

**Meghalaya Board
Class X
Mathematics
Sample Paper – 1 Solution**

Time: 3 hrs

Total Marks: 80

Section A

1. Correct answer: iv

In the word 'PROBABILITY', there are 11 letters out of which 4 are vowels (O, A, I, I).

$$P(\text{getting a vowel}) = \frac{4}{11}$$

2. Correct answer: ii

Let AB be the height h of the pole.

Length of the shadow = BC = $\sqrt{3}h$

If θ denotes the angle of elevation of the sun, then $\tan\theta =$

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

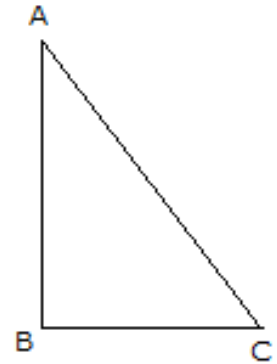
$\Rightarrow \theta = 30^\circ$ Correct answer: C

$$\angle A = \angle R = 80^\circ$$

$$\angle B = \angle Q = 60^\circ$$

Therefore, using the angle sum property, we have:

$$\angle P = 180^\circ - (80^\circ + 60^\circ) = 40^\circ$$



3. Correct answer: iii

$$\angle A = \angle R = 80^\circ$$

$$\angle B = \angle Q = 60^\circ$$

Therefore, using the angle sum property, we have:

$$\angle P = 180^\circ - (80^\circ + 60^\circ) = 40^\circ$$

4. Correct answer: i

It is given that $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$.

$$\therefore \left(\frac{1}{2}\right)^2 + kx \left(\frac{1}{2}\right) - \frac{5}{4} = 0$$

$$1 + 2k - 5 = 0 \text{ or } k = 2$$

Putting the value of k in the given equation we get,

$$4x^2 + 8x - 5 = 0$$

$$\Rightarrow (2x + 5)(2x - 1) = 0$$

$$\Rightarrow x = \frac{1}{2} \text{ or } -\frac{5}{2}$$

Hence, the other root of the given equation is $-\frac{5}{2}$.

5. Correct answer: i

If the denominator of a rational number is of the form $2^n 5^m$, then it will terminate

After n places if $n > m$ or m places if $m > n$.

Now, $\frac{2^3}{2^2 5} = \frac{2}{5} = \frac{2}{2^0 5}$ will terminate after 1 decimal place.

6. Correct answer: ii

Given, $AR = 4$ cm, $BR = 3$ cm and $AC = 11$ cm

We know that the lengths of the tangents drawn to the circle from an external point are equal.

Therefore, $AR = AQ = 4$ cm, $BR = BP = 3$ cm and

$PC = QC = AC - AQ = 11$ cm $- 4$ cm $= 7$ cm

$BC = BP + PC = 3$ cm $+ 7$ cm $= 10$ cm

7. Correct answer: iii

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

Hence, the required ratio is 3:1.

8. Correct answer: ii

Consider the equation $-x^2 + 3x - 3 = 0$.

Here, $a = -1$, $b = 3$ and $c = -3$

$$\text{Sum of the roots} = -\frac{b}{a} = -\frac{3}{(-1)} = 3$$

9. Correct answer: iv

By distance formula,

$$\text{Required distance} = \sqrt{(8-3)^2 + (-6-4)^2} = \sqrt{25+100} = \sqrt{125} = 5\sqrt{5} \text{ units}$$

10. Correct answer: iii

As $\frac{4}{5}$, a and 2 are in A.P.,

$$\text{Therefore, } a - \frac{4}{5} = 2 - a$$

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

$$a = \frac{14}{5} \times \frac{1}{2}$$

$$\text{Hence, } a = \frac{7}{5}$$

Section B

- 11.** α, β are roots of $x^2 - (k + 6)x + 2(2k - 1)$

$$\alpha + \beta = k + 6, \alpha\beta = 2(2k - 1)$$

$$\text{Now, } \alpha + \beta = \frac{1}{2}\alpha\beta$$

$$\Rightarrow k + 6 = \frac{1}{2} \times 2(2k - 1)$$

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

$$\Rightarrow k = 7$$

- 12.** $870 = 225 \times 3 + 195$

$$225 = 195 \times 1 + 30$$

$$195 = 30 \times 6 + 15$$

$$30 = 15 \times 2 + 0$$

$$\therefore \text{HCF}(870, 225) = 15$$

- 13.** It is known that radius is \perp to the tangent at the point of contact.

Therefore, $m\angle OAT = 90^\circ$.

In $\triangle OAT$,

$$\frac{AT}{OT} = \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\Rightarrow AT = \frac{\sqrt{3}}{2} (OT) = \frac{\sqrt{3}}{2} (4) = 2\sqrt{3} \text{ cm}$$

- 14.** There are 10 ribs in an umbrella.

The area between two consecutive ribs subtends an angle of $\frac{360^\circ}{10} = 36^\circ$ at the centre of the assumed flat circle.

$$\text{Area between two consecutive ribs of circle} = \frac{36^\circ}{360^\circ} \times \pi r^2$$

$$= \frac{36^\circ}{360^\circ} \times \frac{22}{7} \times (40)^2$$

$$= \frac{1}{10} \times \frac{22}{7} \times 40 \times 40 = 502.86 \text{ cm}^2$$

- 15.** Let AB be the tower and BC be distance between tower and car. Let θ be the angle of depression of the car.

In $\triangle ABC$,

$$\tan \theta = \frac{BC}{AB} \Rightarrow \tan 30^\circ = \frac{BC}{AB} \Rightarrow \frac{1}{\sqrt{3}} = \frac{BC}{150}$$

$$\therefore BC = \frac{150}{\sqrt{3}} = \frac{150\sqrt{3}}{3} = 50\sqrt{3}$$

Hence, distance between the tower and car is $50\sqrt{3}$.

16.
$$\begin{aligned} \text{LHS} &= \sqrt{\frac{\sec\theta-1}{\sec\theta+1}} + \sqrt{\frac{\sec\theta+1}{\sec\theta-1}} \\ &= \frac{(\sqrt{\sec\theta-1})^2 + (\sqrt{\sec\theta+1})^2}{(\sqrt{\sec\theta+1})(\sqrt{\sec\theta-1})} \\ &= \frac{\sec\theta-1 + \sec\theta+1}{\sqrt{\sec^2\theta-1}} \\ &= \frac{2\sec\theta}{\sqrt{\tan^2\theta}} \\ &= \frac{2\sec\theta}{\tan\theta} = 2 \times \frac{1}{\cos\theta} \times \frac{\cos\theta}{\sin\theta} = 2\operatorname{cosec}\theta = \text{RHS} \end{aligned}$$

Hence, LHS = RHS.

Or

$$\begin{aligned} &\frac{5\sin^2 30^\circ + \cos^2 45^\circ - 4\tan^2 30^\circ}{2\sin 30^\circ \cos^2 30^\circ + \tan 45^\circ} \\ &= \frac{5\left(\frac{1}{2}\right)^2 + \left(\frac{1}{\sqrt{2}}\right)^2 - 4\left(\frac{1}{\sqrt{3}}\right)^2}{2 \times \frac{1}{2} \times \frac{\sqrt{3}}{2} + 1} \\ &= \frac{5\left(\frac{1}{4}\right) + \left(\frac{1}{2}\right) - 4\left(\frac{1}{3}\right)}{\frac{\sqrt{3}}{2} + 1} \\ &= \frac{5}{6(2+\sqrt{3})} \end{aligned}$$

Section C

- 17.** The co-ordinates of the mid-point of AB is given by

$$\left(\frac{0+6}{2}, \frac{-1+7}{2}\right) = 3, 3$$

The co-ordinates of the mid-point of CD are given by

$$\left(\frac{-2+8}{2}, \frac{3+3}{2}\right) = 3, 3$$

∴ Diagonals AB and CD bisect each other at the point M (3, 3).

By distance formula:

$$AD^2 = (8 - 0)^2 + (3 + 1)^2 = 64 + 16 = 80$$

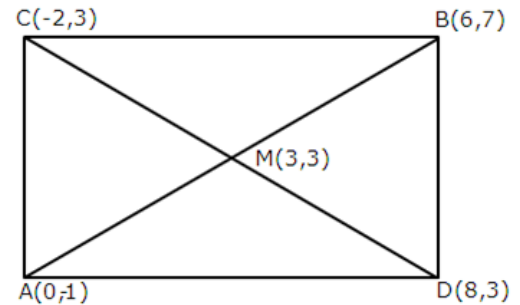
$$DB^2 = (6 - 8)^2 + (7 - 3)^2 = 4 + 16 = 20$$

$$\text{Also, } AB^2 = (6 - 0)^2 + (7 + 1)^2 = 36 + 64 = 100$$

$$\text{Clearly } AD^2 + DB^2 = AB^2$$

Hence the park is rectangular. Its area

$$= AD \times DB = \sqrt{80} \times \sqrt{20} = \sqrt{1600} = 40 \text{ sq.km}$$



- 18.** Discriminant = $b^2 - 4ac = 49 - 4 \times 6 \times 2 = 1 > 0$

So, the given equation has two distinct real roots.

$$\text{Now, } 6x^2 - 7x + 2 = 0$$

$$\Rightarrow 36x^2 - 42x + 12 = 0$$

$$\Rightarrow \left(6x - \frac{7}{2}\right)^2 + 12 - \left(\frac{7}{2}\right)^2 = 0$$

$$\Rightarrow \left(6x - \frac{7}{2}\right)^2 - \left(\frac{1}{2}\right)^2 = 0$$

$$\Rightarrow \left(6x - \frac{7}{2}\right)^2 = \left(\frac{1}{2}\right)^2$$

$$\text{The roots are given by } 6x - \frac{7}{2} = \pm \frac{1}{2}$$

$$\Rightarrow 6x = 4, 3$$

$$\Rightarrow x = \frac{2}{3}, \frac{1}{2}$$

Or

$$\text{Let } f(x) = 2x^2 - 3x + p$$

If $f(a) = 0$, then it is said that a is a zero of $f(x)$.

Given, 3 is a zero of $f(x)$.

$$\therefore f(3) = 0$$

$$2(3)^2 - 3(3) + p = 0$$

$$18 - 9 + p = 0$$

$$p = -9$$

$$\therefore f(x) = 2x^2 - 3x - 9$$

$$= 2x^2 - 6x + 3x - 9$$

$$= 2x(x - 3) + 3(x - 3)$$

$$= (x - 3)(2x + 3)$$

Thus, the other zero of $f(x)$ is $\frac{-3}{2}$.

- 19.** The system has infinitely many solutions. Therefore,

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

$$\frac{2}{a-b} = \frac{3}{a+b} = \frac{7}{3a+b-2}$$

Equating (1) and (2), we get:

$$2a + 2b = 3a - 3b$$

$$\text{or, } a = 5b \quad \dots (4)$$

Equating (2) and (3), we get:

$$9a + 3b - 6 = 7a + 7b$$

$$\text{or, } 2a - 4b = 6 \quad \dots (5)$$

On solving equations (4) and (5), we get,

$$10b - 4b = 6 \text{ or } \mathbf{b = 1}$$

Thus, from (4), we get, $\mathbf{a = 5}$

- 20.** To obtain minimum number of rooms, we need to accommodate maximum number of participants.

In each room we have to have same number of participants in the same subject.

$$60 = 2^2 \times 3 \times 5$$

$$84 = 2^2 \times 3 \times 7$$

$$108 = 2^2 \times 3^3$$

$$\text{HCF}(60, 84, 108) = 2^2 \times 3 = 12$$

So, in each room 12 participants can be seated.

Number of rooms required

$$= \frac{\text{Total number of participants}}{12}$$

$$= \frac{60 + 84 + 108}{12} = 21$$

- 21.** Assume the fixed charge = Rs. x
and the subsequent charge = Rs. y
According to the question, we have,
 $x + 4y = 27$... (i)
and $x + 2y = 21$... (ii)
Subtracting (ii) from (i), we have,
 $2y = 6$ or $y = 3$
So, from (i),
 $x = 27 - 12 = 15$
Thus, the fixed charge is Rs. 15 and the charge for each extra day is Rs. 3.

- 22.** Let the required point $P = (x, 0)$

and the required ratio = $k : 1$

Here $m_1 = k$ and $m_2 = 1$

$x_1 = 3, x_2 = -2, y_1 = -3$ and $y_2 = 7$

By the Section formula,

$$(x, 0) = \left[\frac{k(-2) + 1(3)}{k + 1}, \frac{k(7) + 1(-3)}{k + 1} \right]$$

$$\Rightarrow (x, 0) = \left[\frac{-2k + 3}{k + 1}, \frac{7k - 3}{k + 1} \right]$$

$$\text{So, } x = \frac{-2k + 3}{k + 1} \text{ and } 0 = \frac{7k - 3}{k + 1}$$

$$\text{From (2), } 7k - 3 = 0 \Rightarrow k = \frac{3}{7}$$

Substituting in $x = \frac{-2k + 3}{k + 1}$, we get

$$x = \frac{-2\left(\frac{3}{7}\right) + 3}{\frac{3}{7} + 1} \Rightarrow x = 1.5$$

$$\text{Ratio}(k : 1) = \frac{3}{7} : 1 = 3 : 7$$

Point of division on x-axis = $(1.5, 0)$

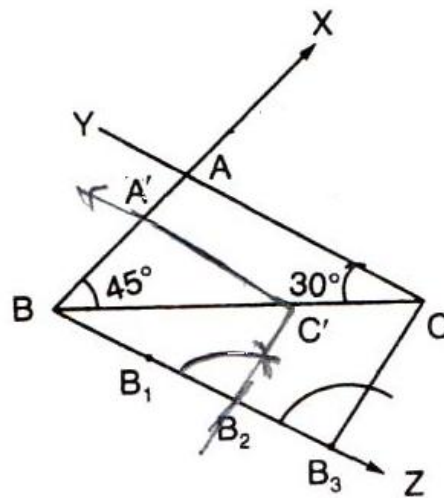
Section D

- 23.** It is given that $\angle A = 105^\circ$, $\angle C = 30^\circ$.
Using angle sum property of triangle, we get, $\angle B = 45^\circ$

The steps of construction are as follows:

1. Draw a line segment $BC = 6$ cm.
2. At B, draw a ray making an angle of 45° with BC.
3. At C, draw a ray making an angle of 30° with BC. Let the two rays meet at point A.
4. Below BC, make an acute angle $\angle CBX$.
5. Along BX mark off three points B_1, B_2, B_3 such that $BB_1 = B_1B_2 = B_2B_3$.
6. Join B_3C .
7. From B_2 , draw $B_2C' \parallel B_3C$.
8. From C' , draw $C'A' \parallel CA$, meeting BA at the point A' .

Then $A'BC'$ is the required triangle.



Or

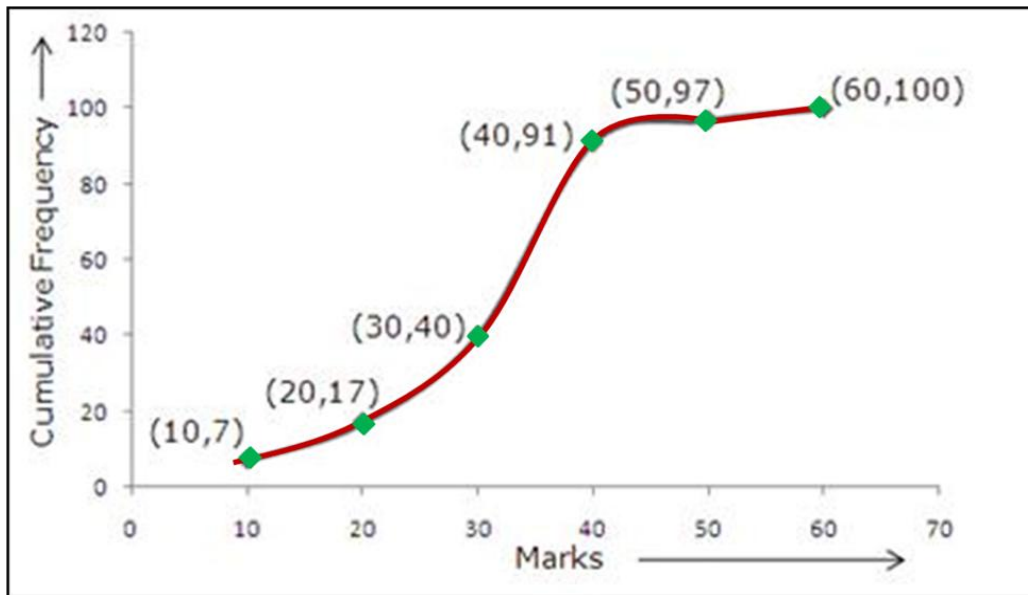
We first prepare the cumulative frequency distribution table as given below:

Marks	No. of students	Marks less than	Cumulative frequency
0-10	7	10	7
10-20	10	20	17

20-30	23	30	40
30-40	51	40	91
40-50	6	50	97
50-60	3	60	100

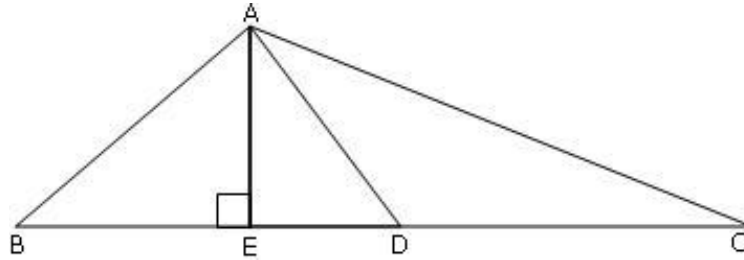
Now, we mark the upper class limits along x-axis by taking a suitable scale and the cumulative frequencies along the y-axis by taking a suitable scale. Thus, we plot the points (10,7), (20,17), (30,40), (40,91), (50,97) and (60,100).

Join the plotted points by a free hand to obtain the required ogive.



- 24.** Here, $a = 52^\circ$ and $d = 8^\circ$
 Let the polygon have n sides. Then, the sum of interior angles of the polygon is
 $(n - 2)180^\circ$
 $\Rightarrow S_n = (n - 2)180$
 $\Rightarrow \frac{n}{2} [2a + (n - 1)d] = (n - 2)180$
 $\Rightarrow \frac{n}{2} [104 + (n-1)8] = (n - 2)180$
 $\Rightarrow \frac{n}{2} [8n + 96] = (n - 2)180$
 $\Rightarrow 8n^2 + 96n = 360n - 720$
 $\Rightarrow 8n^2 - 264n + 720 = 0$
 $\Rightarrow n^2 - 33n + 90 = 0$
 $\Rightarrow (n - 30)(n - 3) = 0$
 $\Rightarrow n = 3, 30$
 Hence, the number of sides of the polygon can be either 3 or 30.

- 25.** AD is the median of triangle ABC since D is the mid-point of BC.



$$\Rightarrow BD = DC = \frac{BC}{2} \dots (i)$$

In right $\triangle AEB$,

$$AB^2 = AE^2 + BE^2 \text{ (Pythagoras theorem)}$$

$$AB^2 = (AD^2 - DE^2) + (BD - DE)^2$$

Using the Pythagoras theorem in right triangle AED
and $BE = BD - DE$, we get

$$AB^2 = AD^2 - DE^2 + \left(\frac{BC}{2} - DE \right)^2 \dots (\text{From (i)})$$

$$AB^2 = AD^2 - DE^2 + \frac{BC^2}{4} + DE^2 - 2 \left(\frac{BC \times DE}{2} \right)$$

$$AB^2 = AD^2 - BC \times DE + \frac{BC^2}{4}$$

Hence proved.

- 26.** To solve the equations, make the table corresponding to each equation.

$$2x - y + 6 = 0$$

$$y = 2x + 6$$

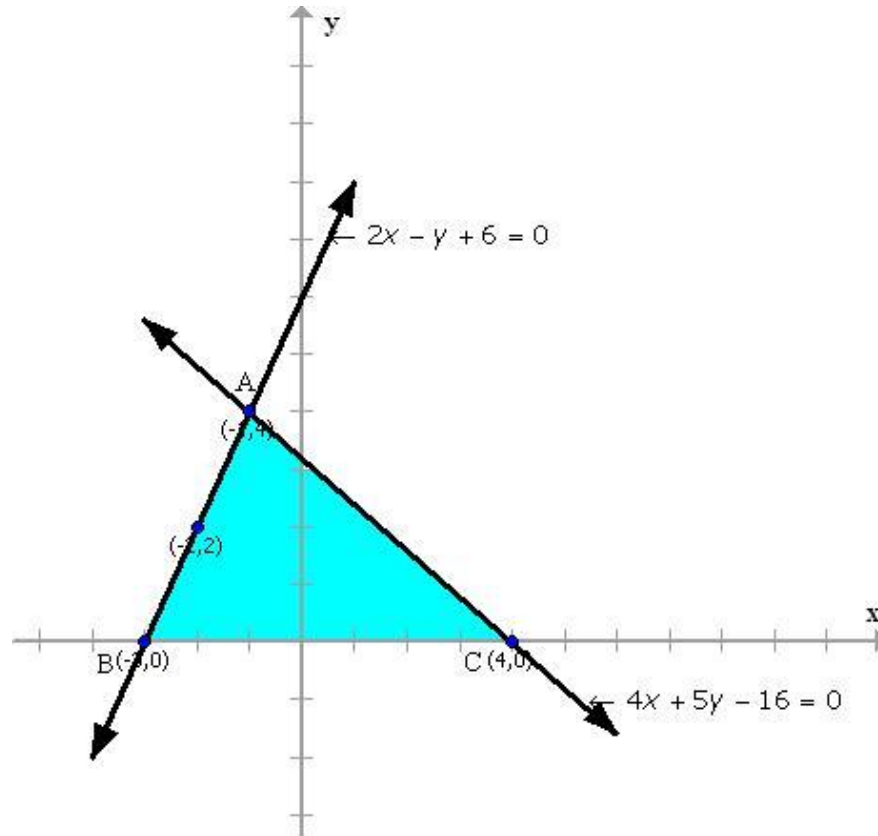
x	-	-	-
y	4	2	0

$$4x + 5y - 16 = 0$$

$$y = \frac{16 - 4x}{5}$$

x	4	-1
y	0	4

Now plot the points and draw the graph.



Because the lines intersect at the point $(-1, 4)$, $x = -1$ and $y = 4$ is the solution. Also, by observation, vertices of triangle formed by lines and x-axis are $A(-1, 4)$, $B(-3, 0)$ and $C(4, 0)$.

Section E

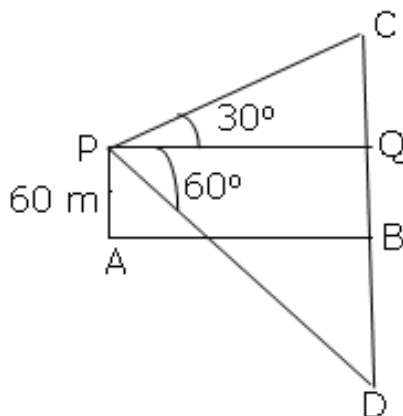
- 27.** Let C be the cloud and D be its reflection. Let the height of the cloud be H metres.

$$BC = BD = H$$

$BQ = AP = 60$ m. Therefore $CQ = H - 60$ and $DQ = H + 60$

In $\triangle CQP$,

$$\frac{PQ}{CQ} = \cot 30^\circ$$



$$\Rightarrow \frac{PQ}{H-60} = \sqrt{3} \Rightarrow PQ = (H - 60)\sqrt{3} \text{ m} \dots\dots\dots(i)$$

In ΔDQP ,

$$\frac{PQ}{DQ} = \cot 60^\circ$$

$$\Rightarrow \frac{PQ}{H+60} = \frac{1}{\sqrt{3}} \Rightarrow PQ = \frac{(H+60)}{\sqrt{3}} \dots\dots\dots(ii)$$

From (i) and (ii),

$$(H-60)\sqrt{3} = \frac{(H+60)}{\sqrt{3}}$$

$$\Rightarrow 3H - 180 = H + 60 \Rightarrow H = 120$$

Thus, the height of the cloud is 120 m.

28. Diameter of graphite = 1mm = 0.1cm

$$\text{Therefore, radius of graphite} = \frac{0.1}{2} = 0.05 \text{ cm}$$

Length of pencil = 10 cm

$$\text{Volume of graphite} = \pi r^2 h = \frac{22}{7} \times (.05)^2 \times 10 = 0.0785 \text{ cm}^3$$

Therefore, weight of graphite = volume \times density

$$= 0.0785 \times 2.3$$

$$= 0.180 \text{ gm}$$

Diameter of the pencil = 0.7 cm

Therefore, radius of the pencil = 0.35 cm

$$\text{Therefore, volume of the pencil} = \pi R^2 h = \frac{22}{7} \times (0.35)^2 \times 10$$

Therefore, volume of wood = Volume of pencil – Volume of graphite

$$\text{Therefore, Volume of wood} = \pi R^2 h - \pi r^2 h$$

$$= \pi h (R^2 - r^2)$$

$$= \frac{22}{7} \times 10 [(0.35)^2 - (0.05)^2]$$

$$= 3.771 \text{ cm}^3$$

Weight of wood = Volume \times density

$$= 3.771 \times .6$$

$$= 2.2626 \text{ gm}$$

Or

Let the radius of inner circle be r cm. Then, its circumference = $(2\pi r)$ cm

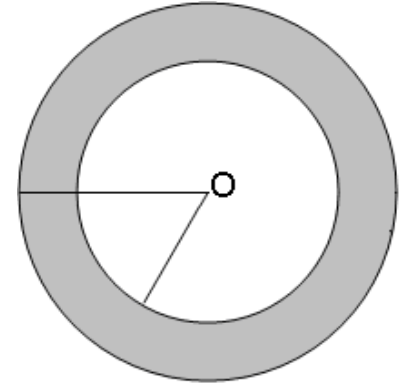
$$\therefore 2\pi r = 88 \Rightarrow 2 \times \frac{22}{7} \times r = 88$$

$$\therefore r = \frac{88 \times 7}{44} = 14 \text{ cm}$$

So, radius of the inner circle, i.e., $r_1 = 14$ cm

Let r_2 be the radius of the outer circle.

$$\begin{aligned} \therefore \text{Area of the ring} &= \pi r_2^2 - \pi r_1^2 = \pi(r_2^2 - r_1^2) \text{ cm}^2 \\ &= \frac{22}{7}(r_2^2 - 14^2) \text{ cm}^2 = \frac{22}{7}(r_2^2 - 196) \text{ cm}^2 \end{aligned}$$



By the given condition,

$$\frac{22}{7} r_2^2 - \frac{22}{7} \times 196 = 346.5$$

$$\Rightarrow \frac{22}{7} r_2^2 - 616 = 346.5 \Rightarrow \frac{22}{7} r_2^2 = 616 + 346.5 = 962.5$$

$$\Rightarrow r_2^2 = \frac{962.5 \times 7}{22} = 306.25 \Rightarrow r_2 = \sqrt{306.25} = 17.5 \text{ cm}$$

Hence, the radius of the outer circle is 17.5 cm.

29.

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

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

Substituting the values,

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

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

$$\Rightarrow p = 3$$

30. Given, $XY \parallel QR$

By using the Basic Proportionality Theorem,

$$\begin{aligned} \frac{PX}{XQ} &= \frac{PY}{YR} \\ \Rightarrow \frac{PX}{XQ} + 1 &= \frac{PY}{YR} + 1 \\ \Rightarrow \frac{PX+XQ}{XQ} &= \frac{PY+YR}{YR} \\ \Rightarrow \frac{PQ}{XQ} &= \frac{PR}{YR} \\ \Rightarrow \frac{7}{3} &= \frac{6.3}{YR} \\ \Rightarrow YR &= \frac{6.3 \times 3}{7} = 2.7 \text{ c.m} \end{aligned}$$

Or

Let ABCD be a square of side a.

Therefore, its diagonal $= \sqrt{2}a$

Two desired equilateral triangles are formed as $\triangle ABE$ and $\triangle DBF$

Length of one side of $\triangle ABE = a$

Length of one side of $\triangle DBF = \sqrt{2}a$

We know that equilateral triangles have all angles as 60° . So, all equilateral triangles are similar to each other.

So, the ratio between areas of these triangles will be equal to the square of the ratio of their corresponding sides of these triangles.

$$\therefore \frac{\text{area of } \triangle ABE}{\text{area of } \triangle DBF} = \left(\frac{a}{\sqrt{2}a} \right)^2 = \frac{1}{2}$$

Hence, proved.