CBSE Board
Class X Mathematics

Time: 3 hrs **Total Marks: 80**

General Instructions:

1. **All** questions are **compulsory**.
2. The question paper consists of **30** questions divided into **four sections** A, B, C, and D. **Section A** comprises of **6** questions of 1 mark each, **Section B** comprises of **6** questions of 2 marks each, **Section C** comprises of **10** questions of 3 marks each and **Section D** comprises of **8** questions of 4 marks each.
3. Question numbers **1 to 6** in **Section A** are multiple choice questions where you are to select **one** correct option out of the given four.
4. Use of calculator is **not** permitted.

Section A
(Questions 1 to 6 carry 1 mark each)

1. Find the probability that a randomly chosen number from 1 to 12 is a divisor of 12.

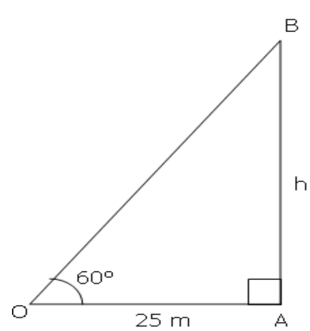
2. If α and β are the zeroes of the polynomial $5x^2 - 7x + 2$, then find the sum of their reciprocals.

3. The ratio of the length of a pole and its shadow is $\sqrt{3}:1$. Find the angle of elevation of the Sun.

4. $\Delta ABC \sim \Delta PQR$. M is the mid-point of BC and B is the mid-point of QR. The area of ΔABC = 100 sq. cm and that of ΔPQR = 144 sq. cm. If AM = 4 cm, then find PN.

5. Is 0. 101100101010 an irrational number? Justify your answer.

6. From the given figure, find h.



Section B
(Questions 7 to 12 carry 2 marks each)

7. The centre of a circle has the co-ordinates (3, 4) and one end of its diameter has (1, 2). Find the co-ordinates of the other end of the diameter.

8. Form a quadratic equation whose roots are $\frac{-1}{3}$ and $\frac{5}{2}$.

9. Using Euclid's division algorithm, find the H.C.F. of 240 and 6552.

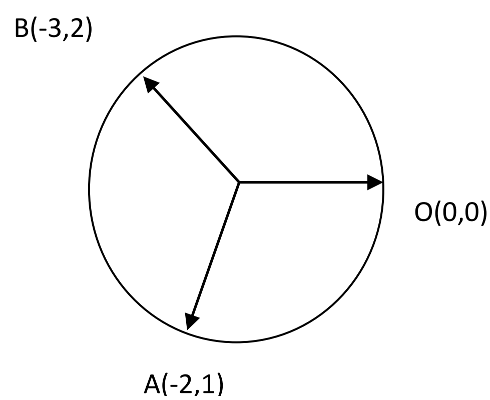
10. If $\sqrt{3}\tan\theta = 3\sin\theta$, prove that $\sin^2\theta - \cos^2\theta = \frac{1}{3}$.

11. Show that the tangents at the end points of a diameter of a circle are parallel.

12. If $7\sin^2\theta + 3\cos^2\theta = 4$, then find θ and hence prove that $\sec\theta + \operatorname{cosec}\theta = 2 + \frac{2}{\sqrt{3}}$

Section C
(Questions 13 to 22 carry 3 marks each)

13. Find the co-ordinates of the centre of the circle passing through the points (0, 0), (−2, 1) and (−3, 2). Also, find its radius.



14. For what value(s) of p does the equation $px^2 + (p-1)x + (p-1) = 0$ have a repeated root?

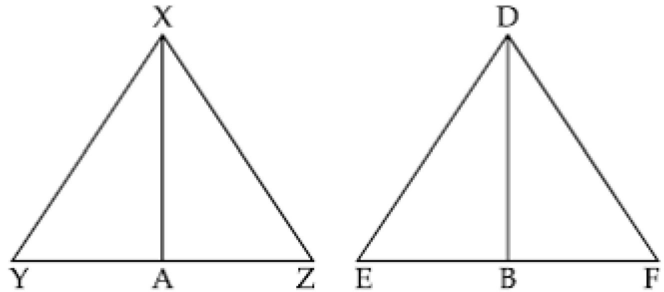
15. Rekha's mother is five times as old as her daughter. Five years later, Rekha's mother will be three times as old as Rekha. Find the present age of Rekha and her mother.

16. Without using trigonometric tables, evaluate:

$$\frac{\cos 37^\circ . \operatorname{cosec} 53^\circ}{\tan 5^\circ . \tan 25^\circ . \tan 45^\circ . \tan 65^\circ . \tan 85^\circ}$$

17. Show that $6 + \sqrt{2}$ is irrational.

18. In the figure, sides XY and YZ and median XA of a triangle XYZ are proportional to sides DE, EF and median DB of Δ DEF. Show that Δ XYZ ~ Δ DEF.



19. The point P divides the join of (2, 1) and (−3, 6) in the ratio 2 : 3. Does P lie on the line x − 5y + 15 = 0?

20. An integer is chosen at random from 1 to 200. What is the probability that the integer chosen is divisible by 6 or 8?

21. If D, E and F are the mid-points of sides BC, CA and AB respectively of a Δ ABC, whose vertices are A(−4, 1), B(6, 7) and C(2, -9), then prove that: ar (ΔDEF) = $\frac{1}{4}$ ar(ΔABC).

22. If mean of the following data is 86, then what is the value of p?

Wages (in Rs.)	50-60	60-70	70-80	80-90	90-100	100-110
Number of workers	5	3	4	p	2	13

Section D
(Questions 23 to 30 carry 4 marks each)

23. The m^{th} term of an A.P. is n and the n^{th} term is m. Find the r^{th} term of the A.P.

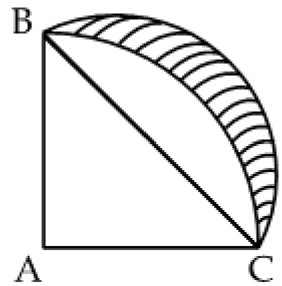
24. Construct a triangle similar to Δ ABC in which AB = 4.6 cm, BC = 5.1 cm, m$\angle$A = 60^o with scale factor 4 : 5.

25. Some students planned a picnic. The budget for food was Rs. 240. Since, four students of the group did not go to picnic, the cost of food increased by Rs. 5 per student. How many students went for the picnic?

26. A copper wire of 4 mm diameter is evenly wound around a cylinder whose length is 24 cm and diameter 20 cm so as to cover the whole surface. Find the length and weight of the wire assuming the density to be 8.68 gm/cm^3.

27. A solid toy is in the form of a hemisphere surmounted by a right circular cone. The height of the cone is 4 cm and the diameter of its base is 8 cm. Determine the volume of the toy. If a cube circumscribes the toy, then find the difference of the volumes of cube and the toy. Also, find the total surface area of the toy.

28. In the figure, ABC is a quadrant of a circle of radius 14 cm and a semi-circle is drawn with BC as diameter. Find the area of the shaded region.



29. Solve the following equations graphically:
$x - y = 1$ and $2x + y = 8$. Shade the region between the two lines and y-axis.

30. The marks obtained in a class test by 30 students of a class are as follows:

Marks obtained	Number of students
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Draw less than type and more than type ogive curves for the given data and hence find the median.

CBSE Board
Class X Mathematics
Solution

Time: 3 hrs **Total Marks: 80**

Section A

1. Total number of outcomes = 12

Numbers which are divisors of 12 are 1, 2, 3, 4, 6, and 12.

Number of favourable outcomes = 6

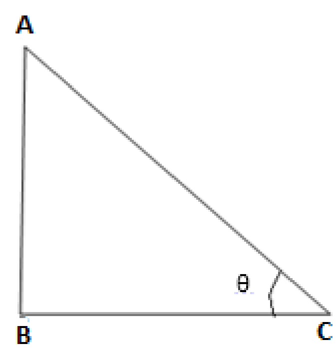
P(divisor of 12) = $\frac{6}{12} = \frac{1}{2}$

2. α and β are the roots of the equation $5x^2 - 7x + 2$

Then, $\alpha + \beta = -\frac{-7}{5} = \frac{7}{5}$ and $\alpha\beta = \frac{2}{5}$

Now, sum of their reciprocals $= \frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} = \frac{7/5}{2/5} = \frac{7}{2}$

3. Let AB be the pole and BC be its shadow.



Given that $\frac{AB}{BC} = \frac{\sqrt{3}}{1}$

Let $\theta = \angle ACB$ be the angle of elevation.

In ΔABC,

$\tan\theta = \frac{AB}{BC}$

$\Rightarrow \tan\theta = \frac{\sqrt{3}}{1}$

$\Rightarrow \tan\theta = \tan 60^\circ$

$\Rightarrow \theta = 60^\circ$

4. $\Delta ABC \sim \Delta PQR$ and AM and PN are the medians of ΔABC and ΔPQR respectively.

$$\Rightarrow \frac{A(\Delta ABC)}{A(\Delta PQR)} = \left(\frac{AM}{PN}\right)^2$$

$$\Rightarrow \frac{100}{144} = \left(\frac{4}{PN}\right)^2$$

$$\Rightarrow \frac{100}{144} = \frac{16}{PN^2}$$

$$\Rightarrow PN^2 = \frac{16 \times 144}{100} \Rightarrow PN = \frac{4 \times 12}{10} = \frac{48}{10} = 4.8 \text{ cm}$$

5. A real number is an irrational number when it has a non-terminating non repeating decimal representation.

Thus, 0.101100101010……. is an irrational number.

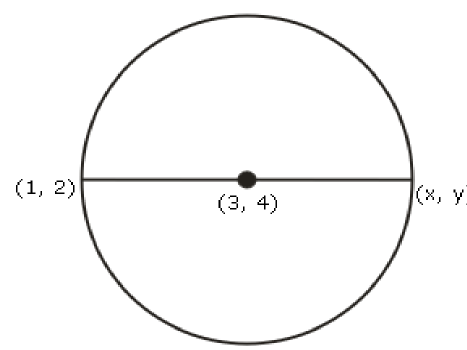
6. In ΔABO,

$$\frac{h}{25} = \tan 60^\circ = \sqrt{3}$$

$$\Rightarrow h = 25\sqrt{3}\,\text{m}$$

Section B

7. Let the other end of the diameter be (x, y).



As center is the mid-point of the diameter, we get

$$\frac{1+x}{2} = 3 \Rightarrow x = 5$$

$$\frac{2+y}{2} = 4 \Rightarrow y = 6$$

Thus, the required point is (5, 6).

8. Sum of roots (S) = $\frac{-1}{3} + \frac{5}{2} = \frac{13}{6}$ and Product of roots (P) = $\frac{-1}{3} \times \frac{5}{2} = \frac{-5}{6}$

Required equation is $x^2 - Sx + P = 0$

$$x^2 - \frac{13}{6}x + \left(\frac{-5}{6}\right) = 0$$

i.e. $6x^2 - 13x - 5 = 0$

9. 6552 = [240 × 27] + 72

240 = [72 × 3] + 24

72 = [24 × 3] + 0

The remainder now, is zero

Since the divisor at this stage is 24, so the H.C.F. of the given numbers is 24.

10.

$$\sqrt{3}\tan\theta = 3\sin\theta \Rightarrow \frac{\sqrt{3}\sin\theta}{\cos\theta} = 3\sin\theta$$

$$\Rightarrow \cos\theta = \frac{1}{\sqrt{3}}$$

$$\text{L.H.S.} = \sin^2\theta - \cos^2\theta$$

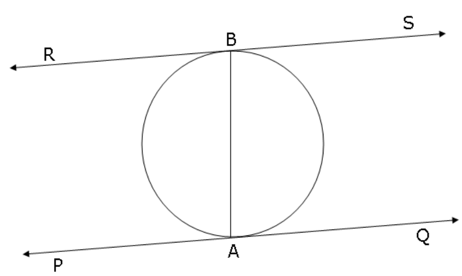
$$= 1 - 2\cos^2\theta \ \ [\text{since } \sin^2\theta = 1 - \cos^2\theta]$$

$$= 1 - 2\left(\frac{1}{\sqrt{3}}\right)^2$$

$$= 1 - \frac{2}{3}$$

$$= \frac{1}{3}$$

11. Let AB be the diameter of the given circle, and let PQ and RS be the tangent lines drawn to the circle at points A and B respectively.



Since tangent at a point to a circle is perpendicular to the radius through the point of contact.

Therefore, AB is perpendicular to both PQ and RS.

$\Rightarrow \angle PAB = 90°$ and $\angle ABS = 90°$

$\Rightarrow \angle PAB = \angle ABS$

But, these are a pair of alternate interior angles.

Therefore, PQ is parallel to RS.

12. $7\sin^2\theta + 3\cos^2\theta = 4$

$\Rightarrow 7\sin^2\theta + 3(1 - \sin^2\theta) = 4$

$\Rightarrow 7\sin^2\theta + 3 - 3\sin^2\theta = 4$

$\Rightarrow 4\sin^2\theta = 1$

$\Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30^{\circ}$

Thus, $\sec 30^{\circ} + \text{cosec } 30^{\circ} = \frac{2}{\sqrt{3}} + 2$

Section C

13. Let P(x, y) be the centre of the circle passing through the points O(0, 0), A(−2, 1) and B(−3, 2).

Then, OP = AP = BP

Now, OP = AP

$\Rightarrow OP^2 = AP^2$

$\Rightarrow x^2 + y^2 = (x + 2)^2 + (y - 1)^2$

$\Rightarrow x^2 + y^2 = x^2 + y^2 + 4x - 2y + 5$

$\Rightarrow 4x - 2y + 5 = 0 \qquad \text{... (i)}$

Now, OP = BP

$\Rightarrow OP^2 = BP^2$

$\Rightarrow x^2 + y^2 = (x + 3)^2 + (y - 2)^2$

$\Rightarrow x^2 + y^2 = x^2 + y^2 + 6x - 4y + 13$

$\Rightarrow 6x - 4y + 13 = 0 \qquad \text{... (ii)}$

On solving equations (i) and (ii), we get $x = \frac{3}{2}$ and $y = \frac{11}{2}$

Thus, the co-ordinates of the centre are $\left(\frac{3}{2}, \frac{11}{2}\right)$

Now, radius = OP = $\sqrt{\left(x^2 + y^2\right)} = \sqrt{\frac{9}{4} + \frac{121}{4}} = \frac{1}{2}\sqrt{130}$ units

14. Given equation: $px^2 + (p - 1)x + (p - 1) = 0$

For repeated root, D = 0

$\Rightarrow b^2 - 4ac = 0$

$\Rightarrow (p - 1)^2 - 4p(p - 1) = 0$

$\Rightarrow (p - 1)(p - 1 - 4p) = 0$

$\Rightarrow (p - 1)(-3p - 1) = 0$

$\Rightarrow p - 1 = 0$ or $-3p - 1 = 0$

$\Rightarrow p = 1$ or $p = -\frac{1}{3}$

15. Let Rekha's age be x years and her mother's age be y years.

From the given information,

$y = 5x \quad \ldots (1)$

After 5 years, we have

Rekha's age = (x + 5) years

Rekha's mother's age = (y + 5) years

From the given information, y + 5 = 3(x + 5)

$\Rightarrow y - 3x = 10$

$\Rightarrow 5x - 3x = 10 \quad \ldots.[\text{From } (1)]$

$\Rightarrow x = 5$

Therefore, Rekha's age = 5 years and Rekha's mother's age = 25 years

16.

$$\frac{\cos 37^\circ.\text{cosec}\, 53^\circ}{\tan 5^\circ.\tan 25^\circ.\tan 45^\circ.\tan 65^\circ.\tan 85^\circ} = \frac{\cos 37^\circ.\text{cosec}(90^\circ - 37^\circ)}{\tan 5^\circ.\tan 25^\circ.\tan 45^\circ.\tan(90^\circ - 25^\circ).\tan(90^\circ - 5^\circ)}$$

$$= \frac{\cos 37^\circ.\sec 37^\circ}{\tan 5^\circ.\tan 25^\circ.\tan 45^\circ.\cot 25^\circ.\cot 5^\circ} \quad \left[\begin{array}{c}\because \text{cosec}(90^\circ - \theta) = \sec\theta \\ \tan(90^\circ - \theta) = \cot\theta\end{array}\right]$$

$$= \frac{1}{\tan 5^\circ.\cot 5^\circ.\tan 25^\circ.\cot 25^\circ.1} \quad \left[\begin{array}{c}\because \sec\theta = \frac{1}{\cos\theta} \\ \tan 45^\circ = 1\end{array}\right]$$

$$= 1 \quad \left[\because \cot\theta = \frac{1}{\tan\theta}\right]$$

17. Let 6 + $\sqrt{2}$ be rational and equal to $\frac{a}{b}$.

Then, $\frac{6+\sqrt{2}}{1}=\frac{a}{b}$, where a and b are co primes, $b\neq 0$

$\therefore \sqrt{2}=\frac{a}{b}-6$

$\sqrt{2}=\frac{a-6b}{b}$

Here a and b are integers. so, $\frac{a-6b}{b}$ is rational.

Therefore, $\sqrt{2}$ is rational.

This is a contradiction as $\sqrt{2}$ is irrational.

Hence, our assumption is wrong.

Thus, 6 + $\sqrt{2}$ is an irrational number.

18. Given: In ΔXYZ and ΔDEF

$\frac{XY}{DE}=\frac{YZ}{EF}=\frac{XA}{DB}$ ...(1)

To prove: $\Delta XYZ \sim \Delta DEF$

Proof: Since XA and DB are medians,

2YA = YZ

2EB = EF ...(2)

From (1) and (2)

$\frac{XY}{DE}=\frac{2YA}{2EB}=\frac{XA}{DB}$

$\Rightarrow \Delta XYA \sim \Delta DEB$ (BY SSS rule)

$\Rightarrow \angle Y = \angle E$ ...(3)

Now, in ΔXYZ and ΔDEF,

$\frac{XY}{DE}=\frac{YZ}{EF}$ [From (1)]

$\angle Y = \angle E$ [From (3)]

$\Rightarrow \Delta XYZ \sim \Delta DEF$ (BY SAS rule)

19. Given, the point P divides the join of (2, 1) and (−3, 6) in the ratio 2 : 3.

Co-ordinates of the point P $\equiv\left(\frac{2\times(-3)+3\times 2}{2+3},\frac{2\times 6+3\times 1}{2+3}\right)\equiv\left(\frac{-6+6}{5},\frac{12+3}{5}\right)\equiv(0,3)$

Now, the given equation is $x - 5y + 15 = 0$.

Substituting $x = 0$ and $y = 3$ in this equation, we have

L.H.S. $= 0 - 5(3) + 15 = -15 + 15 = 0 =$ R.H.S.

Hence, the point P lies on the line $x - 5y + 15 = 0$.

20. Total number of outcomes = 200

Multiples of 6 from 1 to 200:

6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90, 96, 102, 108, 114, 120, 126, 132, 138, 144, 150, 156, 162, 168, 174, 180, 186, 192, 198.

Total outcomes = 33

Multiples of 8 from 1 to 200:

8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 136, 144, 152, 160, 168, 176, 184, 192, 200.

Total outcomes = 25

Multiples of 6 and 8 from 1 to 200:

24, 48, 72, 96, 120, 144, 168, 192

Total outcomes = 8

Number of multiples of 6 or 8 = 33 + 25 – 8 = 50

P (chosen integer is a multiple of 6 or 8) $= \frac{50}{200} = \frac{1}{4}$

21. Let A = (x_1, y_1) = (−4, 1), B = (x_2, y_2) = (6, 7) and C = (x_3, y_3) = (2, −9)

$$\text{Area of } \Delta ABC = \frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

$$= \frac{1}{2}|-4(7+9) + 6(-9-1) + 2(1-7)|$$

$$= \frac{1}{2}|-64 - 60 - 12| = 68 \text{ sq units}$$

Using mid-point formula:

Co-ordinates of D, E and F respectively are:

$$\left(\frac{6+2}{2}, \frac{7-9}{2}\right), \left(\frac{-4+2}{2}, \frac{1-9}{2}\right) \text{ and } \left(\frac{-4+6}{2}, \frac{1+7}{2}\right)$$

i.e., (4, −1), (−1, −4) and (1, 4)

Area of ΔDEF = $\frac{1}{2}|4(-4-4) - 1(4+1) + 1(-1+4)|$

$= \frac{1}{2}|-32 - 5 + 3|$ = 17 sq units

Now, $\frac{1}{4}$ ar (ΔABC) = $\frac{1}{4}$ (68) = 17 = ar(ΔDEF)

22.

CI	50-60	60-70	70-80	80-90	90-100	100-110	Total
f_i	5	3	4	p	2	13	27 + p
x_i	55	65	75	85	95	105	
$f_i x_i$	275	195	300	85p	190	1365	2325+ 85p

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$\Rightarrow 86 = \frac{2325 + 85p}{27 + p}$$

$$\Rightarrow 86p + 2322 = 2325 + 85p$$

$$\Rightarrow p = 3$$

Section D

23. Let a and d respectively be the first term and the common difference of the A.P. respectively.

According to the given conditions,

a + (m – 1)d = n ….(i)

a + (n – 1)d = m ….(ii)

On solving (i) and (ii), we get,

d = –1; a = m + n – 1

Therefore, r^{th} term = a + (r – 1)d = (m + n – 1) –(r – 1) = m + n – r

24. Steps of construction:-

(1) Draw a line segment AB of length 4.6 cm.

(2) At A draw an angle BAY of 60°.

(3) With centre B and radius 5.1 cm, draw an arc which intersects line AY at point C.

(4) Join BC.

(5) At A draw an acute angle BAX of any measure.

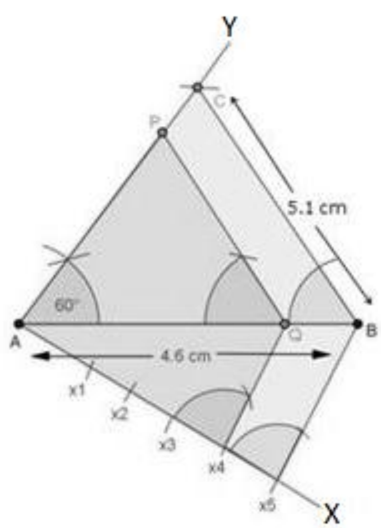
(6) Starting from A, cut 5 equal parts on AX.

(7) Join X_5B

(8) Through X_4, Draw $X_4Q \parallel X_5B$

(9) Through Q, Draw $QP \parallel BC$

$\therefore \Delta PAQ \sim \Delta CAB$



25. Let the number of students be x.

Total budget for food = Rs. 240

Cost of food for each student = Rs. $\frac{240}{x}$

But 4 students failed to go.

Then, number of students who went for picnic = (x – 4)

New cost of food for each student = $\frac{240}{x-4}$

According to the question, we have

$$\frac{240}{x-4}-\frac{240}{x}=5$$

$$\Rightarrow 240\left[\frac{x-x+4}{(x-4)x}\right]=5$$

$\Rightarrow$ 240(4) = 5x(x – 4)

$\Rightarrow$ 48(4) = $x^2 - 4x$

$\Rightarrow x^2 - 4x - 192 = 0$

$\Rightarrow$ (x – 16)(x + 12) = 0

$\Rightarrow$ x = 16 or x = –12

Since, x cannot be negative, x = 16.

Thus the number of students who went for the picnic = x – 4 = 16 – 4 = 12.

26. Length of the cylinder = 24 cm

Diameter of copper wire = 4 mm = 0.4 cm

Therefore, the number of rounds of wire to cover the length of cylinder

$= \frac{\text{Length of cylinder}}{\text{Thickness of wire}}$

$= \frac{24 \text{ cm}}{0.4 \text{ cm}}$

$= 60$

Now, diameter of cylinder = 20 cm

Therefore, length of wire in completing one round = circumference of base of the cylinder = $\pi d = \frac{22}{7} \times 20 = \frac{440}{7} \text{cm}$

Length of wire for covering the whole surface of cylinder

= length of wire in completing 60 rounds

$= 60 \times \frac{440}{7} = 3771.428 \text{ cm}$

Radius of copper wire = $\frac{0.4}{2} \text{cm} = 0.2 \text{ cm}$

Therefore, volume of wire = $\pi r^2 h$ = $\frac{22}{7} \times (0.2)^2 \times 3771.428$ = 474.122 cm^3

Weight of wire = volume × density

= 474.122 × 8.68 gm

= 4115.38 gm

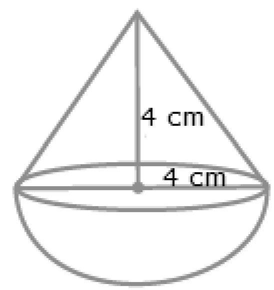
= 4.11538 kg

$\approx$ 4.12 kg

27. Radius of the hemisphere = r = 4 cm = Radius of cone, Height of cone = h = 4 cm

Volume of toy = Volume of hemisphere + Volume of the cone

$$=\frac{2}{3}\pi r^3+\frac{1}{3}\pi r^2 h$$
$$=\frac{1}{3}\pi r^2(2r+h)$$
$$=\frac{1}{3}\times\frac{22}{7}\times 4\times 4(2\times 4+4)$$
$$=\frac{1}{3}\times\frac{22}{7}\times 4\times 4\times 12$$
$$=\frac{1408}{7}\text{ cm}^3$$
$$=201.14\text{ cm}^3$$



It is given that a cube circumscribes the given toy.

$\Rightarrow$ Edge of the cube $= 8$ cm

$\Rightarrow$ Volume of the cube $=(8)^3=512\text{ cm}^3$

Difference in the volumes of the cube and the toy $=512-201.14=310.86\text{ cm}^3$

Total surface area of the toy $=$ CSA of cone $+$ CSA of hemisphere

$$=\pi rl+2\pi r^2$$
$$=\pi r(l+2r)$$

Now, $l=\sqrt{h^2+r^2}=\sqrt{4^2+4^2}=\sqrt{32}=4\sqrt{2}$ cm

$\therefore$ Total surface area of the toy $=\frac{22}{7}\times 4\left(4\sqrt{2}+2\times 4\right)=\frac{22}{7}\times 16\left(1.414+2\right)=171.68\text{ cm}^2$

28. Radius of the quadrant = AB = AC = 14 cm

In right-angled ΔABC, by Pythagoras theorem,

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

$\Rightarrow BC^2 = 14^2 + 14^2 = 2 \times 14^2$

$\Rightarrow BC = 14\sqrt{2}$ cm

Now, Area of shaded region

= Area of semicircle with diameter BC – (Area of quadrant of radius AC + Area (ΔABC)

$$=\frac{1}{2}\times\frac{22}{7}\times\left(\frac{14\sqrt{2}}{2}\right)^2-\frac{1}{4}\times\frac{22}{7}\times 14\times 14+\frac{1}{2}\times 14\times 14$$

= (154 – 154 + 98) cm²

= 98 cm²

29. $x - y = 1 \Rightarrow y = x - 1$

Following table shows some points on the line x - y = 1.

x	0	1
y	−1	0

Plotting points A(0, −1), B(1, 0) on the graph paper and drawing a line passing through them, we obtain the graph of the line represented by the equation $x - y = 1$.

Now consider the second equation.

$2x + y = 8 \Rightarrow y = 8 - 2x$

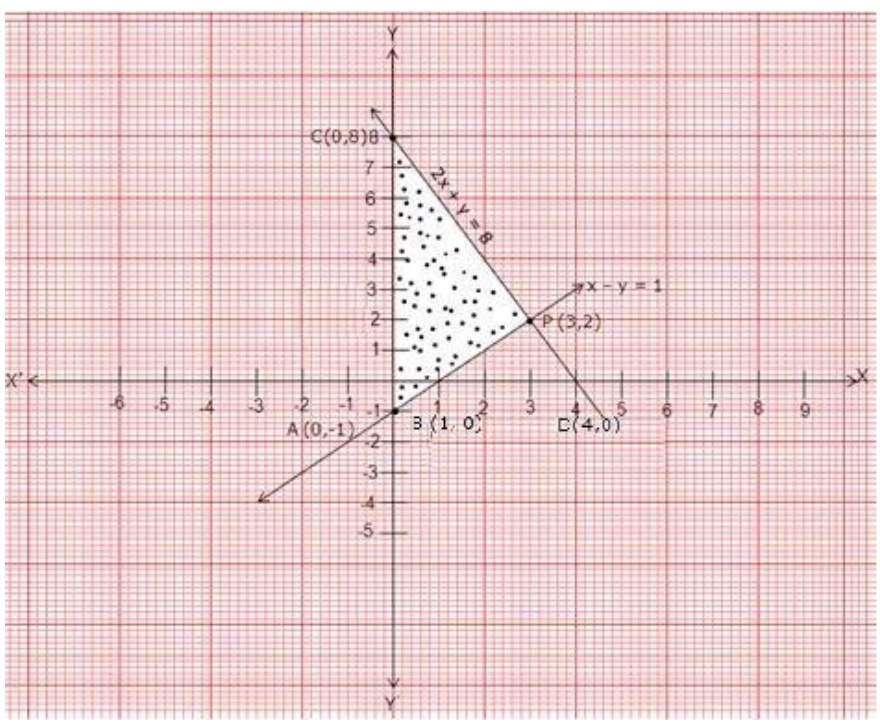
Following table shows some points on the line 2x + y = 8.

x	0	4
y	8	0

Plotting points C(0, 8) and D(4, 0) on the same graph paper and drawing a line passing through them, we obtain the graph of the line represented by the equation $2x + y = 8$.

Clearly, the two lines intersect at the point P(3, 2).

The area bounded by these 2 lines and y-axis is shaded in the graph.



30. More than Method:

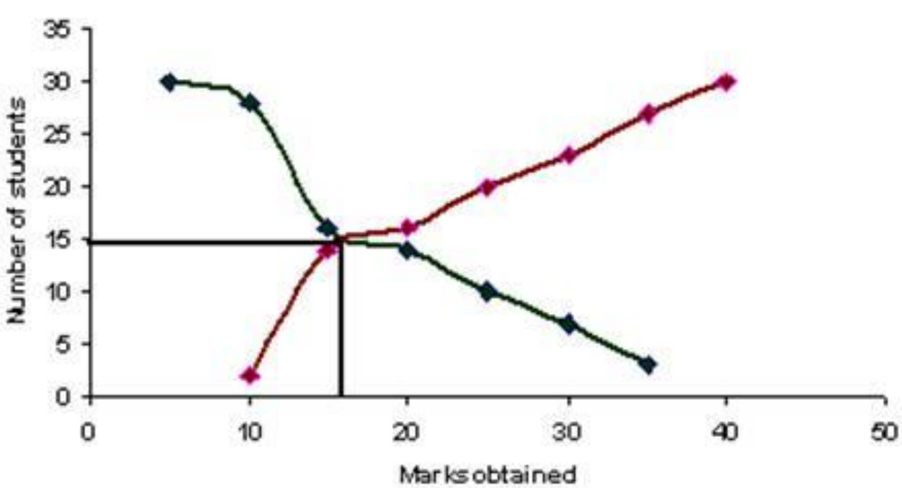
Marks obtained	Number of students
More than or equal to 5	30
More than or equal to 10	28
More than or equal to 15	16
More than or equal to 20	14
More than or equal to 25	10
More than or equal to 30	7
More than or equal to 35	3

Thus, we plot the points (5, 30), (10, 28), (15, 16), (20, 14), (25, 10), (30, 7), (35, 3).

Less than Method:

Marks obtained	No. of students (Frequency)	Marks less than	Cumulative Frequency
5 – 10	30 – 28 = 2	10	2
10 – 15	28 – 16 = 12	15	14
15 – 20	16 – 14 = 2	20	16
20 – 25	14 – 10 = 4	25	20
25 – 30	10 – 7 = 3	30	23
30 – 35	7 – 3 = 4	35	27
35 – 40	3 – 0 = 3	40	30

We plot points (10, 2) (15, 14) (20, 16) (25, 20) (30, 23) (35, 27) (40, 30) to get 'less than' curve.



Median = 17. 5 (x-coordinate of intersection of both curves)