Sample Question Paper - 9
Mathematics-Basic (241)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

General Instructions:

1. The question paper consists of 14 questions divided into 3 sections A, B, C.
2. Section A comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
3. Section B comprises of 4 questions of 3 marks each. Internal choice has been provided in one question.
4. Section C comprises of 4 questions of 4 marks each. An internal choice has been provided in one question. It contains two case study-based questions.

Section A

1. Solve the quadratic equation by factorization: **[2]**

$x^2 - (1 + \sqrt{2})x + \sqrt{2} = 0$

OR

Represent the situation in the form of the quadratic equation: The area of a rectangular plot is 528 m^2. The length of the plot (in metres) is one more than twice its breadth. Formulate the quadratic equation to determine the length and breadth of the plot.

2. A 5m wide cloth is used to make a conical tent of base diameter 14 m and height 24 m. Find the cost of cloth used at the rate of ₹ 25 per metre. **[2]**

3. The daily wages (in rupees) of 100 workers in a factory are given below: **[2]**

Daily wages(in Rs)	**Number of workers**
125	6
130	20
135	24
140	28
145	15
150	4
160	2
180	1

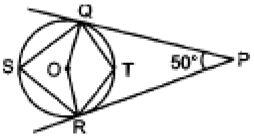
Find the median wage of a worker for the above data.

4. Find the sum of all odd numbers between 100 and 300. **[2]**

5. Find the missing value of p for the following distribution whose mean is 12.58. **[2]**

x	5	8	10	12	p	20	25
f	2	5	8	22	7	4	2

6. In the given figure, find ∠QSR. **[2]**



OR

Prove that the tangents at the end of a chord of a circle make equal angles with the chord.

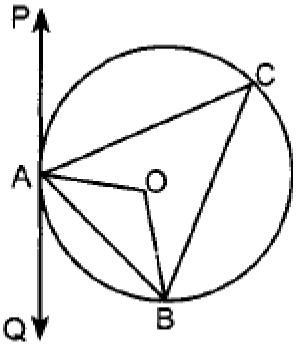
Section B

7. Find the 20^{th} term of an A.P. whose 3^{rd} term is 7 and the seventh term exceeds three times the 3^{rd} term by 2. Also, find its nth term (a_n). **[3]**

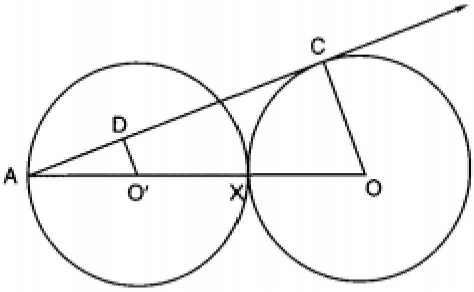
8. From the top of a building AB, 60m high, the angles of depression of the top and bottom of a vertical lamp-post CD are observed to be 30° and 60° respectively. Find the difference between the heights of the building and the lamp-post. **[3]**

OR

PAQ is a tangent to the circle with centre O at a point A as shown in figure. If ∠OBA = 35°, find the value of ∠BAQ and ∠ACB.



9. Equal circles with centres O and O' touch each other at X as shown in figure. OO' produced to meet a circle with centre O', at A. AC is a tangent to the circle whose centre is O. O' D is perpendicular to AC. Find the value of $\frac{DO'}{CO}$. **[3]**



10. Solve: $x^2 + 5x - (a^2 + a - 6) = 0$ **[3]**

Section C

11. Draw a circle of radius 2.5 cm and take a point P outside it, Without using the centre of the circle, draw two tangents to the circle from the point P. **[4]**

OR

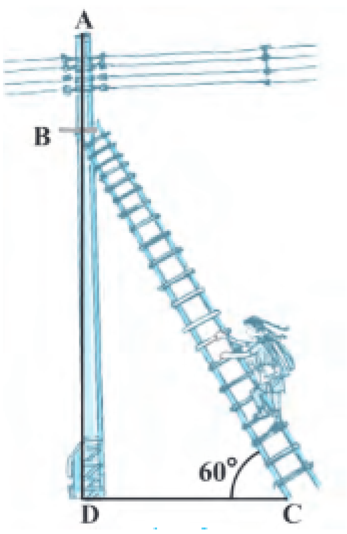
Draw a line segment PQ = 8.4 cm. Using ruler and compass only, find the point R on PQ such that

$PR = \frac{3}{4}RQ.$

12. The following is the cummulative frequency distribution (of less than type) of 1000 persons each of age 20 years and above. Determine the mean age. **[4]**

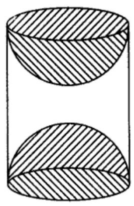
Age below (in years)	30	40	50	60	70	80
Number of persons	100	220	350	750	950	1000

13. Basant Pandey noticed that one of the street lights in front of his society gate was not working. He called BSES customer care and registered the complaint. The electricity department of BSES sent an electrician to check the fault. The electrician has to repair an electric fault on the pole of height 5 m. He needs to reach a point 1.3m below the top of the pole to undertake the repair work (see fig.). **[4]**



i. What should be the length of the ladder that she should use which, when inclined at an angle of 60° to the horizontal, would enable her to reach the required position?
ii. Also, how far from the foot of the pole should she place the foot of the ladder? (You may take $\sqrt{3} = 1.73$)

14. A carpenter used to make different kinds and different shapes of a toy of wooden material. One day a man came to his shop to purchase an article that has values as per his requirement. He instructed the carpenter to make the toy by taking a wooden block of rectangular shape with height 12 cm and width 9 cm, then shaping this block as a solid cylinder and then scooping out a hemisphere from each end, as shown in the given figure. The difference between the length of rectangle and height of the cylinder is 2 cm (Rectangle length > Cylinder height), and the difference between the breadth of rectangle and the base of cylinder is also 2 cm (Rectangle breadth > Cylinder base(diameter)). **[4]**



By using the above information, answer the following question:

i. Find the volume of the cylindrical block before the carpenter started scooping the hemisphere from it.
ii. Find the total surface area of the article.

Solution

MATHEMATICS BASIC 241

Class 10 - Mathematics

Section A

1. Given that,

   $x^2 - (1 + \sqrt{2})x + \sqrt{2} = 0$

   $\Rightarrow x^2 - x - \sqrt{2}x + \sqrt{2} = 0$

   Factorise the equation, we get

   $\Rightarrow x(x - 1) - \sqrt{2}(x - 1) = 0$

   $\Rightarrow (x - 1)(x - \sqrt{2}) = 0$

   $\Rightarrow x - 1 = 0$ or $x - \sqrt{2} = 0$

   Therefore, $x = 1$ or $x = \sqrt{2}$

   OR

   Let the breadth of the plot be 'x' m

   $\therefore$ Length = (2x + 1) m

   Now, Area of the plot = 528 m^2

   $\Rightarrow L \times B = 528\ m^2$

   $\Rightarrow (2x+1) \times x = 528 \Rightarrow 2x^2 + x - 528 = 0$

   This is the required quadratic equation.

2. Given: Radius of base (*r*) and height (*h*) of the conical tank are 7 m and 24 m

   $\Rightarrow$ Slant height (l) = $r^2 + h^2$

   $= \sqrt{r^2 + h^2} = \sqrt{7^2 + 24^2}$

   $= \sqrt{625} = 25\text{m}$

   C.S.A. $= \pi r l$

   $= \frac{22}{7} \times 7 \times 25 = 550\text{m}^2$

   Let x m of cloth is required

   CSA of tent = area of cloth.

   or, $5x = 550$ or, $x = \frac{550}{5} = 110\text{m}$

   $\therefore$ 110 m of cloth is required.

   Cost of cloth $= 25 \times 110 = Rs. 2750$

3.

Daily wages(in Rs)	Number of workers	Cumulative Frequency
125	6	6
130	20	26
135	24	50
140	28	78
145	15	93
150	4	97
160	2	99
180	1	100
	Total = 100	

n = 100

Median is the mean of $\left(\frac{100}{2}\right)$th and $\left(\frac{100+2}{2}\right)$th observations, i.e, 50th and 51th Observations.

Median = $\frac{135+140}{2}$ = 137.5

Median wage of a worker in the factory is Rs 137.50

4. Odd numbers between 100 and 300 are 101, 103, ... 299

First term (a) = 101

Common difference (d) = 103 - 101 = 2

Last term (a_n) = 299

$\Rightarrow$ a + (n - 1)d = 299

$\Rightarrow$ 101 + (n - 1) $\times$ 2 = 299

$\Rightarrow$ 101 + 2n - 2 = 299

$\Rightarrow$ 2n = 299 + 2 - 101

$\Rightarrow$ 2n = 200

$\Rightarrow n = \frac{200}{2}$ = 100

$\therefore$ Sum of 100 terms $= \frac{n}{2}[a + a_n]$

$= \frac{100}{2}[101 + 299]$

= 50 $\times$ 400

= 20,000

5.

x_i	f_i	$f_i x_i$
5	2	10
8	5	40
10	8	80
12	22	264
p	7	7p
20	4	80
25	2	50
	$\sum f_i = 50$	$\sum f_i x_i = 524 + 7p$

According to the question, mean = 12.58

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

$\frac{524+7p}{50}$ = 12.58

524 + 7p = 629

7p = 105 $\Rightarrow$ P = 15

6. Given: PQ and PR are tangents to a circle with centre O and $\angle$QPR = 50°.

To find: $\angle$QSR

$\angle$QOR + $\angle QPR = 180^\circ$

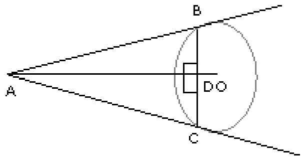
$\Rightarrow \angle QOR + 50^\circ = 180^\circ$

$\Rightarrow \angle QOR = 130^\circ$

$\Rightarrow$ $\angle$QSR = $\frac{1}{2}$ $\angle$QOR

$\Rightarrow$ $\angle$QSR = $\frac{1}{2} \times 130^\circ = 65^\circ$

OR



In $\triangle$ADB and $\triangle$ADC,

BD = DC

And $\angle$ADB = $\angle$ADC = 90^o

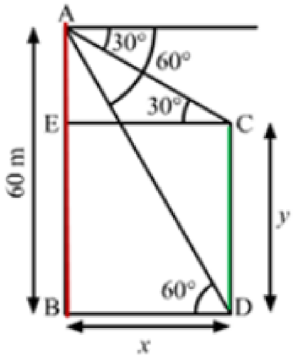
AD = AD [Common]

$\therefore$ $\triangle$ADB $\cong$ $\triangle$ADC [SAS]

$\therefore$ $\angle$ABD = $\angle$ACD [By CPCT]

Section B

7. Let the first term be a and the common difference be d

8. 

Given that AB is a building that is 60m high.

Let BD = CE = x and $BE = y$

$\Rightarrow AE = AB - BE = 60 - y$

In $\triangle$ABD,

$tan\ 60^{\circ} = \frac{AB}{BD}$

$\Rightarrow \sqrt{3} = \frac{60}{x}$

$\Rightarrow x\ = \frac{60}{\sqrt{3}}$ m

In $\triangle$AEC,

$tan\ 30^{\circ} = \frac{AE}{EC} = \frac{60-y}{x}$

$\frac{1}{\sqrt{3}} = \frac{60-y}{60/\sqrt{3}}$

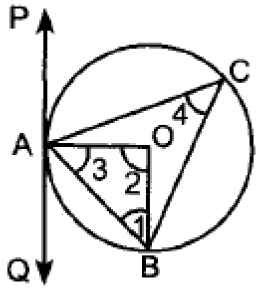
$\Rightarrow y = 40m$

The difference between of the building and the lamp post, AE = 60 - y = 60 - 40 = 20 m

OR

Given:

PAQ is a tangent to the circle with centre O at a point A as shown in figure $\angle OBA = 35^{\circ}$.



$OA = OB$[Radii of the same circle]

$\Rightarrow \angle 3 = 35^{\circ}$ [Angles opposite to equal sides of a triangle are equal]

But, $\angle 1$ + $\angle 2$ + $\angle 3 = 180^{\circ}$

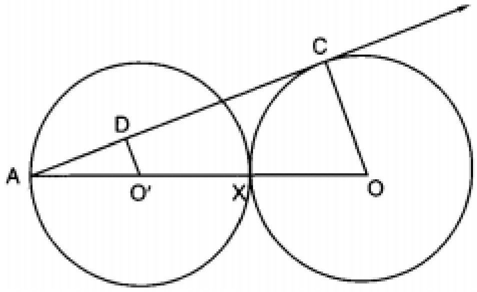
$\Rightarrow 35^{\circ} + 35^{\circ} + \angle 2 = 180^{\circ}$

$\Rightarrow \angle 2 = 180^{\circ} - 70^{\circ} = 110^{\circ}$

$\angle 4 = \frac{1}{2}\angle 2 = \frac{1}{2} \times 110^{\circ} = 55^{\circ}$

$\Rightarrow \angle ACB = 55^{\circ}$ [Degree measure theorem]

$\angle BAQ = \angle ACB = 55^{\circ}$ [Angles in the same segment]

9. 

Two equal circles

$\therefore$ O'X = OX

and O'A = O'X

Now, in ΔAO'D and ΔAOC

$\angle A = \angle A$ [Common]

$\angle ADO' = \angle ACO = 90^\circ$

So, by AA similarly, we have

ΔAO'D ~ ΔAOC

$\therefore \frac{AO}{AO'} = \frac{CO}{DO'}$

$\Rightarrow \frac{AO'+AO'+AO'}{AO'} = \frac{CO}{DO'}$

$\Rightarrow \frac{3AO'}{AO'} = \frac{CO}{DO'}$

$\Rightarrow 3 = \frac{CO}{DO'}$

$\Rightarrow \frac{DO'}{CO} = \frac{1}{3}$

10. Given, $x^2 + 5x - (a^2 + a - 6) = 0$

splitting $a^2 + a - 6$

$\Rightarrow x^2 + 5x - (a^2 + 3a - 2a - 6) = 0$

$\Rightarrow x^2 + 5x - [a(a + 3) - 2 (a + 3)] = 0$

$\Rightarrow x^2 + 5x - (a + 3)(a - 2) = 0$

Now splitting the middle term

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

$\Rightarrow$ x [x + (a + 3)] - (a - 2)[x + (a + 3)] = 0

$\Rightarrow$ [x + (a + 3)] [x - (a - 2)] = 0

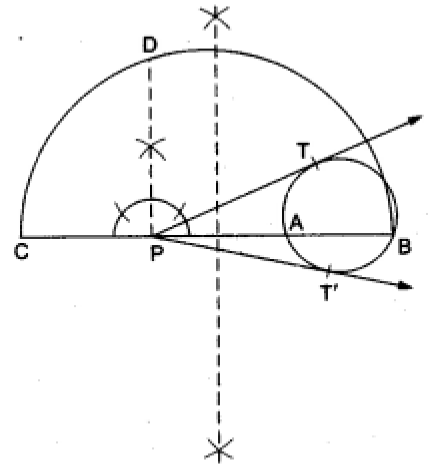
$\Rightarrow$ x + (a + 3) = 0 or x - (a - 2) = 0

Therefore, $x = -(a+3)\ or\ (a-2)$

Section C

11. **STEPS OF CONSTRUCTION**

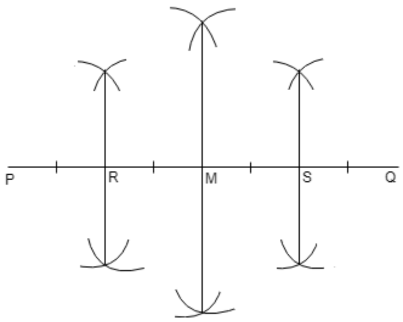
1. Draw a circle of radius 2.5 cm and take a point p outside it.
2. Through P draw a secant PAB to intersect the circle at A and B.



3. Produce AP to a point C such that PA = PC
4. Draw a semicircle with CB as diameter.
5. Draw PD $\perp$ CB, intersecting the semicircle at D.
6. With P as centre and PD as radius, draw arcs to intersect the circle at T and T'.
7. Join PT and PT'.

Then, PT and PT' are the required tangents.

OR



Steps of construction:

1. Draw a line segment PQ=8.4cm.
2. From point P and Q, draw a perpendicular bisector M on PQ such that PM=MQ.
3. Again from point P and M, draw a perpendicular bisector R on PM such that PR=RM.
4. Also, from M and Q, draw a perpendicular bisector S on MQ such that MS=SQ.

Thus, R, M, and S divide the line segment PQ in four equal parts. Hence, PR = $\frac{3}{4}$RQ.

Justification:
Given: PQ = 8.4 cm
Also, PR = $\frac{3}{4}$RQ
Now, we have to mark point R on segment PQ.
Therefore, PQ = PR + RQ
Putting given values of PQ and PR,
8.4 = $\frac{3}{4}$ RQ + RQ
8.4 = $\frac{7}{4}$ RQ
RQ = (8.4 $\times$ 4)/7
RQ = 4.8 cm
So, PR = PQ - RQ
= 8.4 - 4.8
= 3.6 cm
So, mark the point R on segment PQ such that it is 3.6 cm from point P and 4.8 cm from point Q.

12.

Class interval	**Frequency f_i**	**Mid-value X_i**	$u_i = \frac{x_i - A}{h} = \frac{x_i - 45}{10}$	**$f_i u_i$**
20-30	100	25	-2	-200
30-40	120	35	-1	-120
40-50	130	45=A	0	0
50-60	400	55	1	400
60-70	200	65	2	400
70-80	50	75	3	150
	$\Sigma f_i = 1000$			$\sum f_i u_i = 630$

A = 45, h = 10,
$\Sigma f_i = 1000, \sum f_i u_i = 630$
Mean = A + $\left\{h \times \frac{\sum f_i u_i}{\sum f_i}\right\}$
= 45 + $\left\{10 \times \frac{630}{1000}\right\}$
= 45 + 6.3
= 51.3

13. In Fig, the electrician is required to reach point B on the pole AD. So, BD = AD – AB = (5 – 1.3)m = 3.7 m. Here, BC represents the ladder. We need to find its length, i.e., the hypotenuse of the right triangle BDC. Now, we take sin 60°.

So, $\frac{\text{BD}}{\text{BC}}$ = sin 60° or $\frac{3.7}{BC} = \frac{\sqrt{3}}{2}$

Therefore, BC = $\frac{3.7\times2}{\sqrt{3}}$ = 4.28 m (approx.) (by taking $\sqrt{3} = 1.73$)

i.e., the length of the ladder should be 4.28 m.

Now, $\frac{DC}{BD} = \cot 60^\circ = \frac{1}{\sqrt{3}}$

i.e., DC = $\frac{3.7}{\sqrt{3}}$ = 2.14 m (approx.)

Therefore, she should place the foot of the ladder at a distance of 2.14 m from the pole.

14. Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

i. Volume of cylinder = $\pi r^2 h$

= $\frac{22}{7} \times 3.5^2 \times 10$ = 385 cm^3

ii. Total surface area of the article

$= 2\pi(3.5)(10) + 2\left[2\pi(3.5)^2\right]$

$= 70\pi + 49\pi = 119\pi$

$= 119 \times \frac{22}{7} = 17 \times 22$

$= 374\text{cm}^2$