MATHEMATICS (STANDARD)

MOCK TEST PAPER 1

Practice Question Paper for
CBSE, Class X Examination

Time : 3 hrs **M. Marks : 80**

General Instructions :

(*i*) *All the questions are compulsory.*
(*ii*) *The question paper consists of 40 questions divided into 4 sections A, B, C, and D.*
(*iii*) *Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 questions of 4 marks each.*
(*iv*) *There is no overall choice. However, an internal choice has been provided in two questions of 1 mark each, two questions of 2 marks each, three questions of 3 marks each, and three questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.*
(*v*) *Use of calculators is not permitted.*

Section 'A'

Q.1 – Q.10. are multiple choice questions. Select the most appropriate answer from the given options.

1. $n^2 - 1$ is divisible by 8 if n is: **[1]**
(*a*) any natural number (*b*) any integer
(*c*) any odd positive integer (*d*) any even positive integer

2. Which constant should be added and subtracted to solve the quadratic equation $4x^2 - \sqrt{3x} - 5 = 0$ by the method of completing the square? **[1]**
(*a*) $\frac{9}{10}$ (*b*) $\frac{3}{16}$ (*c*) $\frac{3}{4}$ (*d*) $\frac{\sqrt{3}}{4}$

3. The roots of the equation $2x - \frac{3}{x} = 1$ are: **[1]**
(*a*) $\frac{1}{2}, -1$ (*b*) $\frac{3}{2}, 1$ (*c*) $\frac{3}{2}, -1$ (*d*) $\frac{-1}{2}, \frac{3}{2}$

4. The radius of a wheel is 0.25 m. How many revolutions will it make in covering 11 km? **[1]**
(*a*) 2800 (*b*) 4000 (*c*) 5500 (*d*) 7000

5. The circumference of two circles are in the ratio 2 : 3. The ratio between their areas is: **[1]**
(*a*) 2 : 3 (*b*) 4 : 9 (*c*) 9 : 4 (*d*) None of these

6. What is common difference of an AP in which $T_{18} - T_{14} = 32$? **[1]**
(*a*) 8 (*b*) –8 (*c*) 4 (*d*) –4

7. In an AP, the 7th term is 4 and the common difference is –4. What is its first term? **[1]**
(*a*) 16 (*b*) 20 (*c*) 24 (*d*) 28

8. What is the next term of the A.P. $\sqrt{8}, \sqrt{18}, \sqrt{32}, ..., ...?$ **[1]**

(*a*) $\sqrt{40}$ (*b*) $\sqrt{48}$ (*c*) $\sqrt{50}$ (*d*) $\sqrt{54}$

9. If $(\tan^2 45° - \cos^2 30°) = x \sin 45° \cos 45°$, then x = ? **[1]**

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

10. If $x = a \sec\theta \cos\phi$, $y = b \sec\theta \sin\phi$ and $z = c \tan\theta$, then $\left(\frac{x^2}{a^2}+\frac{y^2}{b^2}\right) = ?$ **[1]**

(*a*) $\left(1+\frac{z^2}{c^2}\right)$ (*b*) $\left(1-\frac{z^2}{c^2}\right)$ (*c*) $\left(\frac{z^2}{c^2}-1\right)$ (*d*) $\frac{z^2}{c^2}$

(Q.11 – Q.15) Fill in the blanks.

11. If the points $(k, 2k)$, $(3k, 3k)$ and $(3, 1)$ are collinear then k = __________ **[1]**

12. ΔABC is an isosceles triangle in which $\angle C = 90°$. If $AC = 6$ cm then AB = __________ **[1]**

13. If the area of a sector of a circle is 7/20 of the area of the circle, then the sector angle is __________ **[1]**

14. The volume of two spheres are in the ratio 64 : 27. The ratio of their surface areas is __________ **[1]**

15. $\text{cosec}\,(75 + Q) - \sec\,(15 - Q)$ = __________ **[1]**

(Q.16 – Q.20) Answer the following.

16. If $(k + 1)$, $3k$, $(4k + 2)$ are three consecutive terms of an A.P., then find k. **[1]**

17. Simplify: $\sqrt{\frac{\sec A - \tan A}{\sec A + \tan A}}$ **[1]**

18. Simplify: $(\sin^4\theta - \cos^4\theta + 1)\,\text{cosec}^2\theta$ **[1]**

19. Find k if the points $A(2, 3)$, $B(5, k)$ and $C(6, 7)$ are collinear. **[1]**

20. A man goes 24 m towards west and then 10 m towards north. How far is he from the starting point. **[1]**

Section 'B'

21. Find LCM of numbers whose prime factorisation are expressible as 3×5^2 and $3^2 \times 7^2$. **[2]**

22. Find the value at a for which equation $ax + 3y = 5$ and $4x + 3ay = 10$ will have infinitely many solutions. **[2]**

23. The 4^{th} term of an A.P. is zero. Prove that the 25^{th} term of the A.P. is three times its 11^{th} term. **[2]**

24. Find the ratio in which P(4, m) divides the line segment joining the points A(2, 3) ar B(6, –3). Hence find m. **[2]**

25. Two different dice are tossed together. Find the probability : **[2]**

(***i***) of getting a doublet

(***ii***) of getting a sum 10, of the numbers on the two dice.

26. A box contains 12 balls of which some are red in colour. If 6 more red balls are put in the box and a ball is drawn at random, the probability of drawing a red ball doubles than what it was before. Find the number of red balls in the bag. **[2]**

Section 'C'

27. Express $\left(\frac{15}{4}+\frac{5}{40}\right)$ as a decimal fraction without actual division. **[3]**

28. Find the value of k such that the polynomial $x^2 - (k + 6)x + 2(2k - 1)$ has sum of its zeroes equal to half of their product. **[3]**

29. If the point P(x, y) is equidistant from the points A($a + b$, $b - a$) and B($a - b$, $a + b$). Prove that $bx = ay$. **[3]**

OR

In what ratio does the point $\left(\frac{24}{11}, y\right)$ divide the line segment joining the points P(2, –2) and Q(3, 7)? Also find the value of y.

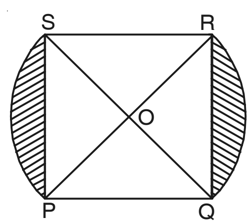
30. If the area of two similar triangles are equal, prove that they are congruent. **[3]**

OR

The perpendicular AD on the base BC of a ΔABC intersects BC at D so that DB = 3CD. Prove that $2(AB)^2 = 2(AC)^2 + BC^2$.

31. Find acute angles A and B, if $\sin(A + 2B) = \frac{\sqrt{3}}{2}$ and $\cos(A + 4B) = 0$, A > B. **[3]**

32. In figure, PQRS is a square lawn with side PQ = 42 metres. Two circular flower beds are there on the sides PS and QR with centre at O, the intersection of its diagonals. Find the total area of the two flower beds (shaded parts). **[3]**



33. A conical vessel, with base radius 5 cm and height 24 cm, is full of water. This water is emptied into a cylindrecal vessel of base radius 10 cm. Find the height to which the water will rise in the cylindrical vessel. (Use $\pi = \frac{22}{7}$) **[3]**

OR

Water in a canal, 5.4 m wide and 1.8 m deep, is flowing with a speed of 25 km/hour. How much area can it irrigate in 40 miutes, if 10 cm of standing water is required for irrigation?

34. The mean of the following frequency table is 50 but the frequencies f_1 and f_2 in the class intervals 20 – 40 and 60 – 80 are missing. Find the missing frequencies.

Class interval	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	Total
Frequency	17	f_1	32	f_2	19	120

[3]

Section 'D'

35. A rectangular park is to be designed whose breadth is 3 m less than its length. Its areas is to be 4 square metres more than the area of a park that has already been made in the shape of an isocseles triangle with its base as the breadth of the rectnagular park and of altitude 12 m. Find the length and breadh of the rectangular park. **[4]**

OR

The sum of a number and its positive square root is $\frac{6}{25}$. Find the number.

36. In ΔABC, the mid-points of sides BC, CA and AB are D, E and F respectively. Find ratio of ar (ΔDEF) to ar (ΔABC). **[4]**

OR

ABCD is a rhombus whose diagonal AC makes an angle α with AB. If $\cos \alpha = \frac{2}{3}$ and OB = 3 cm, find the length of its diagonals AC and BD.

37. Draw a right triangle ABC in which AB = 5 cm, BC = 12 cm and ∠B = 90°. Draw BD perpendicular from B on AC and draw a circle passing through the points B, C an D. Construct tangents from A to this circle. **[4]**

38. A bus travels at a certain average speed for a distance of 75 km and then travels a distance of 90 km at an average speed of 10 km/h more than the first speed. If it takes 3 hours to complete the total journey, find its first speed. **[4]**

39. A container is in the form of a cone mounted on a cylinder of radius 4.9 cm and the height of 9.8. The total height of the toy is 15.4 cm. Find the curved surface area of the container. **[4]**

40. If the mean of the following data is 14.7, find the values of p and q. **[4]**

Class	0–6	6–12	12–18	18–24	24–30	30–36	36–42	Total
Frequency	10	p	4	7	q	4	1	40

OR

The distribution of monthly wages of 200 workers of a certain factory is as given below:

Monthly wages (in ₹)	80–100	100–120	120–140	140–160	160–180
Number of workers	20	30	20	40	90

Change the above distribution to a 'more than type' distribution and draw its ogive.

MATHEMATICS (STANDARD)

SOLUTIONS MOCK TEST PAPER 1

CBSE Class X Examination

Section 'A'

1. (*c*) **2.** (*b*) **3.** (*c*) **4.** (*d*) **5.** (*b*) **6.** (*a*) **7.** (*d*) **8.** (*c*)
9. (*c*) **10.** (*a*) **[1 × 10 = 10]**

Fill in the blanks

11. $k = -\frac{1}{3}$ **[1]**

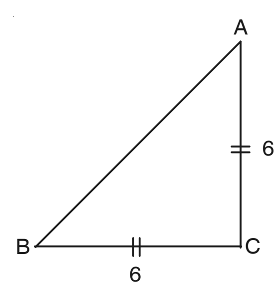
Explanation

If three points are collinear, then area of triangle formed by them is zero.

$$A = \frac{1}{2}[x_1 (y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$$

$$O = \frac{1}{2}[k(3k - 1) + 3k(1 - 2k) + 3(2k - 3k)] = 0$$

$$O = 3k^2 - k + 3k - 6k^2 - 3k$$



$$-3k^2 - k = 0$$

$$-k[3k + 1] = 0$$

$$\Rightarrow \quad k = -\frac{1}{3}$$

12. $AB = 6\sqrt{2}$ cm **[1]**

Explanation

$AC = BC$ (Isosceles Δ) Applying Pythagoras theorem

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

$$AB^2 = B^2 + 6^2$$

$$AB^2 = 36 + 36$$

$AB^2 = 2 \times 36$

$AB = 6\sqrt{2}$ cm

13. $\theta = 126°$ **[1]**

Explanation

Area of sector = $\frac{7}{20}$ Area of circle

$$\frac{\theta}{360} \times \pi r^2 = \frac{7}{20}\pi r^2 \quad \Rightarrow \quad \theta = 126°$$

14. $\frac{16}{9}$ **[1]**

Explanation

Given: $\frac{V_1}{V_2} = \frac{64}{27}$

$$\frac{\frac{4}{3}\pi r_1^3}{\frac{4}{3}\pi r_2^3} = \left(\frac{4}{3}\right)^3$$

$$\left(\frac{r_1}{r_2}\right)^3 = \left(\frac{4}{3}\right)^3$$

$$\therefore \quad \frac{r_1}{r_2} = \frac{4}{3}$$

$$\frac{s_1}{s_2} = \frac{4\pi r_1^2}{4\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$$

15. 0 **[1]**

Explanation

cosec $(75 + \theta)$ – sec $(15 - \theta)$ = cosec $(90 - 15 + \theta)$ – sec $(15 - \theta)$

= cosec $[90 - (15 - \theta)]$ – sec $(15 - \theta)$ = sec $(15 - \theta)$ – sec $(15 - \theta)$

= 0

Answer the following.

16. $(k + 1), 3k, (4k + 2)$

Common difference

$3k - (k + 1) = (4k + 2) - 3k$

$2k - 1 = k + 2$

$k = 3$ **[1]**

17. $$\sqrt{\frac{\sec A - \tan A}{\sec A + \tan A} \times \frac{\sec A - \tan A}{\sec A - \tan A}} = \sqrt{\frac{(\sec A - \tan A)^2}{\sec^2 A - \tan^2 A}}$$

$$= \sqrt{\frac{(\sec A - \tan A)^2}{1}} \qquad (\sec^2 A - \tan^2 A = 1)$$

$= \sec A - \tan A$ **[1]**

18. $= [(\sin^2\theta)^2 - (\cos^2\theta)^2 + 1]\ \text{cosec}^2\theta$

$= [(\sin^2\theta + \cos^2\theta)$ $(\sin^2\theta - \cos^2\theta) + 1]\ \text{cosec}^2\theta$

$= [\sin^2\theta - \cos^2\theta + 1]\ \text{cosec}^2\theta$

$= [\sin^2\theta + (1 - \cos^2\theta)]\ \text{cosec}^2\theta$

$= [\sin^2\theta + \sin^2\theta]\ \text{cosec}^2\theta$

$= 2\sin^2\theta \times \frac{1}{\sin^2\theta} = 2$ **[1]**

19. Area of triangle formed by three points is zero if they are collinear

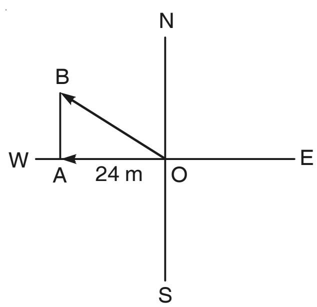
$\Rightarrow \frac{1}{2}[2(k-7) + 5(7-3) + 6(3-k)] = 0$

$\Rightarrow 2k - 14 + 20 + 18 - 6k = 0$

$-4k + 24 = 0$

$k = 6$ **[1]**

20.



$OB^2 = (24)^2 + (10)^2$

$= 576 + 100$

$OB^2 = 676 = (26)^2$

$OB = 26$ **[1]**

Section 'B'

21. LCM of numbers 3×5^2 and $3^2 \times 7^2$ is given as

$= 3^2 \times 5^2 \times 7^2$

$= 9 \times 25 \times 49$

$= 11025.$ **[2]**

22. $ax + 3y = 5$

$a_1 = a,\ b_1 = 3,\ c_1 = 5$

$4x + 3ay = 10$

$a_2 = 4,\ b_2 = 3a,\ c_2 = 10$

For infinitely many solutions $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$$\frac{a}{4} = \frac{3}{3a} = \frac{5}{10}$$ **[1]**

$$\Rightarrow \quad \frac{a}{4} = \frac{5}{10}$$

$$\Rightarrow \quad a \times 10 = 5 \times 4$$

$$\Rightarrow \quad a = \frac{20}{10}$$

$$\Rightarrow \quad a = 2$$ **[1]**

23. CBSE Topper's Answer, 2016

We have,

$a_4 = 0$

$a + 3d = 0$ $\quad [a+(n-1)d = a_n]$

$3d = -a$

or $-3d = a$ ← ①

Now,

$a_{25} = a + 24d$ $\quad [a+(n-1)d = a_n]$

$= -3d + 24d$ $\quad$ (Putting value of "a" from eq ①)

$= 21d$ ← ②

$a_{11} = a + 10d$

$= -3d + 10d$

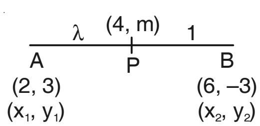
$= 7d$ ← ③ $\quad (a = -3d)$

From eq ② & eq ③

$a_{25} = 3a_{11}$

Hence Proved. **[2]**

24.



Let $\frac{AP}{BP} = \frac{\lambda}{1}$

$$P_x = \frac{m_1x_2 + m_2x_1}{m_1 + m_2}$$

$$4 = \frac{\lambda(6) + 1(2)}{\lambda + 1}$$ **[1]**

$$4\lambda + 4 = 6\lambda + 2$$

$$6\lambda - 4\lambda = 4 - 2$$

$$2\lambda = 2$$

$$\lambda = 1$$ **[½]**

∴ Ratio in which point P divides the line segment AB = 1 : 1

$$P_y = \frac{m_1 y_2 + m_2 y_1}{m_1 + m_2}$$

$$m = \frac{1\times(-3)+1(3)}{1+1}$$

$$m = \frac{-3+3}{2} = 0$$

$$\therefore \quad m = 0$$

[½]

25. (i) Probability of getting a doublet when two different dice are tossed. then

Total events $n(S) = 6 \times 6 = 36$

Favourable events i.e., to getting doublets

$$E = \{(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\}$$

$$\therefore \quad n(E) = 6$$

Probability of getting a doublet

$$= \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

∴ Probability of getting a doublet $= \frac{1}{6}$ **[1]**

(ii) Favourable events of getting a sum 10, of the numbers on the two dice

$$E = \{(4, 6), (5, 5), (6, 4)\}$$

$$\therefore \quad n(E) = 3$$

Probability of getting a sum 10, of the numbers on the two dice

$$= \frac{n(E)}{n(S)} = \frac{3}{36} = \frac{1}{12}$$ **[1]**

26. Let number of red balls be $= x$

$$\therefore \quad P(\text{red ball}) = \frac{x}{12}$$

If 6 more red balls are added: The number of red balls $= x + 6$

$$P(\text{red ball}) = \frac{x+6}{18}$$

Since, $$\frac{x+6}{18} = 2\left(\frac{x}{12}\right) \Rightarrow x = 3$$

∴ There are 3 red balls in the bag. **[½ + 1 + ½]**

Section 'C'

27. $$\left(\frac{15}{4}+\frac{5}{40}\right) = \left(\frac{15}{2^2}+\frac{5}{2^3\times 5}\right) = \left(\frac{15}{2^2}\times\frac{5^2}{5^2}+\frac{5}{2^3\times 5}\times\frac{5^2}{5^2}\right)$$ **[1 + 1]**

$$= \left(\frac{375}{100}+\frac{125}{1000}\right) = 3.75 + 0.125 = 3.875$$ **[1]**

28. Given polynomial = $x^2 - (k + 6)x + 2(2k - 1)$

Here $a = 1$, $b = -(k + 6)$ and $c = 2(2k - 1)$

Sum of zeroes = $\dfrac{-b}{a} = k + 6$

Product of zeroes = $c/a = 2(2k - 1)$ **[1]**

According to question,

$k + 6 = \dfrac{1}{2}(2)(2k - 1)$

$\therefore k + 6 = 2k - 1$

$7 = k$

$\therefore k = 7$ **[1]**

29. **CBSE Topper's Solution 2015**

Given – The point $P(x, y)$ is equidistant from point $A[(a+b), b-a]$ & $B[(a-b), (a+b)]$

To prove: $bx = ay$

Proof –

$AP = BP \Rightarrow AP^2 = BP^2$

By distance formula: $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$AP^2 = BP^2$

$\Rightarrow [x-(a+b)]^2 + [y-(b-a)]^2 = [x-(a-b)]^2 + [y-(a+b)]^2$

$\Rightarrow x^2 + (a+b)^2 - 2x(a+b) + y^2 + (b-a)^2 - 2y(b-a)$

$= x^2 + (a-b)^2 - 2x(a-b) + y^2 + (a+b)^2 - 2y(a+b)$

$(b-a)^2 - 2x(a+b) + 2y(a-b) = (a-b)^2 - 2x(a-b) - 2y(a+b)$

$b^2 + a^2 - 2ba - 2ax - 2bx + 2ay - 2by = a^2 + b^2 - 2ab - 2ax + 2bx - 2ay + 2by$

$= 4ay = 4bx$

$ay = bx$

Hence proved **[3]**

OR

CBSE Topper's Solution 2017

m : n ; $P(2, -2)$, $\left(\frac{24}{11}, y\right)$, $Q(\ldots)$

Here $x_1 = 2$, $y_1 = -2$

$x_2 = 3$, $y_2 = 7$

Using section formula,

$\left(\frac{24}{11}, y\right) = \left(\frac{3m+2n}{m+n}, \frac{7m-2n}{m+n}\right)$ —(1)

$\Rightarrow \frac{24}{11} = \frac{3m+2n}{m+n}$

$24m + 24n = 33m + 22n$

$2n = 9m$

$\frac{2}{9} = \frac{m}{n}$

∴ The given point divides the line segment in ratio 2 : 9.

Taking $m = 2$ and $n = 9$,

$$y = \frac{7m - 2n}{m+n} \quad \text{(from ①)}$$

$$y = \frac{7(2) - 2(9)}{2+9}$$

$$y = \frac{14 - 18}{11}$$

$$\boxed{y = \frac{-4}{11}}$$

[3]

30. Given $\Delta ABC \sim \Delta PQR$

and ar ΔABC = ar ΔPQR

To prove $\Delta ABC \cong \Delta PQR$

Proof : Since, $\Delta ABC \sim \Delta PQR$

ar ΔABC = ar ΔPQR (given)

$$\therefore \quad \frac{ar\Delta ABC}{ar\Delta PQR} = 1$$ **[1]**

$$= \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{PR^2} = 1$$ **[1]**

[Using theorem of Area of similar triangles]

$\Rightarrow$ AB = PQ,

BC = QR & CA = PR

Thus $\Delta ABC \cong \Delta PQR$ **[1]**

[By SSS Criterion of Congruence]

OR

Given In $\Delta ADB, AB^2 = AD^2 + BD^2$ ...(*i*)

(Pythagoras Theorem)

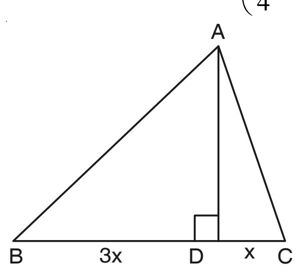
In ΔADC, $AC^2 = AD^2 + CD^2$ ...(*ii*)

(Pythagoras theorem)

Subtracting eqn. (*ii*) from eqn. (*i*),

$$AB^2 - AC^2 = BD^2 - CD^2$$ **[1]**

$$\text{or,} \quad = \left(\frac{3}{4}BC\right)^2 - \left(\frac{1}{4}BC\right)^2$$



[1]

or, $= \frac{9}{16}BC^2 - \frac{1}{16}BC^2 = \frac{BC^2}{2}$

$\therefore\ 2(AB^2 - AC^2) = BC^2$

$2(AB)^2 = 2AC^2 + BC^2.$ **[1]**

Hence proved.

31. Given : $\sin(A + 2B) = \frac{\sqrt{3}}{2}$

$\sin(A + 2B) = \sin 60°$ [We know that $\sin 60° = \frac{\sqrt{3}}{2}$]

$A + 2B = 60°$ ...(1) **[1]**

Given, $\cos(A + 4B) = 0$

$\cos(A + 4B) = \cos 90°$ [As we know $\cos 90° = 0°$]

$A + 4B = 90°$ ...(2) **[1]**

On Subtracting eq. (1) from eq. (2), we get

$A + 4B = 90°$

$A + 2B = 60°$

$- \quad - \quad -$

$2B = 30$

$B = 15$ **[½]**

On putting B = 15° in eq. (1) to get value of angle A.

$A + 2B = 60°$

$A + 2(15) = 60°$

$A + 30 = 60°$

$A = 60° - 30°$

$A = 30°$ **[½]**

OR

$$\frac{\sec^2(90° - \theta) - \cot^2\theta}{2(\sin^2 25 + \sin^2 65°)} + \frac{2\cos^2 60° \tan^2 28 \tan^2 62°}{3(\sec^2 43° - \cot^2 47°)} + \frac{\cot 40°}{\tan 50°}$$

$$= \frac{\text{cosec}^2\theta - \cot^2\theta}{2[\sin^2 25 + \sin^2(90° - 25)]} + \frac{2\cos^2 60° \tan^2 28 \tan^2(90° - 28°)}{3(\sec^2 43° - \cot^2(90° - 43°)} + \frac{\cot(90° - 50°)}{\tan 50°}$$ **[1]**

$$= \frac{1}{2[\sin^2 25 + \cos^2 25°)]} + \frac{2\left(\frac{1}{2}\right)^2 \frac{1}{\cot^2 28} \times \cot^2 28}{3[\sec^2 43 - \tan^2 43]} + \frac{\tan 50°}{\tan 50°}$$ [$\text{cosec}^2\theta - \cot^2\theta = 1$] **[1]**

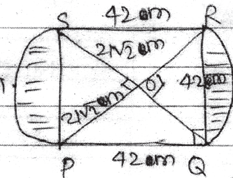
$$= \frac{1}{2(1)} + \frac{2 \times \frac{1}{4} \times 1}{3(1)} + 1$$ [Using identity $\sin^2\theta + \cos^2\theta = 1$ and $\sec^2\theta - \tan^2\theta = 1$]

$$= \frac{1}{2} + \frac{1}{3} \times \frac{1}{2} + 1 = \frac{1}{2} + \frac{1}{6} + 1 = \frac{3 + 1 + 6}{6} = \frac{10}{6} = \frac{5}{3}$$ **[1]**

32. CBSE Topper's Solution, 2015

Given, PQRS is a square lawn of side, $PQ = 42$ cm

Here, Two circular flower beds are drawn on sides PS and QR with O as centre.



Diagonals of sq. bisect each other at O.

Now, In right ΔRQP, By pythagoras theorem

$$PR = \sqrt{(RQ)^2 + (PQ)^2} = \sqrt{(42)^2 + (42)^2}$$
$$= \sqrt{2(42)^2}$$
$$= 42\sqrt{2} \text{ cm}$$

And, as we know that diagonals of a square bisect each other at 90°

$$\therefore OS = OP = \frac{42\sqrt{2}}{2} = 21\sqrt{2} \text{ cm}$$

And, $\angle POS = \angle ROQ = 90°$

Now, Req. shaded area = Area of 2 segments with $r = 21\sqrt{2}$ cm & $\theta = 90°$

$$= 2 \times \frac{r^2}{2}\left[\frac{\pi\theta}{180} - \sin\theta\right]$$

$$= r^2\left[\frac{\pi \times 90}{180} - \sin 90\right]$$

$$= (21\sqrt{2})^2\left[\frac{22}{14} - 1\right]$$

$$= 441 \times 2\left[\frac{22-14}{14}\right] = 441 \times 2\left[\frac{8}{14}\right]$$

$$= 63 \times 8$$

$$= 504 \text{ m}^2$$

[3]

33. CBSE, Topper's Solution, 2016

12) Radius & height of conical vessel = 5 cm & 24 cm resp.

Volume of cone = $\frac{1}{3}\pi r^2 h$

Volume of cone = $\frac{1}{3}\pi \times 25 \times 24$ cm^3

water is emptied of cylindrical vessel of r = 10 cm & height = h

Volume of cone = Volume of cylinder

$\Rightarrow \frac{1}{3} \pi \times 25 \times 24 = \pi \times 10 \times 10 \times h$

$= \frac{200}{100}$ cm = h

= 2 cm = h

{Volume of – Cone = $\frac{1}{3}\pi r^2 h$, Cylinder = $\pi r^2 h$}

[3]

OR

CBSE Topper's Solution, 2017

speed of water in canal = 25 km/hr.

in 40 min = $\frac{40}{60} = \frac{2}{3}$ hr,

length of water = $25 \times \frac{2}{3} = \frac{50}{3}$ km $= \frac{50000}{3}$ m

volume of water in canal in 40 minutes = volume of water for irrigation.

$\frac{54}{10} \times \frac{18}{10} \times \frac{50000}{3}$ m^3 = $\frac{10}{100} \times l \times b$ m^3

$324 \times 5000 = l \times b$

$1620000 = l \times b$

area irrigated in 40 minutes is 1620000 m^2

$= \frac{1620000}{1000000}$

= 1.62 km^2, or 162 hectares.

[3]

34. Given, $\bar{x} = 50$

C.I.	*Mid value (n)*	*f*	*fx*
0 – 20	10	17	170
20 – 40	30	f_1	$30f_1$
40 – 60	50	32	1600
60 – 80	70	f_2	$70f_2$
80 – 100	90	19	1710
		$\Sigma f = 120$	$\Sigma fx = 3480 + 30f_1 + 70f_2$

[1]

$$\text{Mean } \bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$50 = \frac{3480 + 30f_1 + 70f_2}{120}$$

$$3480 + 30f_1 + 70f_2 = 6000$$
$$30f_1 + 70f_2 = 6000 - 3480$$
$$30f_1 + 70f_2 = 2520 \qquad ...(i) \quad [1]$$

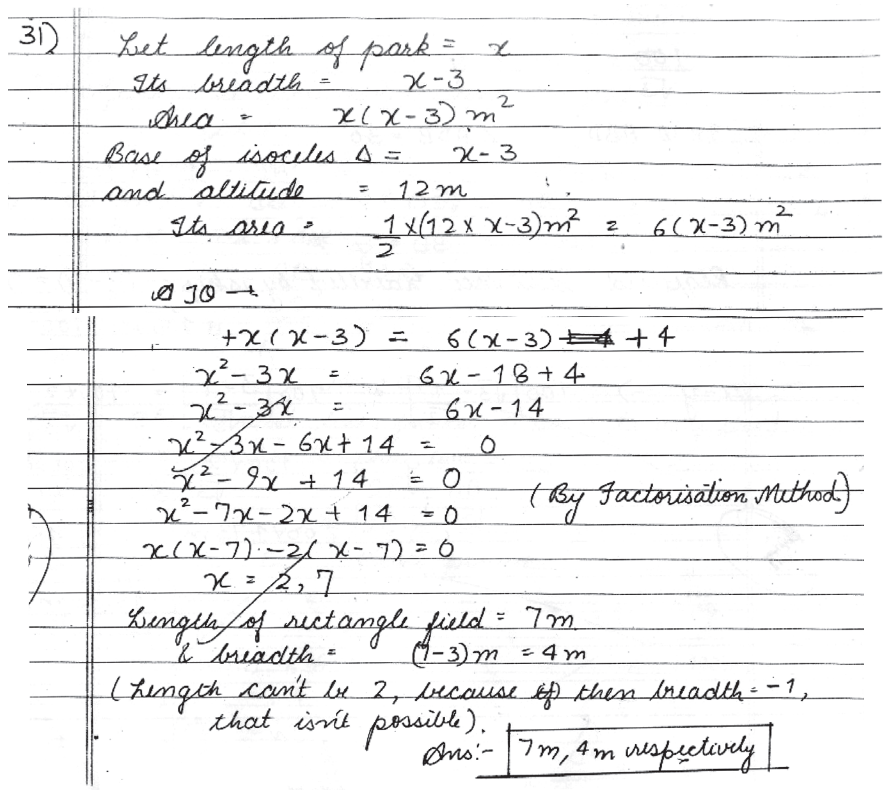
Given, $\Sigma f = 120$

$$17 + f_1 + 32 + f_2 + 19 = 120$$
$$f_1 + f_2 = 52 \qquad ...(ii)$$

On solving eq. (*i*) & eq. (*ii*) we get, $f_1 = 28$ and $f_2 = 24$. **[1]**

Section 'D'

35. CBSE, Topper's Solution, 2016


31) Let length of park = x
Its breadth = $x-3$
Area = $x(x-3)\,m^2$
Base of isoceles Δ = $x-3$
and altitude = 12 m
Its area = $\frac{1}{2}\times(12\times x-3)m^2 = 6(x-3)\,m^2$
ATQ —
$x(x-3) = 6(x-3) + 4$
$x^2 - 3x = 6x - 18 + 4$
$x^2 - 3x = 6x - 14$
$x^2 - 3x - 6x + 14 = 0$
$x^2 - 9x + 14 = 0$
$x^2 - 7x - 2x + 14 = 0$ (By Factorisation Method)
$x(x-7) - 2(x-7) = 0$
$x = 2, 7$
Length of rectangle field = 7 m
& breadth = $(7-3)$ m = 4 m
(Length can't be 2, because then breadth = −1, that isn't possible).
Ans:- 7 m, 4 m respectively

[4]

OR

Let the number be y. Then, its positive square root by $\sqrt{y}$. according to the question,

$$y + \sqrt{y} = \frac{6}{25} \qquad [1]$$

$$\Rightarrow \quad 25y + 25\sqrt{y} = 6$$

$$\Rightarrow \quad 25y + 25\sqrt{y} - 6 = 0 \qquad ...(i)$$

Let $\sqrt{y} = z$

or $y = z^2$ ...(*ii*)

Then, Eq. (*i*) becomes

$25z^2 + 25z - 6 = 0$ **[1]**

$\Rightarrow \quad 25z^2 + 30z - 5z - 6 = 0$[by factorisation]

$\Rightarrow 5z\,(5z + 6) - 1\,(5z + 6) = 0$

$\Rightarrow \quad (5z + 6)\,(5z - 1) = 0$

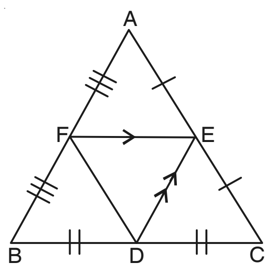
$\therefore \quad z = \frac{-6}{5}$ or $\frac{1}{5}$ **[1]**

Now, on substituting the values of z in Eq. (*ii*), we get $\sqrt{y} = \frac{1}{5} \Rightarrow y = \frac{1}{25}$ or $\sqrt{y} = \frac{-6}{5}$

which is not possible, because $\sqrt{y}$ is positive.

Hence, the requred number is $\frac{1}{25}$. **[1]**

36. In ΔABC, Given that F, E and D are the mid-points of AB, AC and BC respectively.



[1]

Hence, FE ‖ BC, DE ‖ AB and DF ‖ AC

By mid-point theorem.

If DE ‖ BA

then DE ‖ BF

and if FE ‖ BC

then FE ‖ BD

$\therefore$ FEDB is parallelogram in which DF is diagonal and a diagonal of Parallelogram divides it into two equal areas.

Hence *ar* (ΔBDF) = *ar* (ΔDEF) ...(*i*) **[½]**

Similarly*ar* (ΔCDE) = *ar* (ΔDEF) ...(*ii*) **[½]**

or (ΔAFE) = *ar* (ΔDEF) ...(*iii*)**[½]**

or (ΔDEF) = *ar* (ΔDEF) ...(*iv*)**[½]**

On adding eqns. (*i*), (*ii*), (*iii*) and (*iv*),

ar (ΔBDF) + *ar* (ΔCDE) + *ar* (ΔAFE) + *ar* (ΔDEF)

= 4*ar* (ΔDEF)

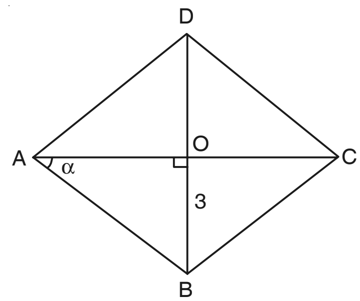
or,*ar* (ΔABC) = 4*ar* (ΔDEF)

$$\frac{ar(\Delta DEF)}{ar(\Delta ABC)} = \frac{1}{4}$$ **[1]**

OR

Given : $\cos\alpha = \frac{2}{3}$

and $\quad OB = \text{cm}$



In $\Delta AOB, \cos\alpha = \frac{2}{3} = \frac{AO}{AB}$

Let $\quad OA = 2x$ and $AB = 3x$

In ΔAOB,

$$AB^2 = AO^2 + OB^2$$

or, $\quad (3x)^2 = (2x)^2 + (3)^2$

or, $\quad 9x^2 = 4x^2 + 9$

or, $\quad 5x^2 = 9$ **[1]**

$\therefore \quad x = \sqrt{\frac{9}{5}} = \frac{3}{\sqrt{5}}$

Hence, $\quad OA = 2x = 2\left(\frac{3}{\sqrt{5}}\right) = \frac{6}{\sqrt{5}}\text{cm}$ **[1]**

and $\quad AB = 3x = 3\left(\frac{3}{\sqrt{5}}\right) = \frac{9}{\sqrt{5}}\text{cm}$ **[1]**

So diagonalBD = $\quad 2 \times OB = 2 \times 3 = 6$ cm

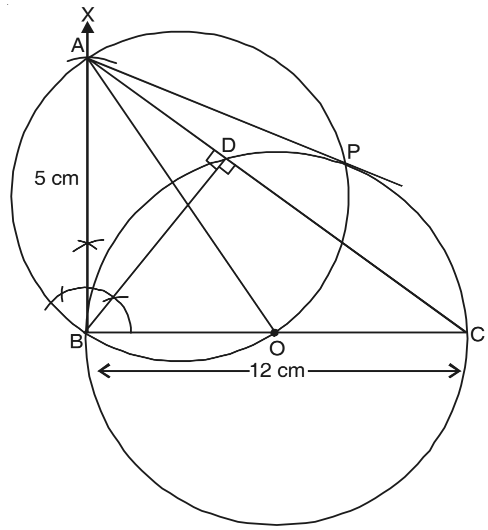
and $\quad AC = 2AO$

$$= 2\times\frac{6}{\sqrt{5}} = \frac{12}{\sqrt{5}}\text{cm}$$ **[1]**

37. Steps of Construction :

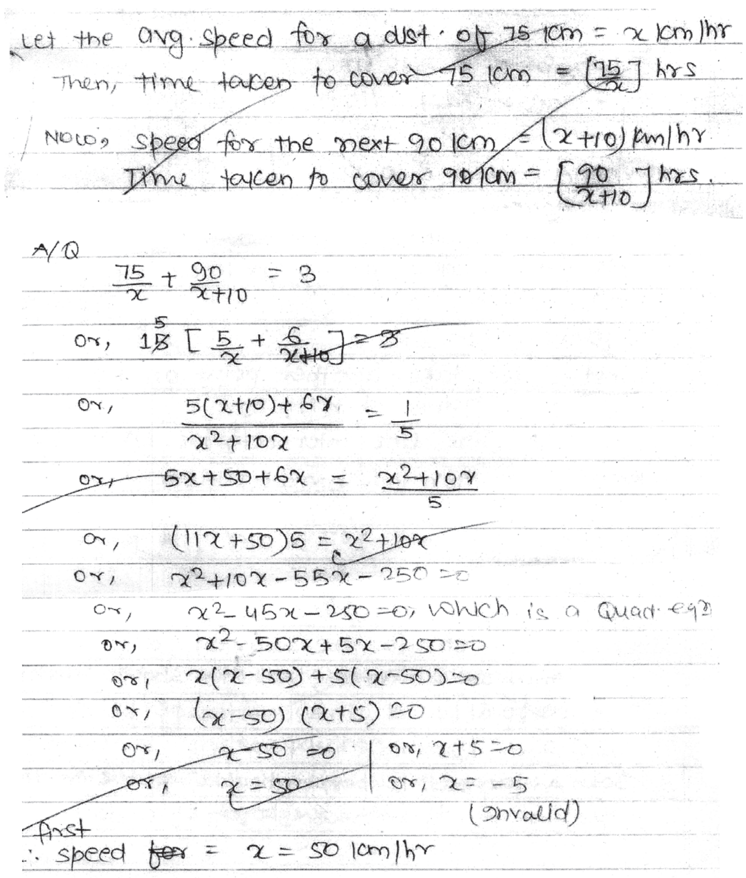
1. Draw a line segment BC = 12 cm.
2. At B, construct ∠CBX = 90°.
3. With B as centre and radius = 5 cm, draw an arc intersecting the line BX at A.
4. Join AC to obtain ΔABC.
5. Draw perpendicular BD from B on AC.
6. Let O be the mid-point of BC. Draw a circle with centre O and radius OB = OC. This circle will pass through the point D.

7. Join AO. Draw a circle with AO as diameter. This circle cuts the circle drawn in step 6 at B and P.
8. Join AP . AP and AB are desired tangents drawn from A to the circle passing through B, C and D. **[2]**



[2]

38. CBSE Topper's Solution, 2015



Let the avg. speed for a dist. of 75 km = x km/hr

Then, time taken to cover 75 km = $\left[\frac{75}{x}\right]$ hrs

Now, speed for the next 90 km = $(x+10)$ km/hr

Time taken to cover 90 km = $\left[\frac{90}{x+10}\right]$ hrs.

A/Q

$$\frac{75}{x} + \frac{90}{x+10} = 3$$

or, $15\left[\frac{5}{x} + \frac{6}{x+10}\right] = 3$

or, $\frac{5(x+10)+6x}{x^2+10x} = \frac{1}{5}$

or, $5x+50+6x = \frac{x^2+10x}{5}$

or, $(11x+50)5 = x^2+10x$

or, $x^2+10x-55x-250=0$

or, $x^2-45x-250=0$, which is a Quad. eqn

or, $x^2-50x+5x-250=0$

or, $x(x-50)+5(x-50)=0$

or, $(x-50)(x+5)=0$

or, $x-50=0$ | or, $x+5=0$

or, $x=50$ | or, $x=-5$ (invalid)

∴ First speed = $x = 50$ km/hr

[4]

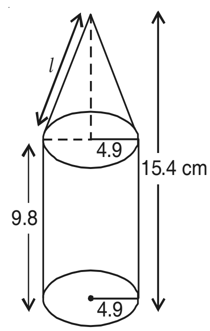
39. Given, raidus of conical and cylinderical portion = 4.9 cm **[4]**

And, Total height of the container = 15.4 cm

height of the conical portion = Total height of the container – height of the cylinder

= 15.4 – 9.8

h = 5.6 cm **[1]**



Slant height of the cone (l) = $\sqrt{h^2 + r^2}$ **[1]**

$= \sqrt{(5.6)^2 + (4.9)^2}$

$= \sqrt{31.36 + 24.01}$

$= \sqrt{55.37}$

l = 7.4 cm **[1]**

Now, total surface area of container

= C.S.A coke + CSA of cylinder

$= \pi rl + 2\pi rh_1$

$= \pi r(l + 2h_1)$

$= \frac{22}{7} \times 4.9(7.4 + 2 \times 9.8)$

$= \frac{22}{7} \times 4.9 \times 27$

= 415.8 cm^2 **[1]**

40.

Class	x_i	f_i	$x_i f_i$
0 – 6	3	10	30
6–12	9	p	$9p$
12–18	15	4	60
18–24	21	7	147
24–30	27	q	$27q$
30–36	33	4	132
36–42	39	1	39
		$\Sigma f_i = 26 + p + q = 40$	$\Sigma x_i f_i = 408 + 9p + 27q$

[2]

Given, $\Sigma f_i = 40$

$\Rightarrow 26 + p + q = 40$

$p + q = 14$ ...(*i*) **[½]**

$\therefore$ Mean, $\bar{x} = \dfrac{\Sigma x_i f_i}{\Sigma f_i}$

$\Rightarrow 14.7 = \dfrac{408 + 9p + 27q}{40}$

$\Rightarrow 588 = 408 + 9p + 27q$

$\Rightarrow 180 = 9p + 27q$

$\Rightarrow p + 3q = 20$ ...(*ii*) **[½]**

Subtracting eq. (*i*) from eq. (*ii*),

$2q = 6$

$\therefore q = 3$

Putting this value of q in eq. (*i*),

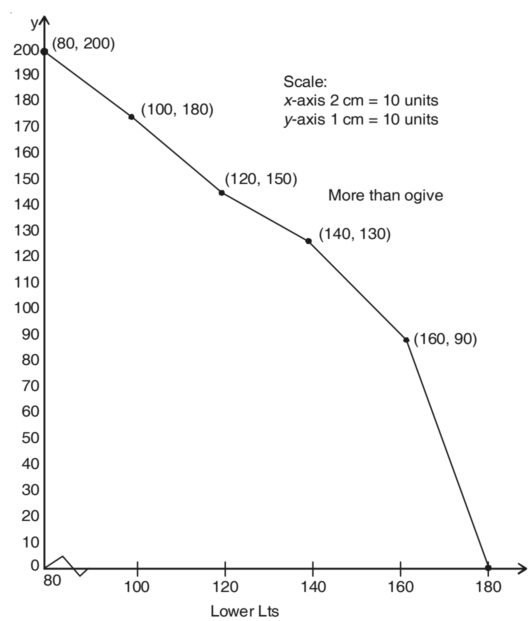
$p = 14 - q = 14 - 3 = 11$

Hence, $p = 11, q = 3$ **[1]**

OR

Wages	***c.f.***
More than 80	200
More than 100	180
More than 120	150
More than 140	130
More than 160	90
More than 180	0

[2]



[2]

MATHEMATICS (STANDARD)

MOCK TEST PAPER 2

Practice Question Paper for
CBSE, Class X Examination

Time : 3 hrs **M. Marks : 80**

General Instructions :

(*i*) *All the questions are compulsory.*

(*ii*) *The question paper consists of 40 questions divided into 4 sections A, B, C, and D.*

(*iii*) *Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 questions of 4 marks each.*

(*iv*) *There is no overall choice. However, an internal choice has been provided in two questions of 1 mark each, two questions of 2 marks each, three questions of 3 marks each, and three questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.*

(*v*) *Use of calculators is not permitted.*

Section 'A'

Q.1 – Q.10. are multiple choice questions. Select the most appropriate answer from the given options.

1. The roots of the equation $\sqrt{2}x^2+7x+5\sqrt{2}=0$ are: **[1]**

(*a*) $\sqrt{2},\frac{5\sqrt{2}}{2}$ (*b*) $-\sqrt{2},\frac{5\sqrt{2}}{2}$ (*c*) $\sqrt{2},\frac{-5\sqrt{2}}{2}$ (*d*) $-\sqrt{2},\frac{-5\sqrt{2}}{2}$

2. If one zero of the quadratic polynomial $(k-1)x^2+kx+1$ is -4, then the value of k is: **[1]**

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

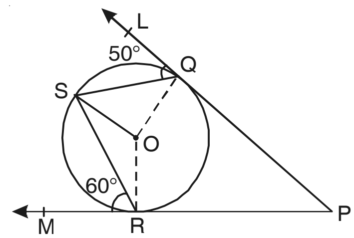
3. In an AP, the first term is 8, n^{th} term is 33 and the sum of the first n term is 123. Then, d = ? **[1]**

(*a*) 5 (*b*) –5 (*c*) 7 (*d*) 3

4. The sum of n terms of the AP $\sqrt{2},\sqrt{8},\sqrt{18},\sqrt{32},...$ is : **[1]**

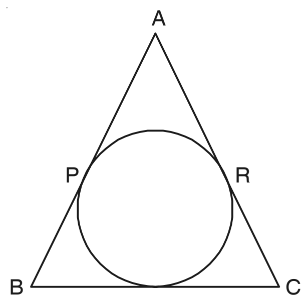
(*a*) 1 (*b*) $2n(n+1)$ (*c*) $\frac{1}{2}n(n+1)$ (*d*) $\frac{1}{\sqrt{2}}n(n+1)$

5. In the given figure, 0 is the centre of a circle; PQL and PRM are the tangents at the points Q and R respectively and S is a point on the circle such that ∠SQL = 50° and ∠SRM = 60°. Then, ∠QSR = ? **[1]**



(*a*) 40° (*b*) 50° (*c*) 60° (*d*) 70°

6. In the given figure, ΔABC is circumscribed touching the circle at P, Q, R. If AP = 4 cm, BP = 6 cm, AC = 12 cm and BC = x cm, then, x = ? **[1]**



(*a*) 10 cm (*b*) 14 cm (*c*) 18 cm (*d*) 12 cm

7. tan 2A = cot (A – 21°), where 2A is an acute angle, then ∠A = ? **[1]**

(*a*) 24° (*b*) 27° (*c*) 35° (*d*) 37°

8. $\dfrac{(\tan^2 60° + 4\sin^2 45° + 3\sec^2 30° + 5\cos^2 90°)}{(\text{cosec } 30° + \sec 60° - \cot^2 30°)} = ?$ **[1]**

(*a*) $\dfrac{9}{7}$ (*b*) 9 (*c*) $\dfrac{7}{9}$ (*d*) 6

9. If the centroid of the triangle formed by the points (3, –5), (–7, 4), (10, –k) is at the point (k, –1), then k = ? **[1]**

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

10. The HCF of 95 and 152 is: **[1]**

(*a*) 57 (*b*) 1 (*c*) 19 (*d*) 38

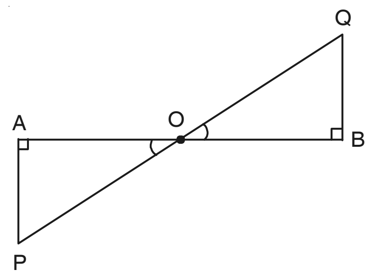
(Q.11 – Q.15) Fill in the blanks.

11. If $-\dfrac{1}{2}$ is the root of the equation $5x^2 - \dfrac{7}{2}x + 2a = 0$, then the value of a is _________ **[1]**

12. The 15th term of the A.P.: $x - 7, x - 2, x - 3, \ldots$ is _________ **[1]**

13. If $P(-1, 1)$ is the mid-point of the line segment joining $A(-3, b)$ and $B(1, b + 4)$ then the value of b is _________. **[1]**

14. In the given figure ∠A = ∠B = 90°, OB = 4.5 cm, OA = 6 cm and $A.P.$ = 4 cm, then QB = _________ **[1]**



15. The value of $\dfrac{\sin 25°}{\cos 65°}+\dfrac{\tan 23°}{\cot 67°}$ is __________ **[1]**

(Q.16 – Q.20) Answer the following.

16. If in a circle with centre *O*, radius is 4 units and length of tangent from an external point *P* is 3 units, then find the distance of point *P* from *O*. **[1]**

17. Evaluate: cos (40 + *Q*) – sin (50 – *Q*). **[1]**

. **18.** Evaluate: sin 43° cos 47° + cos 43° . sin 47° **[1]**

19. If the angle between two radii of a circle is 130°, then find angle between the tangents of the end of radii. **[1]**

20. Find the value of 2*uQ* if sin θ + tan θ = *x*. **[1]**

Section 'B'

21. Can the number 6^n, *n* being a natural number end with the digit 5? Give reasons. **[2]**

22. Five year ago, A was thrice as old as B and ten years later, A shall be twice as old as B. What are the present ages of A and B ? **[2]**

23. If the sum of first *n* terms of an AP is given by $S_n = 3n^2 - 4n$, find its n^{th} term. **[2]**

24. A line intersects the *y*-axis and *x*-axis at the points P and Q respectively. If (2, –5) is the mid-point of PQ, then find the coordinates of P and Q. **[2]**

25. A bag contains 5 red, 8 green and 7 white balls. One ball is drawn at random from the bag, find the probability of getting : **[2]**

(*i*) not a white ball

(*ii*) neither a green nor a red ball.

26. Two different dice are thrown together. Find the probaility that the product of the number appeaeed is less than 18. **[2]**

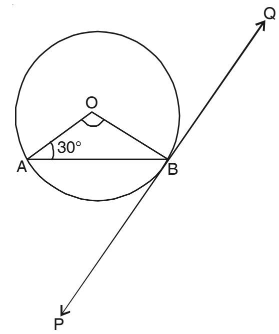
Section 'C'

27. Show that exactly one of the numbers, *n*, *n* + 2 or *n* + 4 is divisible by 3. **[3]**

28. Find the HCF and LCM of 510 and 92 and verify that HCF × LCM = product of two given number. **[3]**

29. If the co-ordinates of points A and B are (–2, –2) and (2, –4) respectively, find the co-ordinates of P such that $AP = \dfrac{3}{7}AB$, where P lies on the line segment AB. **[3]**

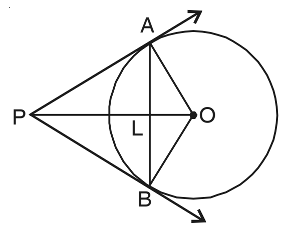
30. In the figure, PQ is a tengent to a circle with centre O. If ∠OAB = 30º, find ∠ABP and ∠AOB. **[3]**



31. Prove that the lengths of tangents drawn from an external point to a circle are equal. **[3]**

OR

In figure, AB is a chord of a circle, with centre O, such that AB = 16 cm and radius of circle is 10 cm. Tangents at A and B intersect each other at P. Find the length of PA.



32. Calculate the area and the perimeter of the remaining portion, after cutting four quadrants each of radius 7 cm, from the four corners of a rectangle measuring 30 cm by 40 cm. **[3]**

33. A solid metalic cone of radius 2 cm and height 8 cm is melted into a sphere. Find the radius of sphere. **[3]**

OR

The sum of the radius of base and height of a solid right circular cylinder is 37 cm. If the total surface area of the solid cylinder is 1628 sq. cm, find the volume of the cylinder. [Use $\pi = \frac{22}{7}$]

34. Following frequency distribution shows the daily expenditure on milk of 30 households in a locality :

Daily expenditure on milk (in ₹)	0–30	30–60	60–90	90–120	120–150
Number *of* households	5	6	9	6	4

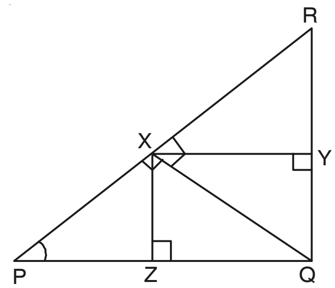
Find the mode for the above data.

35. Solve for x : $\frac{x-1}{2x+1}+\frac{2x+1}{x-1}=2$, where $x \neq -\frac{1}{2}, 1$ **[4]**

OR

In a flight of 6000 km, an aircraft was slowed down due to bad weather. The average speed for the trip was reduced by 400 km/h and the time of flight increased by 30 min. Find the original duration of the flight.

36. ΔPQR is right angled at Q. $QX \perp PR$, $XY \perp RQ$ and $XZ \perp PQ$ are drawn. Prove that $XZ^2 = PZ.ZQ$.



OR

In ΔABC, AD is the median to BC and in ΔPQR, PM is median to QR, if $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$. Prove that $\Delta ABC \sim \Delta PQR$. **[4]**

37. Draw a ΔABC with sides BC = 5 cm, AB = 6 cm and AC = 7 cm and then construct a triangle smilar to ΔABC whose sides are $\frac{4}{7}$ of the corresponding sides of ΔABC. **[4]**

38. The angle of elevation of the top of the tower at a distance of 120 m from a point A on the ground is 45. If the angle of elevation of the top of a flagstaff fixed at the top of the tower, at A is 60°, then find the height of the flagstaff. [Use $\sqrt{3}$ = 1.73] **[4]**

39. The diameters of the lower and upper ends of a bucket in the form of a frustum of a cone are 10 cm and 30 cm respectively. If its height is 24 cm, find : **[4]**

(*i*) The area of the metal sheet used to make the bucket.

(*ii*) Why we should avoid the bucket made by ordinary plastic? [Use π = 3.14]

40. On the annual day of school, age-wise participation of students is given in the following frequency distribution table : **[4]**

Age (in years)	Number of students
Less than 6	2
Less than 8	6
Less than 10	12
Less than 12	22
Less than 14	42
Less than 16	67
Less than 18	76

Draw a less than type ogive and hence find the Median.

OR

The following table gives the life time of 200 bulbs. Calculate the mean life tme of a bulb by step deviation method:

Life time (in hours)	400–499	500–599	600–699	700–799	800–899	900–999
Number of bulbs	24	47	39	42	34	14

MATHEMATICS (STANDARD)

SOLUTIONS MOCK TEST PAPER 2

CBSE Class X Examination

Section 'A'

1. (*d*) **2.** (*b*) **3.** (*a*) **4.** (*d*) **5.** (*d*) **7.** (*b*) **7.** (*d*)
8. (*b*) **9.** (*c*) **10.** (*c*) **[1 × 10 = 10]**

Fill in the blanks

11. $a = -\frac{3}{2}$ **[1]**

Explanation

The given equation is $5x^2 - \frac{7}{2}x + 2a = 0$ putting $x = \frac{1}{2}$

$$5\left(-\frac{1}{2}\right)^2 - \frac{7}{2}\left(-\frac{1}{2}\right) + 2a = 0$$

$$\frac{5}{4} + \frac{7}{4} + 2a = 0$$

$$a = -\frac{3}{2}$$

12. $x + 63$ **[1]**

Explanation

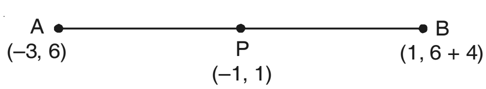
Here $a = x - 7$

$d = (x - 2) - (x - 7) = 5$

$\therefore\ a_{15} = a + 14d = x - 7 + 14(5) = x + 63$

13. $b = -1$ **[1]**

Explanation



Applying mid-point formula for *Y* coordinate

$$\frac{b + b + 4}{2} = 1$$

$$2b + 4 = 2$$

$$2b = -2$$

$$b = -1$$

14. $QB = 3$ cm **[1]**

Explanation

$\Delta AOP \sim \Delta BOQ$ (AA)

$\therefore \quad \frac{OA}{AP} = \frac{BO}{QB} \quad \Rightarrow \quad \frac{6}{4} = \frac{4.5}{QB}$

$\Rightarrow \quad QB = 3$ cm

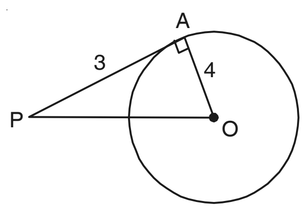
15. 2 **[1]**

Explanation

$$\frac{\sin 25°}{\cos 65°} + \frac{\tan 23°}{\cot 67°} = \frac{\sin(90° - 65)}{\cos 65°} + \frac{\tan(90° - 67°)}{\cot(67°)} = \frac{\cos 65°}{\cos 65°} + \frac{\cot 67°}{\cot 67°} = 1 + 1 = 2$$

Answer the following.

16. Applying pythagoras theorem.



$PO^2 = 3^2 + 4^2 = 25$

$\therefore \quad PQ = 5$ units **[1]**

17. Cos $(40 + \theta) - \sin(50 - \theta)$

$= \cos[90 - (50 - \theta)] - \sin(50 - \theta)$

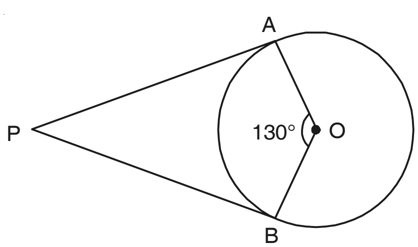
$= \sin(50 - \theta) - \sin(50 - \theta)$

$= 0$ **[1]**

18. $\sin 43° \cos(90° - 43°) + \cos 43° \sin(90° - 43°)$

$= \sin 43° . \sin 43 + \cos 43° \cos 43°$

$= \sin^2 43 + \cos^2 43 = 1$ **[1]**

19.  **[1]**

Given $\quad \angle AOB = 130$

Also $\angle APB + \angle AOB = 180°$

$\therefore \quad \angle APB = 180° - 130° = 50°$

20. $\sec\theta + \tan\theta = x$ ... (i)

Rationalising

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

$$\Rightarrow \frac{\sec^2\theta - \tan^2\theta}{\sec\theta - \tan\theta} = \frac{x}{1}$$

($\sec^2\theta - \tan^2 x = 1$)

$$\Rightarrow \sec\theta - \tan\theta = \frac{1}{x} \quad \text{... (ii)}$$

from (i) and (ii)

$\sec\theta + \tan\theta = x$

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

Adding $2\sec\theta = x + \frac{1}{x}$

$$2\sec\theta = \frac{x^2+1}{x}$$

$$\sec\theta = \frac{x^2+1}{2x}$$ **[1]**

Section 'B'

21. No, because $6^n = (2 \times 3)^n = 2^n \times 3^n$, so the only primes in the factorisation of 6^n are 2, 3 and not 5. **[1]**

Hence, it canot end with the digit 5. **[1]**

22. Let the present age of A and B be x years and y years, respectively.

Then five years ago, the age of A = $(x - 5)$ years

and the age of B = $(y - 5)$ years

Similarly, 10 years later,

the age of A = $(x + 10)$ years

the age of B = $(y + 10)$ years

Now, according to first condition,

$(x - 5) = 3(y - 5)$

$\Rightarrow x - 5 = 3y - 15$ ...(*i*)

$\Rightarrow x - 3y = -10$ **[½]**

Also, according to second condition,

$(x + 10) = 2(y + 10)$

$\Rightarrow x + 10 = 2y + 20$

$\Rightarrow x - 2y = 10$ ...(*ii*) **[½]**

Now subtracting (*i*) from (*ii*), we get

$y = 20$

Now, putting $y = 20$ in (*i*), we get

$x - 60 = -10$

$\Rightarrow x = 50$

Hence, A's present age = 50 years

and B's present age = 20 years **[1]**

23. Given $S_n = 3n^2 - 4n$

$a_n = S_n - S_{n-1}$ **[1]**

$= (3n^2 - 4n) - [3(n-1)^2 - 4(n-1)]$

$= [3n^2 - 4n] - [3(n^2 - 2n + 1) - 4(n-1)]$

$= 3n^2 - 4n - 3n^2 + 6n - 3 + 4n - 4$

$= 6n - 7$

$\therefore$ n^{th} term is $6n - 7$ **[1]**

24. Let the coordinates of points P and Q be $(0, b)$ and $(a, 0)$ resp.

$\therefore \quad \frac{a}{2} = 2 \Rightarrow a = 4$ **[½]**

$\frac{b}{2} = -5 \Rightarrow b = -10$ **[½]**

$\therefore$ P (0, –10) and Q (4, 0) **[1]**

25. Total balls = 5 + 8 + 7 = 20

(***i***) P(white balls) = $\frac{7}{20}$

P(not white) = $1 - \frac{7}{20} = \frac{13}{20}$ **[1]**

(***ii***) P(green or red) = $\frac{8+5}{20} = \frac{13}{20}$

P(neither green or red) = $1 - \frac{13}{20} = \frac{7}{20}$ **[1]**

26. No. of all possible outcomes = $6^2 = 36$

No. of favearable outcomes = 26 **[1]**

(4, 2) (4, 3) (4, 5) (5, 1) (5, 2) (5, 3) (3, 5) (6, 1) (6, 2) (1, 1) (1, 1) (1, 2) (1, 3) (1, 4) (1, 5) (1, 6) (2, 1) (2, 4) (2, 5) (2, 6) (3, 1) (3, 2) (3, 3) (3, 4) (2, 5) (4, 1)

$\therefore$ P (Product appears in less than 18)

$= \frac{26}{36} = \frac{13}{18}$ **[1]**

Section 'C'

27. Let $n = 3k$, $3k + 1$ or $3k + 2$. **[½]**

(***i***) When $n = 3k$:

n is divisible by 3. **[½]**

$n + 2 = 3k + 2 \Rightarrow n + 2$ is not divisible by 3.

$n + 4 = 3k + 4 = 3(k + 1) + 1 \Rightarrow n + 4$ is not divisible by 3.

(***ii***) When $n = 3k + 1$:

n is not divisible by 3.

$n + 2 = (3k + 1) + 2 = 3k + 3 + 3\,(k + 1)$

$\Rightarrow n + 2$ is divisible by 3. **[½]**

$n + 4 = (3k + 1) + 4 = 3k + 5 = 3\,(k + 1) + 2 \Rightarrow n + 4$ is not divisible by 3. **[½]**

(***iii***) When $n = 3k + 2$:

n is not divisible by 3.

$n + 2 = (3k + 2) + 2 = 3k + 4 = 3\,(k + 1) + 1 \Rightarrow n + 2$ is not divisible by 3.

$n + 4 = (3k + 2) + 4 = 3k + 6 = 3\,(k + 2)$

$\Rightarrow n + 4$ is divisible by 3. **[½]**

Hence exactly one of the numbers n, $n + 2$ or $n + 4$ is divisible by 3. **[½]**

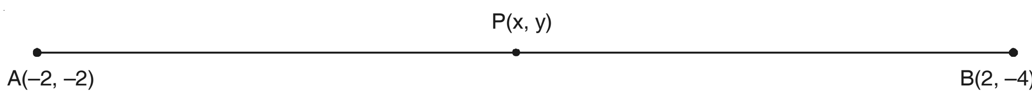
28.
$$92 = 2^2 \times 23$$
$$510 = 2 \times 3 \times 5 \times 17$$
$$\text{HCF}(510, 92) = 2$$ **[1]**
$$\text{LCM}(510, 92) = 2^2 \times 23 \times 3 \times 5 \times 17$$
$$= 23460$$ **[1]**

HCF (510, 92) × LCM (510, 92)
$$= 2 \times 23460 = 46920$$

Product of two number $= 510 \times 92 = 46920$

Hence, HCF × LCM = Product of two numbers. **[1]**

29.



Let $A(-2, -2) = (x_1, y_1)$ and $B(2, -4) = (x_2, y_2)$

$$AP = \frac{3}{7}AB$$
$$\frac{AP}{AB} = \frac{3}{7}$$
$$AP = 3x \text{ and } AB = 7x$$
$$AB = AP + PB$$
$$7x = 3x + PB$$
$$PB = 7x - 3x$$
$$PB = 4x$$ **[1]**
$$\frac{AP}{PB} = \frac{3\cancel{x}}{4\cancel{x}}$$
$$\frac{AP}{PB} = \frac{3}{4}$$
$$m_1 : m_2 = 3 : 4$$ **[1]**
$$P(x, y) = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$$
$$= \left(\frac{(3)(2) + (4)(-2)}{3 + 4}, \frac{(3)(-4) + (4)(-2)}{3 + 4}\right)$$
$$= \left(\frac{6 - 8}{7}, \frac{-12 - 8}{7}\right) = \left(\frac{-2}{7}, \frac{-20}{7}\right)$$ **[1]**

OR

Area of quadrilateral ABCD = ar(ΔABC) + ar(ΔADC)

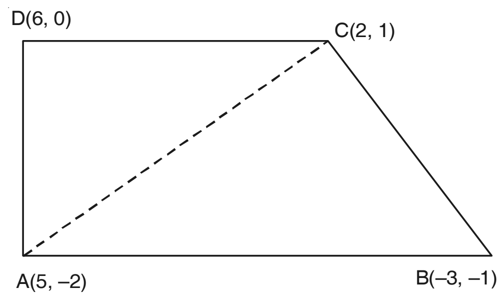
$$\text{Area } (\Delta ADC) = \frac{1}{2}[5(0-1)+6(1+2)+2(-2-0)]$$

$$= \frac{1}{2}[(5(-1)+6(3)+2(-2)]$$

$$= \frac{1}{2}[-5+18-4]$$

$$= \frac{1}{2}[18-9]$$

$$= \frac{9}{2} \text{ sq. unit}$$ **[1]**



$$\text{Area } (\Delta ABC) = \frac{1}{2}\{5(-1-1)+(-3)(1+2)+2(-2+1)\}$$

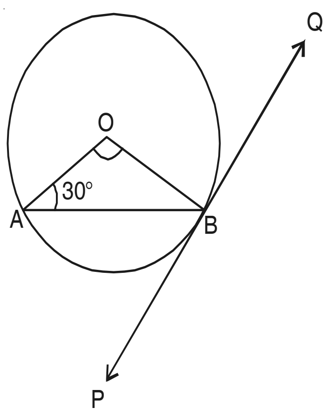
$$= \frac{1}{2}[(5)(-2)+(-3)(3)+(2)(-1)] = \frac{1}{2}[-10-9-2] = \frac{1}{2}[-21]$$

$$= \frac{21}{2} \text{ sq. unit}$$ **[1]**

Area of quadrilateral ABCD = ar(ΔABC) + ar(ΔADC)

$$= \frac{21}{2}+\frac{9}{2} = \frac{21+9}{2} = \frac{30}{2} = 15 \text{ sq. units.}$$ **[1]**

30.



[1]

Since the tangent is perpendicular to the end point of raduis,

∴ $\angle OBP = 90°$

$\angle OAB = \angle OBA$ ($\because OA = OB$)

$\angle OBA = 30°$ **[1]**

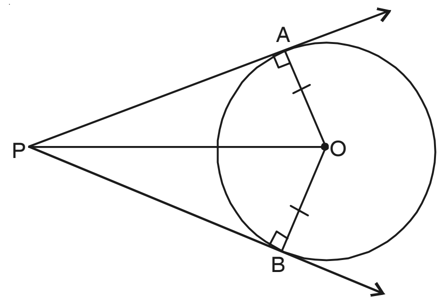
∴ $\angle AOB = 180° - (30° + 30°)$

$\angle AOB = 120°$

$\angle ABP = \angle OBP - \angle OBA$

$\angle ABP = 90° - 30° = 60°$ **[1]**

31. Given: AP and BP are tangents of circle having centre O.



To prove : AP = BP

Construction Join : OP, AO and BO. **[1]**

Proof : ΔOAP and ΔOBP

OA = OB (Radius of circle)

OP = OP (Common side)

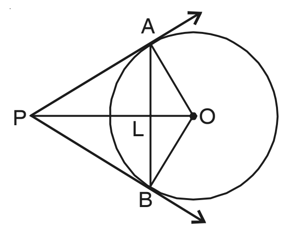
$\angle$OAP = $\angle$OBP = 90º (Radius tangent angle)

ΔOAP = ΔOBP **[1]** (RHS congruency rule)

AP = BP (CPCT) **[1]**

OR

Since OP is perpendicular bisector of *AB*, therefore



AL = LB ...(*i*)

But AB = 16 cm [Given]

$\Rightarrow$ AL + LB = 16

$\Rightarrow$ AL + AL = 16 [using (*i*)]

$\Rightarrow$ 2AL = 16

$\Rightarrow$ AL = 8 cm

$\Rightarrow$ AL = LB = 8 cm ...(*ii*) [using (*i*)] **[½]**

In right triangle OLA, we have

$OA^2 = OL^2 + AL^2$ [By Pythagoras Theorem]

$\Rightarrow$ $OL^2 = OA^2 - AL^2$

$\Rightarrow$ $OL^2 = (10)^2 - (8)^2$

$\Rightarrow$ $OL^2 = 100 - 64 = 36$

$\Rightarrow$ OL = 6 cm ...(*iii*) **[½]**

Since PA is a tangent to circle with centre O and OA is its radius, therefore,

OA $\perp$ PA

[$\because$ The tangent at any point of a circle is perpendicular to the radius through the point of contact]

$\therefore$ $\angle$OAP = 90º

In right triangle OPA, we have

$$OP^2 = PA^2 + OA^2$$ **[½]** [By Pythagoras Theorem]

$$\Rightarrow \quad (PL + OL)^2 = PA^2 + (10)^2$$

$$\Rightarrow \quad (PL + 6)^2 = PA^2 + 100 \qquad ...(iv) \text{ [using } (iii)]$$

In right triangle ALP, we have

$$PA^2 = PL^2 + AL^2$$ **[½]**

$$\Rightarrow \quad PA^2 = PL^2 + 64 \qquad ...(v) \text{ [using } (ii)]$$

From (*iv*) and (*v*), we have

$$(PL + 6)^2 = (PL^2 + 64) + 100$$

$$\Rightarrow PL^2 + 36 + 12PL = PL^2 + 164$$

$$\Rightarrow \quad 12PL = 128$$

$$\Rightarrow \quad PL = \frac{128}{12} = \frac{32}{3} \qquad ...(vi)$$ **[½]**

Now, from (*v*) and (*vi*), we get

$$PA^2 = \left(\frac{32}{3}\right)^2 + 64$$

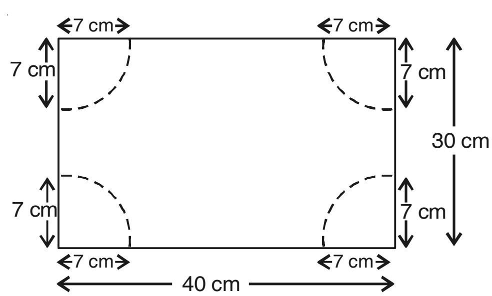
$$\Rightarrow \quad PA^2 = \frac{1024 + 576}{9}$$

$$= \frac{1600}{9} = \left(\frac{40}{3}\right)^2$$

$$\Rightarrow \quad PA = \frac{40}{3} \text{ cm}$$ **[½]**

32. Area of rectangle of length 40 cm and width 30 cm

$$= 40 \times 30 = 1200 \text{ cm}^2$$ **[1]**



Area of each quadrant with radius of 7 cm

$$= \frac{1}{4} \times \pi r^2$$

$$= \frac{1}{4} \times \frac{22}{7} \times (7)^2$$

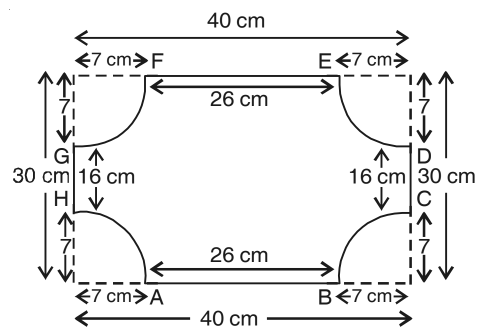
$$= \frac{1}{4} \times 22 \times 7 = 38.5 \text{ cm}^2$$

Area of all 4 quadrants = 4 × Area of each quadrant

$= 4 \times 38.5 = 154 \text{ cm}^2$

Area of remaining portion = Area of rectangle – Area of all 4 quadrants

$= 1200 - 154 = 1046 \text{ cm}^2$ **[1]**



Perimeter of remaining portion = AB + length of curve BC + CD + length of curve DE + EF + length of curve FG + GH + length of curve HA

$= 26 + \frac{1}{2}\pi(7) + 16 + \frac{1}{2}\pi(7) + 26 + \frac{1}{2}\pi(7) + 16 + \frac{1}{2}\pi(7)$

$= 26 \times 2 + 16 \times 2 + 4 \times \frac{1}{2}\pi(7)$

$= 52 + 32 + 2 \times \frac{22}{7} \times 7$

$= 84 + 44 = 128$ cm **[1]**

33. Let the radius of sphere = R cm

Volume of sphere = Volume of cone

$\Rightarrow \quad \frac{4}{3}\pi R^3 = \frac{1}{3}\pi r^2 h$ **[1]**

$\Rightarrow \quad \frac{4}{3}\pi R^3 = \frac{1}{3}\pi \times 2 \times 2 \times 8$

$R^3 = \frac{2 \times 2 \times 8}{4}$ **[1]**

$R^3 = 8$

$R = 2$ cm **[1]**

OR

Here, $r + h = 37$

and $2\pi r(r + h) = 1628$

$2\pi r \times 37 = 1628$ **[1]**

$2\pi r = \frac{1620}{37}$

$$\Rightarrow \quad 2\times\frac{22}{7}\times r = \frac{1620}{37}$$

$$\Rightarrow \quad r = \frac{1628}{37}\times\frac{7}{2\times 22}$$

$\Rightarrow \quad r = 7$ cm **[½]**

and $\quad h = 30$ cm **[½]**

Hence volume of cylinder

$$= \pi r^2 h = \frac{22}{7}\times 7\times 7\times 30$$

Volume of cylinder $= 4620$ cm^3. **[1]**

34. Here, maximum frequency = 9, hence modal class is 60–90

$$\text{Mode} = l_1 + h\left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)$$

Here, $l_1 = 60, f_1 = 9, f_0 = 6, f_2 = 6$ and $h = 30$.

$$\text{Mode} = 60 + 30\left(\frac{9-6}{2\times 9 - 6 - 6}\right)$$

$$= 60 + \frac{30\times 3}{6} = 60 + 15 = 75$$ **[1+1+1]**

Section 'D'

35. CBSE Topper's Solution, 2017

Let $\frac{x-1}{2x+1}$ be y,

$y + \frac{1}{y} = 2$

$y^2 + 1 = 2y$

$y^2 - 2y + 1 = 0$

$y^2 - y - y + 1 = 0$

$y(y-1) - 1(y-1) = 0$

$(y-1)(y-1) = 0$

$\therefore y = 1$ or 1.

Now, $\frac{x-1}{2x+1} = 1$ or $\frac{x-1}{2x+1} = 1$

$x - 1 = 2x + 1$

$-2 = x$

$\therefore x = -2$ or -2

$\therefore \boxed{x = -2}$ **[4]**

OR

Let the original speed be x km/h.

Then, reduced speed = $(x - 400)$ km/h

The duration of flight at original speed

$$= \left(\frac{6000}{x}\right)\text{hours} \qquad \left[\because \text{time} = \frac{\text{distance}}{\text{speed}}\right]$$

The duration of flight at reduced speed

$$= \left(\frac{6000}{x-400}\right)\text{hours} \qquad ...(1)$$

Since, the difference between these two duration is $\frac{1}{2}$hours .

$$\therefore \quad \frac{6000}{x-400} - \frac{6000}{x} = \frac{1}{2} \qquad \textbf{[1]}$$

$$\Rightarrow \quad \frac{6000x - 6000(x-400)}{x(x-400)} = \frac{1}{12000}$$

$$\Rightarrow \quad \frac{6000\{x-(x-400)\}}{x(x-400)} = \frac{1}{12000}$$

$$\Rightarrow \quad \frac{x-x+400}{x(x-400)} = \frac{1}{12000}$$

$$\Rightarrow \quad \frac{400}{x(x-400)} = \frac{1}{12000}$$

$\Rightarrow \quad x(x - 400) = 4800000$

$\Rightarrow \quad x^2 - 400x - 4800000 = 0$ **[1]**

$\Rightarrow x^2 - 2400x + 2000x - 4800000 = 0$

[by factorsation]

$\Rightarrow x(x - 2400) + 2000(x - 2400) = 0$

$\Rightarrow \quad (x - 2400)(x + 2000) = 0$

$\Rightarrow \quad x - 2400 = 0$ or $x + 2000 = 0$

$\Rightarrow \quad x = 2400$ or -2000 **[1]**

Since, the speed of aircraft cannot be negative

So, $\quad x = 2400$

Hence, the original speed is 2400 km/h.

$\therefore$ Original duration of the flight

$$= \frac{6000}{2400} = 2\frac{1}{2}\text{hours} \quad \left[\because \text{time} = \frac{\text{distance}}{\text{speed}}\right] \qquad \textbf{[1]}$$

36. Here $\quad RQ \perp PQ$ and $XZ \perp PQ$

Therefore $\quad ZX \parallel QY$

Similarly, $\quad PQ \perp QR$ and $XY \perp QR$

$XY \parallel ZQ$ **[1]**

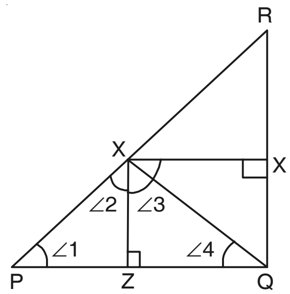
XZQY is rectangle.

In $\Delta XZP \angle 1 + \angle 2 = 90°$ ...(1)

In $\Delta XZQ \angle 3 + \angle 4 = 90°$ ...(2)

Given $QX \perp PR, \angle 2 + \angle 3 = 90°$ ...(3)

From eq. (1) and eq. (3)



[1]

$\angle 1 = \angle 3$ ...(4)

In ΔXZP and ΔXZQ, $\angle 1 = \angle 3$ [From eq. (4)]

$\angle XZP = \angle XZQ$ [each 90°]

$\Delta XZP \sim \Delta XZQ$ [by AA] **[1]**

$$\frac{PZ}{XZ} = \frac{XZ}{ZQ}$$

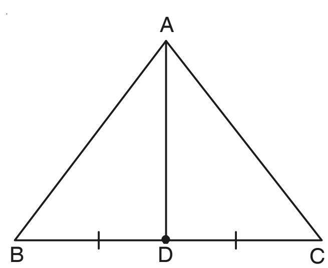
$XZ^2 = PZ \cdot ZQ$ **Hence proved** **[1]**

OR

Here, In ΔABC, AD is median

$$BD = DC = \frac{1}{2}BC$$

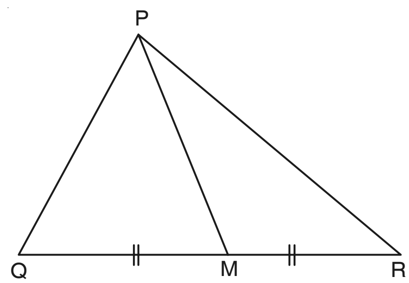
$\therefore$ $BC = 2\,BD$



Here, In ΔPQR, PM is median

$$QM = MR = \frac{1}{2}QR$$

$QR = 2\,QM$ **[1]**



(Given) $\dfrac{AB}{PQ} = \dfrac{BC}{QR} = \dfrac{AD}{PM}$

$\dfrac{AB}{PQ} = \dfrac{2\,BD}{2\,QM} = \dfrac{AD}{PM}$

$\dfrac{AB}{PQ} = \dfrac{BD}{QM} = \dfrac{AD}{PM}$ **[1]**

In ΔABD and ΔPQM $\dfrac{AB}{PQ} = \dfrac{BD}{QM} = \dfrac{AD}{PM}$

$\Delta ABD \sim \Delta PQM$ (SSS Similarly) **[1]**

$\angle B = \angle Q$ ...(1)

In ΔABC and ΔPQR **[1]**

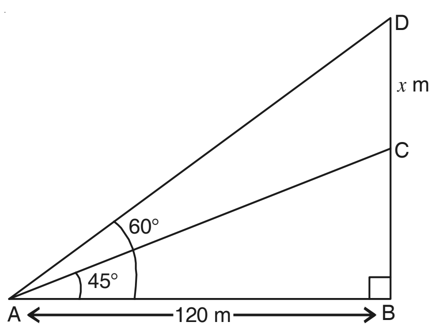
$\dfrac{AB}{PQ} = \dfrac{BC}{QR}$ (Given)

$\angle B = \angle Q$ [From eq. (1)]

$\therefore$ $\Delta ABC \sim \Delta PQR$ [By SAS Similarity]

Hence proved

38.



Let the height of the tower BC = h

and the height of the flastaff CD = x m

Given, AB =120 m, $\angle CAB = 45°$ and $\angle DAB = 60°$

In ΔABC, $\angle B = 90°$

$\tan A = \dfrac{BC}{AB}$ $\left[\tan\theta = \dfrac{P}{B}\right]$

$\tan 45° = \dfrac{h}{120}$

$h = 120$ m **[1]**

Now in ΔABD, ∠B = 90°

$$\tan A = \frac{BD}{AB}$$

$$\tan 60° = \frac{BC + CD}{120°}$$ **[1]**

$$\sqrt{3} = \frac{120 + x}{120}$$

$$x + 120 = 120\sqrt{3}$$

$$x = 120\sqrt{3} - 120$$

$$x = 120(\sqrt{3} - 1)$$ **[1]**

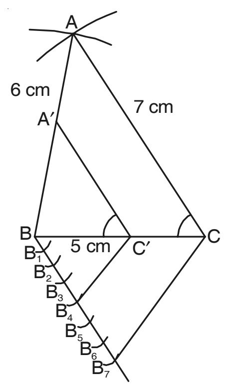
$$x = 120(1.73 - 1)$$

$$x = 120 \times 0.73$$

$$x = 87.6 \text{ m}$$

Hence, height of the flagstaff 87.6 m. **[1]**

37.



[2]

Steps of Construction:

(*i*) Draw BC = 5 cm.

(*ii*) From B cut an arc of 6 cm and from C cut on arc of 7 cm.

(*iii*) Join AB and AC.

(*iv*) Make an acute angle from B.

(*v*) Cut 7 equal parts on it.

(*vi*) Join B_1 to C and draw a line B_4C' parallel to B_7C.

(*vii*) Draw C′A′ parallel to CA. **[2]**

39. Here r_1 =15 cm, r_2 = 5 and h = 24 cm

(*i*)Area of metal sheet

= CSA of the bucket + area of lower end

$$= \pi l(r_1 + r_2) + \pi r_2^2$$ **[1]**

where $$l = \sqrt{24^2 + (15-5)^2}$$

$$= 26 \text{ cm}$$ **[1]**

(*ii*) Surface area of metal sheet

$$= 3.14(26 \times 20 + 25)\text{ cm}^2$$

$$= 1711.3 \text{ cm}^2$$ **[1]**

We should avoid use of plastic because it is non-degradable or similar value. **[1]**

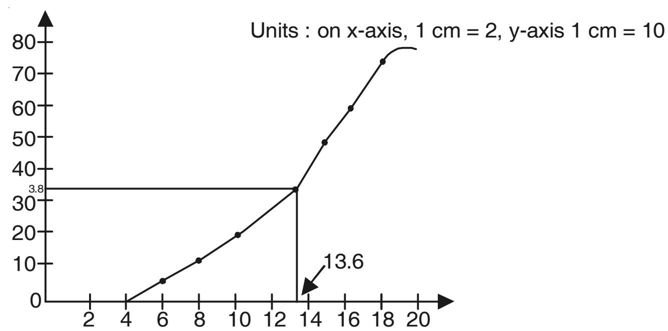
40. Find the median of the students and how can get the median graphically

Age of student	C.I.	*c.f.*
Less than 6	4–6	2
Less than 8	6–8	6
Less than 10	8–10	12
Less than 12	10–12	22
Less than 14	12–14	42
Less than 16	14–16	67
Less than 18	16–18	76
		N = 76

[2]

$$\text{Median} = \frac{N}{2}\text{th term} = \frac{76}{2} = 38\text{th term}$$

Median class = 12 – 14



[2]

Hence Medium = 13.6

OR

Let assumed mean, $A = 649.5$

Life time (in hrs)	x_i	$u_i = \frac{x_i - a}{h}$	f_i	$f_i u_i$
399.5–499.5	449.5	–2	24	–48
499.5–599.5	549.5	–1	47	–47
599.5–699.5	649.5 = a	0	39	0
699.5–799.5	749.5	1	42	42
799.5–899.5	849.5	2	34	68
899.5–999.5	949.5	3	14	42
Total			$\Sigma f_i = 200$	$\Sigma f_i u_i = 57$

[2]

$$\text{Mean, } x = a + \left(\frac{\sum f_i u_i}{\sum f_i} \times h\right)$$

$$= 649.5 + \frac{57}{200} \times 100$$

$= 649.5 + 28.5 = 678$ **[1]**

Hence, Mean life time of a bulb is 678 hours.

[1]