN are the tangents drawn at the end points of the diameter DE of the circle with centre O. Prove that XY || MN.



Ans: Since, XY is the tangent to the circle at the point D.

⇒ OD ⊥ XY ⇒ ∠EDX = 90°

Also, MN is the tangent to the circle at E.

⇒ OE ⊥ MN ⇒ ∠ DEN = 90°

As, ∠EDX = ∠DEN (each 90°)

which are alternate interior angles.

⇒ XY ||MN

23. A rope by which a cow is tethered is increased from 16mto 23m. How much additional ground does it have now to graze?

Ans: Given : length of rope (r) = 16 m

Increased length of rope (R) = 23 m

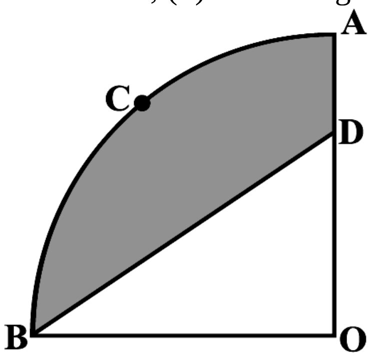
Hence the additional area cow can graze = $\pi R^2 - \pi r^2 = \pi(R^2 - r^2)$

$= \frac{22}{7}(23^2 - 16^2) = \frac{22}{7}(529 - 256)$

$= \frac{22}{7} \times 273 = 858 m^2$

OR

In the below figure, OACB is a quadrant of a circle with centre O and radius 3.5 cm. If OD = 2 cm, find the area of the (i) quadrant OACB, (ii) shaded region.



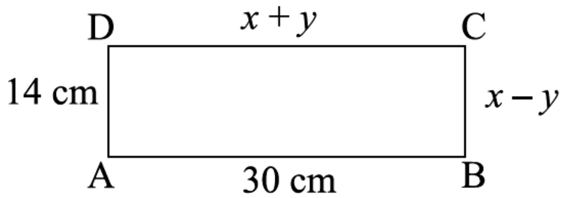
Ans: (i) Area of the quadrant OACB = $\frac{1}{4}\pi r^2 = \frac{1}{4} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{8}$ = 9.625 cm^2

(ii) Area of the ΔBOD = (1/2) x OB x OD = (1/2) x 3.5 x 2 = 3.5 cm^2

Area of the shaded region = Area of the quadrant OACB – Area of the ΔBOD

= 9.625 – 3.5 = 6.125 cm^2

24. In figure, ABCD is a rectangle. Find the values of x and y.



Ans: AB = DC and BC = AD

⇒ x + y = 30 ...(i)

and x – y = 14 ...(ii)

Adding (i) and (ii), we get 2x = 44 ⇒ x = 22

⇒ y = 30 - 22 = 8

Thus, x = 22 and y = 8

25. Find A and B, if sin (A + 2B) = √3/2 and cos (A + B) = 1/2.

Ans: Given : sin (A + 2B) = sin 60°

⇒ A + 2B = 60° ...(i)

cos (A + B) = cos 60°

⇒ A + B = 60° ...(ii)

Subtracting equation (i) and (ii), we get B = 0°

Putting the value of B in equation (ii), we get,

A = 60° – 0° = 60°

So, A = 60° and B = 0°.

OR

If (1 + cos A) (1 – cos A) = 3/4 , find the value of tan A.

Ans: (1 + cos A) (1 – cos A) = 3/4

⇒ 1 – $\cos^2$A = 3/4 ⇒ $\cos^2$A = 1 – 3/4 = 1/4 ⇒ cosA = ±1/2

Also, 1 – $\cos^2$A = 3/4 ⇒ $\sin^2$A = 3/4 ⇒ sinA = ±√3/2

⇒ tanA = sinA/cosA = ±√3

SECTION – C

Questions 13 to 22 carry 3 marks each.

26. A part of monthly hostel charges in a college is fixed and the remaining depends on the number of days one has taken food in the mess. When a student 'A' takes food for 22 days, he has to pay Rs. 1380 as hostel charges; whereas a student 'B', who takes food for 28 days, pays Rs. 1680 as hostel charges. Find the fixed charges and the cost of food per day.

Ans: Let the fixed hostel charges be Rs. x and the cost of food per day be Rs. y.
According to the question, we get
$x + 22y = 1380$ ...(i)
and $x + 28y = 1680$ ...(ii)
Subtracting (i) from (ii), we get
$6y = 300 \Rightarrow y = 300 \div 6 = 50$
Putting y = 50 in (i), we get
$x + 22(50) = 1380 \Rightarrow x + 1100 = 1380 \Rightarrow x = 280$
∴ Fixed hostel charges = Rs. 280 and cost of the food per day = Rs. 50.

OR

The ratio of income of two persons is 9 : 7 and the ratio of their expenditure is 4 : 3, if each of them manage to save Rs. 2000/month. Find their monthly incomes.

Ans: Let the income of first person be 9x and the income of second person be 7x. Further, let the expenditures of first and second persons be 4y and 3y respectively. Then, Saving of the first person = $9x – 4y$
Saving of the second person = $7x – 3y$
According to question,
$9x – 4y = 2000$ or $9x – 4y – 2000 = 0$ ...(i)
and $7x – 3y = 2000$ or $7x – 3y – 2000 = 0$ ...(ii)
Solving (i) and (ii), we get x = 2000 and y = 4000
Thus, monthly income of first person = 9 × 2000 = Rs. 18000
Monthly income of second person = 7 × 4000 = Rs. 28000

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

And: 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

28. Prove that √5 is and irrational number.

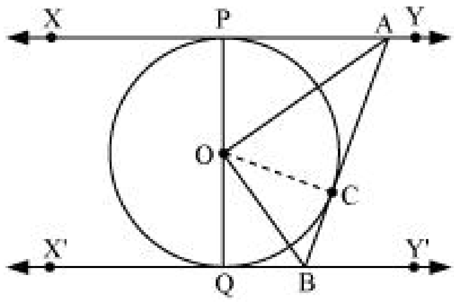
Ans: Let $\sqrt{5}$ is a rational number then we have $\sqrt{5} = \frac{p}{q}$, where p and q are co-primes.

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

29. Find the zeroes of the quadratic polynomial $6x^2 - 7x - 3$ and verify the relationship between the zeroes and the coefficients of the polynomial.
Ans: $6x^2 - 7x - 3 = 0$
$\Rightarrow 6x^2 - 9x + 2x - 3 = 0$
$\Rightarrow 3x(2x - 3) + 1(2x - 3) = 0$
$\Rightarrow (3x + 1)(2x - 3) = 0$
$\Rightarrow x = \frac{-1}{3}, \frac{3}{2}$
Now, $\alpha + \beta = \frac{-1}{3} + \frac{3}{2} = \frac{-2+9}{6} = \frac{7}{6}$ and $\frac{-b}{a} = \frac{7}{6} \Rightarrow \alpha + \beta = \frac{-b}{a}$
$\alpha\beta = \frac{-1}{3} \times \frac{3}{2} = \frac{-1}{2}$ and $\frac{c}{a} = \frac{-1}{2} \Rightarrow \alpha\beta = \frac{c}{a}$

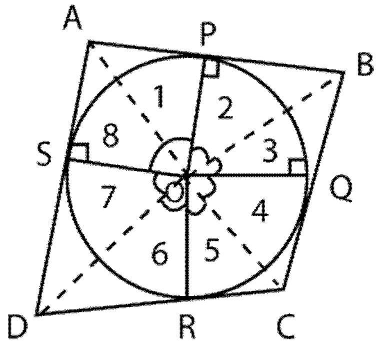
30. Prove that the intercept of a tangent between two parallel tangents to a circle subtends a right angle at the center
Ans: Given: XY and X'Y' are two parallel tangents to the circle wth centre O and AB is the tangent at the point C, which intersects XY at A and X'Y' at B.



In ΔOAP and ΔOAC
AP = AC (Tangents from to same point A)
PO = OC (Radii of the same circle)
OA = OA (Common side)
so, ΔOAP = ΔOAC (SSS congruence criterion)
∴ ∠AOP =∠AOC = ∠1 (CPCT)
Similarly, ∠BOQ =∠BOC = ∠2
Now, POQ is a diameter of the circle.
Hence, it is a straight line.
∴ ∠1 + ∠1 + ∠2 + ∠2 = 180°
2(∠1 + ∠2) = 180°
∴ ∠1 + ∠2 = 90°
∴ ∠AOB = 90°.

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, $\Delta OAP = \Delta OAS$ (SSS congruence criterion)
$\therefore \angle POA = \angle AOS$ (CPCT)
$\Rightarrow \angle 1 = \angle 8$
Similarly, $\angle 2 = \angle 3$, $\angle 4 = \angle 5$ and $\angle 6 = \angle 7$
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360^o$
$\Rightarrow (\angle 1 + \angle 8) + (\angle 2 + \angle 3) + (\angle 4 + \angle 5) + (\angle 6 + \angle 7) = 360^o$
$\Rightarrow 2(\angle 1) + 2(\angle 2) + 2(\angle 5) + 2(\angle 6) = 360^o$
$\Rightarrow (\angle 1) + (\angle 2) + (\angle 5) + (\angle 6) = 180^o$
$\therefore \angle AOD + \angle COD = 180^o$
Similarly, $\angle BOC + \angle DOA = 180^o$

31. One card is drawn at random from a well-shuffled deck of 52 playing cards. Find the probability that the card drawn is (i) either a red card or a king, (ii) neither a red card nor a queen.
Ans: Total number of cards = 52
(i) Number of either red card or a king card = 28
Required Probability = $\frac{28}{52} = \frac{7}{13}$
(ii) Number of cards neither a red card or a queen card = 52 – 28 = 24
Required Probability = $\frac{24}{52} = \frac{6}{13}$

SECTION – D

Questions 32 to 35 carry 5 marks each.

32. A vessel is in the form of an inverted cone. Its height is 8 cm and the radius of its top which is open, is 5 cm. It is filled with water upto the brim. When lead shots, each of which is a sphere of radius 0.5 cm are dropped into the vessel, one-fourth of water flows out. Find the number of lead shots dropped into the vessel.
Ans: We have, height of the conical vessel, h = 8 cm
and radius of the conical vessel, r = 5 cm
$\therefore$ Volume of water filled in the vessel cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 5^2 \times 8 = \frac{200}{3}\pi cm^3$
Also, we have radius of a spherical lead shot = 0.5 cm
$\therefore$ Volume of each lead shot = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times (0.5)^3 cm^3$
$\therefore$ Volume of lead shots dropped = Volume of water that overflows = $\frac{1}{4} \times \frac{200}{3}\pi cm^3 = \frac{50}{3}\pi cm^3$

$\therefore$ Number of lead shots dropped = $\dfrac{\frac{50}{3}\pi}{\frac{4}{3}\pi \times 0.5 \times 0.5 \times 0.5} = 100$

Hence required number of lead shots is 100.

OR

A copper wire of diameter 8 mm is evenly wrapped on a cylinder of length 24 cm and diameter 49 cm to cover the whole surface. Find (i) the length of the wire (ii) the volume of the wire.

Ans: The thickness of wire = its diameter = 8 mm = 0.8 cm.

And, the length of the cylinder = 24 cm

$\therefore$ Number of turns of the wire required to cover the whole surface of the cylinder

= Length of the cylinder/Diameter of the wire = 24/0.8 = 30

Since, diameter of the cylinder = 49 cm

$\therefore$ Radius of the cylinder, r = 49/2 cm

(i) Length of wire wrapped in 1 round = Circumference of the cylinder

= $2\pi r = 2 \times \frac{22}{7} \times \frac{49}{2} = 154cm$

Length of wire wrapped in 30 rounds = 30 × 154 cm = 4620 cm

(ii) Since radius (r) of wire = $\frac{0.8}{2} = 0.4cm$ and its length or height (h) = 4620 cm

$\therefore$ Volume of the wire = $\pi r^2 h = \frac{22}{7} \times (0.4)^2 \times 4620 = 2323.2cm^3$

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

Using the above theorem prove that a line through the point of intersection of the diagonals and parallel to the base of the trapezium divides the non parallel sides in the same ratio.

Ans: For the Theorem :

Given, To prove, Construction and figure of 1½ marks

Proof of 1½ marks

Let ABCD be a trapezium DC ∥ AB and EF is a line parallel to AB and hence to DC.

Join AC, meeting EF in G.

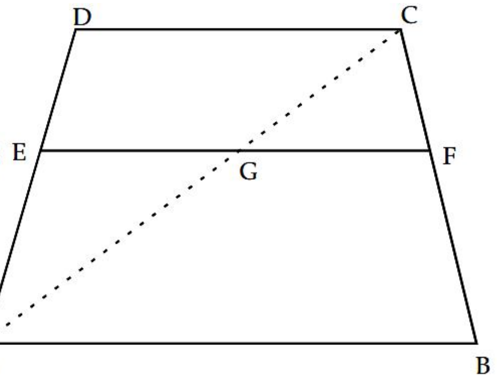
In ΔABC, we have GF ∥ AB

$\frac{CG}{GA} = \frac{CF}{FB}$ [By BPT] …(1)

In ΔADC, we have EG ∥ DC (EF ∥ AB & AB ∥ DC)

$\frac{DE}{EA} = \frac{CG}{GA}$ [By BPT] …(2)

From (1) & (2), we get, $\frac{DE}{EA} = \frac{CF}{FB}$



34. Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank. **(NCERT Exercise 4.3 Q9)**

OR

A rectangular park is to be designed whose breadth is 3 m less than its length. Its area is to be 4 square metres more than the area of a park that has already been made in the shape of an isosceles triangle with its base as the breadth of the rectangular park and of altitude 12 m. Find its length and breadth. **NCERT Quadratic Equations Example-12, page no. 84**

35. If the median of the distribution given below is 28.5, find the values of x and y.

Class	0-10	10-20	20-30	30-40	40-50	50-60	**Total**
Frequency	5	x	20	15	y	5	**60**

Ans: Here, median = 28.5, n = 60

Class interval	*Frequency (f_i)*	*Cumulative frequency (cf)*
0–10	5	5
10–20	x	$5 + x$
20–30	20	$25 + x$
30–40	15	$40 + x$
40–50	y	$40 + x + y$
50–60	5	$45 + x + y$
Total	$\Sigma f_i = 60$	

Since the median = 28.5, therefore, median class is 20–30

$\therefore \quad \frac{n}{2} = 30,\ l = 20,\ h = 10,\ cf = 5 + x,\ f = 20$

$$\therefore \quad \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h \quad \Rightarrow \quad 28.5 = 20 + \left(\frac{30 - (5 + x)}{20}\right) \times 10$$

$$\Rightarrow \quad 28.5 = 20 + \frac{25 - x}{20} \times 10 \quad \Rightarrow \quad 28.5 = 20 + \frac{25 - x}{2} \quad \Rightarrow \quad 57 = 40 + 25 - x$$

$\Rightarrow \quad 57 = 65 - x \quad \Rightarrow \quad x = 65 - 57 = 8$

Also, $45 + x + y = 60 \quad \Rightarrow \quad y = 7$

SECTION – E(Case Study Based Questions)

Questions 35 to 37 carry 4 marks each.

36. Anita's mother start a new shoe shop. To display the shoes, she put 3 pairs of shoes in 1st row, 5 pairs in 2nd row, 7 pairs in 3rd row and so on.

On the basis of above information, answer the following questions.

(i) If she puts a total of 120 pairs of shoes, then find the number of rows required.

(ii) What is the difference of pairs of shoes in 17th row and 10th row.

Ans: Number of pairs of shoes in 1st, 2nd, 3rd row, ... are 3, 5, 7, ...

So, it forms an A.P. with first term a = 3, d = 5 – 3 = 2

(i) Let n be the number of rows required.

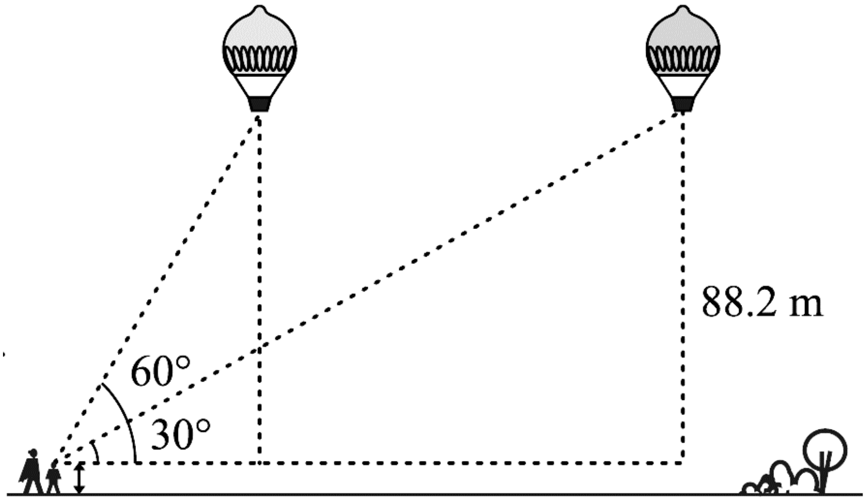
$\therefore$ Sn = 120 ⇒ (n/2) [2(3) + (n − 1)2] = 120

⇒ $n^2 + 2n - 120 = 0 \Rightarrow n^2 + 12n - 10n - 120 = 0$

⇒ (n + 12) (n – 10) = 0 ⇒ n = 10

So, 10 rows required to put 120 pairs.
(ii) No. of pairs in 17th row = a_{17} = 3 + 16(2) = 35
No. of pairs in 10th row = a_{10} = 3 + 9(2) = 21
∴ Required difference = 35 – 21 = 14

37. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60°. After 30 seconds, the angle of elevation reduces to 30° (see the below figure).



Based on the above information, answer the following questions. (Take √3 =1.732)
(i) Find the distance travelled by the balloon during the interval.
(ii) Find the speed of the balloon.
Ans: (i) In the figure, let C be the position of the observer (the girl).
A and P are two positions of the balloon.
CD is the horizontal line from the eyes of the (observer) girl.
Here PD = AB = 88.2 m − 1.2 m = 87 m

In right Δ ABC, we have $\frac{AB}{BC} = \tan 60°$

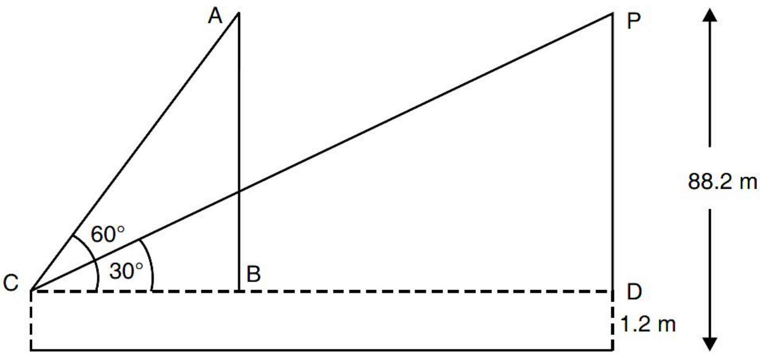
$\Rightarrow \frac{87}{BC} = \sqrt{3} \Rightarrow BC = \frac{87}{\sqrt{3}}$ m

In right Δ PDC, we have $\frac{PD}{CD} = \tan 30°$

$\Rightarrow \frac{87}{CD} = \frac{1}{\sqrt{3}} \Rightarrow CD = 87\sqrt{3}$

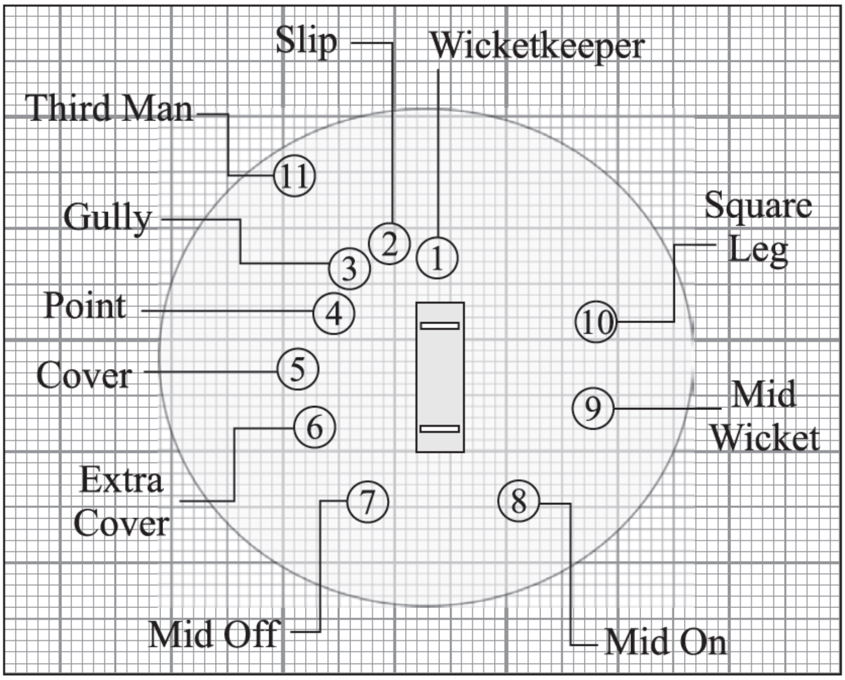
Now, $BD = CD - BC = 87\sqrt{3} - \frac{87}{\sqrt{3}}$

$= 58\sqrt{3}$ m



Thus, the required distance between the two positions of the balloon = 58 √3 m
= 58 x 1.73 = 100.46 m (approx.)
(ii) Speed of the balloon = Distance/time = 100.46/30 = 3.35 m/s (approx.)

38. In the sport of cricket the Captain sets the field according to a plan. He instructs the players to take a position at a particular place. There are two reasons to set a cricket field—to take wickets and to stop runs being scored.
The following graph shows the position of players during a cricket match.
(i) Find the coordinate of the point on y-axis which are equidistant from the points representing the players at Cover P(2, –5) and Mid-wicket Q(–2, 9)
(ii) Find the ratio in which x-axis divides the line segment joining the points Extra Cover S(3, –3) and Fine Leg (–2, 7).



Ans: (i) Let A (0, y) be any point on the y-axis.

Since A (0, y) is equidistant from P (2, –5) and Q (–2, 9)

So AP = AQ $\Rightarrow AP^2 = AQ^2$

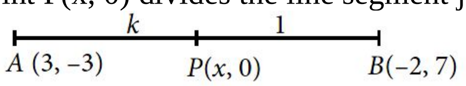
$\Rightarrow (2)^2 + (y + 5)^2 = (2)^2 + (y - 9)^2 \Rightarrow y^2 + 10y + 25 = y^2 - 18y + 81$

$\Rightarrow 28y = 81 - 25 \Rightarrow 28y = 56$

$\Rightarrow y = 28/56 = 2$

So, the point is (0, 2)

(ii) Let point P(x, 0) divides the line segment joining the points A and B in the ratio k : 1



Using section formula,

Coordinates of P are $\left(\frac{-2k+3}{k+1}, \frac{7k-3}{k+1}\right)$

y-coordinate of $P = \frac{7k-3}{k+1} = 0$

$\Rightarrow \quad 7k = 3 \quad \Rightarrow \quad k = \frac{3}{7}$

Hence, the point P divides the line segment in the ratio 3 : 7.