Sample Question Paper - 34
Mathematics-Basic (241)
Class- X, Session: 2021-22
TERM II

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

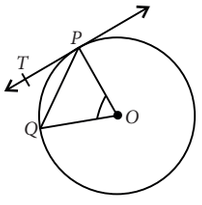
General Instructions :

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. If the mean and mode of a frequency distribution are 28 and 16 respectively, then find its median.

2. If in the given figure, O is the centre of a circle, PQ is a chord and PT is the tangent at P. If $\angle POQ = 70°$, then what is the measure of $\angle TPQ$?



3. A solid is hemispherical at the bottom and conical above. If the surface areas of the two parts are equal, then find the ratio of its radius and the height of its conical part.

OR

A vessel is in the form of a hemispherical bowl mounted by a right circular cylinder. The diameter of the hemisphere is 7 cm and the total height of the vessel is 10 cm. Find its capacity.

4. The sum of the squares of two consecutive multiples of 7 is 637. Find the multiples.

5. In an A.P., if the common difference (d) = –4, and the seventh term (a_7) is 4, then find the first term.

6. Solve the following quadratic equation for x :

$4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$

OR

Find the value of m so that the quadratic equation $mx(x - 7) + 49 = 0$ has two equal roots.

SECTION - B

7. Consider the following table:

Class interval	10-14	14-18	18-22	22-26	26-30
Frequency	5	11	16	25	19

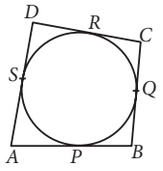
Find the mode of the above data.

8. The ratio of the height of a tree and its shadow is 1: $\frac{1}{\sqrt{3}}$. Find the angle of the sun's elevation. Hence find the height of tower, if its shadow is $125\sqrt{3}$ m long, at the same time.

OR

The tops of two poles of height 18 m and 10 m are connected by a wire of length l metres. If the wire makes an angle of 30° with the horizontal, then find the value of l.

9. In the given figure, a quadrilateral $ABCD$ is drawn to circumscribe a circle such that its sides AB, BC, CD and AD touch the circle at P, Q, R and S respectively. If $AB = x$ cm, $BC = 7$ cm, $CR = 3$ cm and $AS = 5$ cm, find x.



10. Find the value of p, if the mean of the following distribution is 7.5.

x_i	3	5	7	9	11	13
f_i	6	8	15	p	8	4

SECTION - C

11. Draw a circle of radius 4 cm. Draw two tangents to the circle inclined at an angle of 60° to each other.

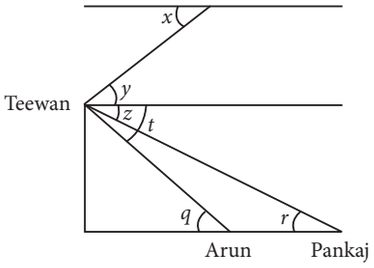
OR

Draw a circle of radius 3 cm. From a point P, 7 cm away from its centre draw two tangents to the circle. Measure the length of each tangent.

12. From a solid cylinder whose height is 2.4 cm and diameter 1.4 cm, a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid.

Case Study - 1

13. Teewan, Arun and Pankaj were celebrating the festival of Diwali in open ground with firecrackers. There is a pedestal in the ground. All of sudden Teewan stands on pedestal and release sky lantern from the top of pedestal.



Based on the above information answer the following questions. (Take $\sqrt{3} = 1.73$)

(i) If the position of Pankaj is 25 m away from the base of pedestal and $\angle r = 30°$, then find the height of pedestal.

(ii) If the height of pedestal is 30 m, $\angle t = 45°$ and $\angle z = 30°$, then find the horizontal distance between Arun and Pankaj.

Case Study - 2

14. Ankita gets pocket money from his father everyday. Out of the pocket money, he saves ₹ 2 on first day, ₹ 7 on second day, ₹ 12 on third day and so on.

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

(i) What is the amount saved by Ankita on 14^{th} day?

(ii) What is the total amount saved by Ankita in 8 days?

Solution

MATHEMATICS BASIC 241

Class 10 - Mathematics

1. We know that, Mode = 3 Median – 2 Mean

$\Rightarrow$ 3 Median = Mode + 2 Mean

$\Rightarrow$ 3 Median = $16 + 2 \times 28 \Rightarrow$ Median = 72/3 = 24

2. In ΔOPQ, $OP = OQ$ (Radii of same circle)

$\Rightarrow \angle OQP = \angle OPQ$

(Angles opposite to equal sides are equal)

$$\Rightarrow \angle OQP = \angle OPQ = \frac{(180° - 70°)}{2} = 55° \quad \text{...(i)}$$

[By using angle sum property]

Also, $\angle OPT = 90°$ ...(ii)

[$\because$ Tangent is perpendicular to the radius through the point of contact.]

$\Rightarrow \angle TPQ = 90° - 55° = 35°$ [From (i) and (ii)]

3. Let h be the height of the cone and r be the radius of cone and hemisphere.

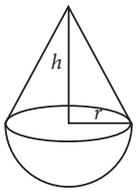
$\therefore$ Curved surface area of conical part = Curved surface area of hemispherical part [Given]

$\therefore \pi rl = 2\pi r^2 \Rightarrow l = 2r \Rightarrow \sqrt{h^2 + r^2} = 2r$

$\Rightarrow h^2 + r^2 = 4r^2$

$\Rightarrow h^2 = 3r^2$

$$\Rightarrow \left(\frac{r}{h}\right)^2 = \frac{1}{3} \Rightarrow \frac{r}{h} = \frac{1}{\sqrt{3}} \text{ i.e., } 1 : \sqrt{3}$$



OR

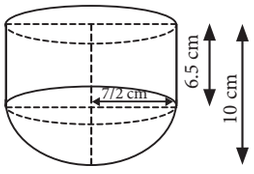
Let r be the radius of the hemispherical bowl and cylinder and h be the height of the cylinder.

$$\therefore \quad r = \frac{7}{2} \text{ cm and } h = 10 - \frac{7}{2} = 6.5 \text{ cm}$$

Total capacity of the vessel = Volume of the cylinder + Volume of the hemisphere = $\pi r^2 h + \frac{2}{3}\pi r^3$

$$= \pi r^2 \left(h + \frac{2}{3} r\right)$$

$$= \frac{22}{7} \times \left(\frac{7}{2}\right)^2 \left(6.5 + \frac{2}{3} \times \frac{7}{2}\right)$$



$$= \frac{22 \times 7}{4} \times \frac{53}{6} = \frac{4081}{12} = 340.08 \text{ cm}^3$$

4. Let two consecutive multiples of 7 be k, $k + 7$.

According to question,

$(k)^2 + (k + 7)^2 = 637$

$\Rightarrow k^2 + k^2 + 49 + 14k = 637$

$\Rightarrow 2k^2 + 14k - 588 = 0 \Rightarrow k^2 + 7k - 294 = 0$

$\Rightarrow (k + 21)(k - 14) = 0 \Rightarrow k = 14$ or $k = -21$

Hence, multiples are 14, 21 or –14, – 21

5. Let a be the first term of A.P.

Here, common difference (d) = – 4,

Seventh term (a_7) = 4, $n = 7$

$\therefore \quad a_n = a + (n - 1)d$

$\Rightarrow a_7 = a + (7 - 1) \times (-4) = 4$

$\Rightarrow a + 6 \times (-4) = 4 \Rightarrow a - 24 = 4 \Rightarrow a = 28$

6. We have, $4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$

$\Rightarrow 4\sqrt{3}x^2 + 8x - 3x - 2\sqrt{3} = 0$

$\Rightarrow 4x(\sqrt{3}x + 2) - \sqrt{3}(\sqrt{3}x + 2) = 0$

$\Rightarrow (4x - \sqrt{3})(\sqrt{3}x + 2) = 0$

$$\Rightarrow x = \frac{\sqrt{3}}{4} \text{ or } x = -\frac{2}{\sqrt{3}}$$

OR

Given, $mx(x - 7) + 49 = 0$

$\Rightarrow mx^2 - 7mx + 49 = 0$

Since for equal roots, $D = 0$

$\therefore (-7m)^2 - 4 \times m \times 49 = 0$

$\Rightarrow 49m^2 - 4 \times m \times 49 = 0$

$\Rightarrow 49m(m - 4) = 0 \quad \Rightarrow \quad m = 4 \quad (\because m \neq 0)$

7. Here, the maximum frequency is 25 and the corresponding modal class is 22–26.

$\therefore \quad l = 22, h = 4, f_1 = 25, f_0 = 16$ and $f_2 = 19$

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

$$= 22 + \left(\frac{25 - 16}{50 - 16 - 19}\right) \times 4 = 22 + \frac{9}{15} \times 4$$

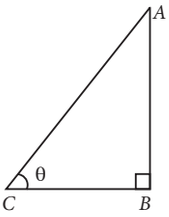
$$= 22 + \frac{12}{5} = 24.4$$

8. Let AB be the tree and BC be its shadow such that

$$\frac{AB}{BC} = \frac{1}{\left(\frac{1}{\sqrt{3}}\right)} = \sqrt{3}.$$

Let θ be the sun's elevation.

In ΔABC, $\tan\theta = \frac{AB}{BC} = \sqrt{3} = \tan 60°$



$\Rightarrow \theta = 60°$

Hence, the angle of the sun's elevation is 60°.

Now, let height of tower be h m.

According to question,

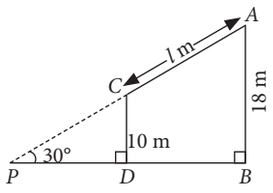
$$\tan 60° = \frac{h}{125\sqrt{3}}$$

$\Rightarrow h = 125 \times 3 = 375$ m.

OR

Let AB and CD be the two poles of height 18 m and 10 m respectively, such that $AC = l$ m.

In ΔCDP, $\sin 30° = \frac{CD}{PC}$



$\Rightarrow \frac{1}{2} = \frac{10}{PC}$

$\Rightarrow PC = 20$ m

In ΔABP, $\sin 30° = \frac{AB}{PA} \Rightarrow \frac{1}{2} = \frac{18}{PA} \Rightarrow PA = 36$ m

Now $l = AC = PA - PC = 36 - 20 = 16$

9. We know, tangents drawn from an external point to the circle are equal in length.

i.e., $AP = AS$, $BP = BQ$, $CQ = CR$, $DR = DS$

So, $CR = CQ \Rightarrow CQ = 3$ cm

Now, $BC = 7$ cm $\Rightarrow CQ + BQ = 7$ cm

$\Rightarrow BQ = (7 - 3)$cm $= 4$ cm

Also, $BQ = BP \Rightarrow BP = 4$ cm

Also, $AS = AP$ and $AS = 5$ cm $\Rightarrow AP = 5$ cm

$\therefore AB = AP + PB = (5 + 4)$ cm $= 9$ cm

So, $x = 9$

10. Let us construct the following table for the given data.

x_i	f_i	$f_i x_i$
3	6	18
5	8	40
7	15	105
9	p	$9p$
11	8	88
13	4	52
Total	$\Sigma f_i = 41 + p$	$\Sigma f_i x_i = 303 + 9p$

$\therefore$ Mean $= \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 7.5 = \frac{303 + 9p}{41 + p}$ (Given)

$\Rightarrow 7.5 \times (41 + p) = 303 + 9p$

$\Rightarrow 307.5 + 7.5p = 303 + 9p$

$\Rightarrow 9p - 7.5p = 307.5 - 303$

$\Rightarrow 1.5\,p = 4.5 \Rightarrow p = 3$

11. Steps of construction :

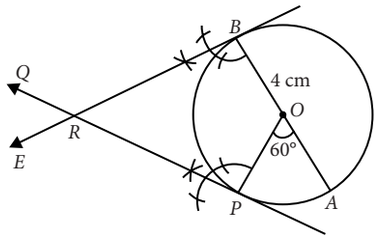
Step-I : Draw a circle with centre O and radius 4 cm.

Step-II : Draw any diameter AOB.

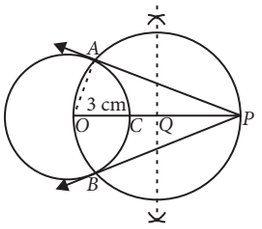
Step-III : Take a point P on the circle such that $\angle AOP = 60°$.

Step-IV : Draw $PQ \perp OP$ and $BE \perp OB$. Let PQ and BE intersect at R.

Hence, RB and RP are the required tangents.



OR



Now, join OA to find PA.

In ΔAOP, $\angle OAP = 90°$ [Angle in semicircle]

$\therefore AP^2 = OP^2 - OA^2 = 7^2 - 3^2 = 40$

$\Rightarrow AP = 6.32$ cm

Since, lengths of tangents drawn from an external point to a circle are equal.

$\therefore$ Length of each tangent = 6.32 cm

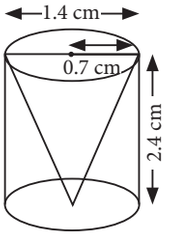
12. Given, diameter of cylinder = 1.4 cm

$\Rightarrow$ Radius of cylinder, $r = \frac{1.4}{2} = 0.7$ cm

Slant height of cone, $l = \sqrt{(0.7)^2 + (2.4)^2} = \sqrt{6.25}$

$= 2.5$ cm

$\therefore$ Total surface area of remaining solid = Curved surface area of cone + Curved surface area of cylinder + Area of one base of cylinder



$= \pi rl + 2\pi rh + \pi r^2$

$= \pi(0.7)\,(2.5) + 2\pi(0.7)\,(2.4) + \pi(0.7)^2$

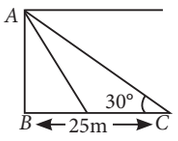
$= \pi(0.7)\,(2.5 + 4.8 + 0.7)$

$= \frac{22}{7} \times \frac{7}{10} \times 8 = 17.6$ cm^2

13. (i) Let AB be the height of pedestal.

In ΔABC,

$$\tan 30° = \frac{AB}{BC}$$



$$\Rightarrow \quad AB = \frac{25}{\sqrt{3}} = \frac{25}{1.73} = 14.45 \text{ m}$$

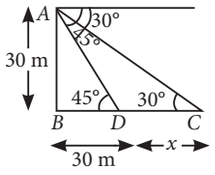
(ii) Let x be the distance between Arun and Pankaj.

In ΔABD, $\tan 45° = \frac{AB}{BD}$

$\Rightarrow \quad BD = 30$ m

Now, in ΔABC,

$$\tan 30° = \frac{AB}{BC}$$



$$\Rightarrow \quad \frac{30}{30+x} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad x = 30 \ (\sqrt{3} - 1) = 30 \times 0.73 = 21.9 \text{ m}$$

14. Here the savings form an A.P. *i.e.*, ₹ 2, ₹ 7, ₹ 12, …

So, $a = 2$, $d = 7 - 2 = 5$

(i) Amount saved by Ankita on 14^{th} day

$= t_{14} = a + 13d = 2 + 13 \times 5 =$ ₹ 67

(ii) Total amount saved by Ankita in 8 days

$= S_8 = \frac{8}{2}[2(2) + 7 \times 5] =$ ₹ 156