# Sample Question Paper - 31
# 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 for $x : \sqrt{2x+9}+x=13$

**2.** In a class test, 50 students obtained marks as follows:

| **Marks obtained** | 0–20 | 20–40 | 40–60 | 60–80 | 80–100 |
|---|---|---|---|---|---|
| **Number of students** | 8 | 6 | 15 | 12 | 9 |

Find the modal class and the median class.

**3.** If the first three terms of an A.P. respectively are $3y - 1$, $3y + 5$ and $5y + 1$, then find the value of $y$.

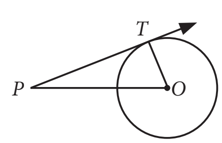
**OR**

Find the next term of the A.P. $\sqrt{7}, \sqrt{28}, \sqrt{63}, \ldots$.

**4.** For what values of $k$, the roots of the equation $x^2 + 4x + k = 0$ are real?

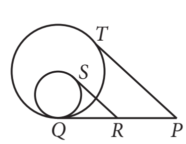
**5.** If two cubes, each of edge 4 cm are joined end to end, then find the surface area of the resulting cuboid.

**6.** In the given figure, point $P$ is 13 cm away from the centre $O$ of a circle and the length $PT$ of the tangent drawn from $P$ to the circle is 12 cm. Then find the radius of the circle.




**OR**

In the following figure, $PQ$ is the common tangent to both the circles. $SR$ and $PT$ are tangents. If $SR = 4$ cm, $PT = 7$ cm, then find the length of $RP$.



## SECTION - B

**7.** Find '$p$' if the mean of the given data is 15.45.

| Class interval | 0–6 | 6–12 | 12–18 | 18–24 | 24–30 |
|---|---|---|---|---|---|
| Frequency | 6 | 8 | $p$ | 9 | 7 |

**8.** Two men on either side of a 75 m high building and in line with base of building observe the angles of elevation of the top of the building as 30° and 60°. Find the distance between the two men. (Use $\sqrt{3} = 1.73$)

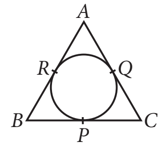
**OR**

The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 45°. If the tower is 30 m high, then find the height of the building. (Use $\sqrt{3} = 1.73$)

**9.** Compare the modal ages of two groups of students appearing for an entrance test.

| Age (in years) | 16-18 | 18-20 | 20-22 | 22-24 | 24-26 |
|---|---|---|---|---|---|
| Group A | 50 | 78 | 46 | 28 | 23 |
| Group B | 54 | 89 | 40 | 25 | 17 |

**10.** In the given figure, the incircle of $\Delta ABC$ touches the sides $BC$, $CA$ and $AB$ at $P$, $Q$ and $R$ respectively. Prove that $(AR + BP + CQ) = (AQ + BR + CP) = \frac{1}{2}$ (Perimeter of $\Delta ABC$).




## SECTION - C

**11.** Find the A.P. whose fourth term is 9 and the sum of its sixth term and thirteenth term is 40.

**OR**

The sum of the first seven terms of an A.P. is 182. If its $4^{th}$ and the $17^{th}$ terms are in the ratio 1 : 5, then find the A.P.

**12.** Draw a circle of radius 6 cm and draw a tangent to this circle making an angle of 30° with a line passing through the centre.

## Case Study - 1

**13.** Anku and his friends went for a vacation in Manali. There they had a stay in tent for a night. Anku found that the tent in which they stayed is in the form of a cone surmounted on a cylinder. The total height of the tent is 42 m, diameter of the base is 42 m and height of the cylinder is 22 m.

(i) How much canvas is needed to make the tent?

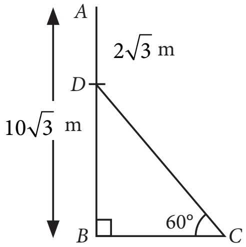
(ii) If each person needs 126 $m^2$ of floor, then how many persons can be accommodated in the tent?

## Case Study - 2

**14.** Suppose a straight vertical tree is broken at some point due to storm and the broken part is inclined at a certain distant from the foot of the tree.

(i) If the top of upper part of broken tree touches ground at a distance of 45 m (from the foot of the tree) and makes an angle of inclination 60°, then find the height of remaining part of the tree.

(ii) If $AB = 10\sqrt{3}$ m, $AD = 2\sqrt{3}$ m, then find the length of $CD$.



**Solution**

**MATHEMATICS BASIC 241**

**Class 10 - Mathematics**

**1.** We have, $\sqrt{2x+9}+x=13$

$\Rightarrow \sqrt{2x+9}=13-x$

Squaring both sides, we have $2x + 9 = (13 - x)^2$

$\Rightarrow 2x + 9 = 169 + x^2 - 26x$

$\Rightarrow x^2 - 28x + 160 = 0 \Rightarrow x^2 - 20x - 8x + 160 = 0$

$\Rightarrow x(x - 20) - 8(x - 20) = 0 \Rightarrow (x - 20)(x - 8) = 0$

$\therefore x = 20$ or $8$

**2.** The cumulative frequency distribution table from the given data can be drawn as :

| Marks obtained | Number of students | Cumulative frequency |
|---|---|---|
| 0-20 | 8 | 8 |
| 20-40 | 6 | 14 |
| 40-60 | 15 | 29 |
| 60-80 | 12 | 41 |
| 80-100 | 9 | 50 |

The highest frequency is 15 and its corresponding class is 40 – 60. So, the modal class is 40 – 60.

Also, $n = 50 \Rightarrow n/2 = 25$. The cumulative frequency just greater than 25 is 29, which lies in the interval 40 – 60. So, the median class is 40 – 60.

**3.** Given, $3y - 1$, $3y + 5$ and $5y + 1$ are in A.P.

$\therefore 3y + 5 - (3y - 1) = 5y + 1 - (3y + 5)$

$\Rightarrow 3y + 5 - 3y + 1 = 5y + 1 - 3y - 5$

$\Rightarrow 6 = 2y - 4 \Rightarrow y = \frac{10}{2} = 5$

**OR**

First term, $a = \sqrt{7}$ and common difference,

$d = \sqrt{28} - \sqrt{7} = 2\sqrt{7} - \sqrt{7} = \sqrt{7}$

$\therefore$ Next term of the A.P. is $(a_4) = a + 3d$

$= \sqrt{7} + 3\sqrt{7} = 4\sqrt{7} = \sqrt{112}$

**4.** Given, $x^2 + 4x + k = 0$

For real roots, discriminant, $D \geq 0$

$\therefore b^2 - 4ac \geq 0 \Rightarrow 16 - 4(1)(k) \geq 0$

$\Rightarrow 16 - 4k \geq 0 \Rightarrow k \leq 4$

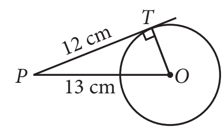
**5.** $\because$ Two cubes of edge 4 cm each are joined end to end to form a cuboid.

$\therefore$ For resulting cuboid, length $(l) = 4 + 4 = 8$ cm, breadth $(b) = 4$ cm and height $(h) = 4$ cm

$\therefore$ Surface area of cuboid

$= 2(lb + bh + hl) = 2(8 \times 4 + 4 \times 4 + 4 \times 8) = 160 \text{ cm}^2$

**6.** In $\Delta PTO$,




$OP^2 = PT^2 + OT^2$

$\Rightarrow 13^2 = 12^2 + OT^2$

$\Rightarrow 169 - 144 = OT^2$

$\Rightarrow 25 = OT^2 \Rightarrow OT = 5$ cm

**OR**

Since tangents drawn from an external point to a circle are equal in length.

$\therefore PQ = PT = 7$ cm and $RQ = RS = 4$ cm

Now, $RP = PQ - RQ = (7 - 4)$ cm $= 3$ cm

**7.** The frequency distribution table from the given data can be drawn as :

| Class interval | $x_i$ | $f_i$ | $f_i x_i$ |
|---|---|---|---|
| 0–6 | 3 | 6 | 18 |
| 6–12 | 9 | 8 | 72 |
| 12–18 | 15 | $p$ | $15p$ |
| 18–24 | 21 | 9 | 189 |
| 24–30 | 27 | 7 | 189 |
| Total | | $\sum f_i = 30 + p$ | $\sum f_i x_i = 468 + 15p$ |

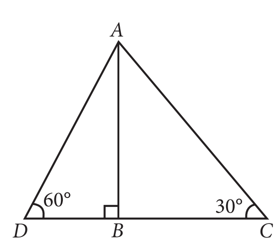
Mean, $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 15.45 = \frac{468+15p}{30+p}$

$\Rightarrow 463.5 + 15.45p = 468 + 15p$

$\Rightarrow 15.45p - 15p = 468 - 463.5$

$\Rightarrow 0.45p = 4.5 \Rightarrow p = 10$

**8.** Let $AB = 75$ m be the building and $C$, $D$ be the positions of two men.




Now, in $\Delta ABC$,

$\tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{BC}$

$\Rightarrow BC = 75\sqrt{3}$ m

In $\Delta ABD$, $\tan 60° = \frac{AB}{BD}$

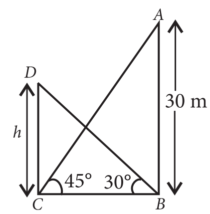
$\Rightarrow \quad \sqrt{3} = \frac{75}{BD} \quad \Rightarrow \quad BD = \frac{75}{\sqrt{3}}$ m $= 25\sqrt{3}$ m

$\therefore$ Distance between the two men

$= BC + BD = 75\sqrt{3} + 25\sqrt{3} = 100\sqrt{3} = 173$ m

**OR**

Let $AB$ be the tower of height 30 m and $DC$ is the building of height $h$ m.




In $\Delta ABC$, $\tan 45° = \frac{AB}{BC}$

$\Rightarrow \quad 1 = \frac{30}{BC} \Rightarrow BC = 30$ m

In $\Delta BDC$, $\tan 30° = \frac{CD}{BC}$

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

$\Rightarrow \quad h = \frac{30}{\sqrt{3}} = 10\sqrt{3} = 17.32$

Thus, height of building is 17.32 m.

**9.** Maximum frequency in group $A$ is 78 and its corresponding class is 18-20.

$\therefore$ Mode for group $A = 18 + \left(\frac{78-50}{2\times78-50-46}\right)\times 2$

$$= 18 + \frac{28}{30} = 18.9 \text{ years.}$$

Maximum frequency in group $B$ is 89 and its corresponding class is 18-20.

$\therefore$ Mode for group $B = 18 + \left(\frac{89-54}{2\times89-54-40}\right)\times 2$

$$= 18 + \frac{70}{84} = 18.8 \text{ years.}$$

Since, 18.9 > 18.8

$\therefore$ Modal age of group $A$ is greater than that of group $B$.

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

$\therefore \quad AR = AQ$ ...(i)

$BP = BR$ ...(ii)

$CQ = CP$ ...(iii)

Adding (i), (ii) and (iii), we get

$(AR + BP + CQ) = (AQ + BR + CP) = k$(say)

Perimeter of $\Delta ABC = (AB + BC + CA)$

$= (AR + BR) + (BP + CP) + (CQ + AQ)$

$= (AR + BP + CQ) + (AQ + BR + CP) = k + k = 2k$

$\Rightarrow \quad k = \frac{1}{2}$ (Perimeter of $\Delta ABC$)

$\therefore \quad (AR + BP + CQ) = (AQ + BR + CP)$

$= \frac{1}{2}$ (Perimeter of $\Delta ABC$)

**11.** Given, $a_4 = 9$ and $a_6 + a_{13} = 40$

Now $\quad a_4 = 9 \Rightarrow a + 3d = 9 \Rightarrow a = 9 - 3d$

Also, $a_6 + a_{13} = 40$

$\Rightarrow \quad (a + 5d) + (a + 12d) = 40$

$\Rightarrow \quad 2a + 17d = 40$

On substituting the value of $a$, we get

$2(9 - 3d) + 17d = 40$

$\Rightarrow \quad 18 + 11d = 40 \Rightarrow 11d = 22$

$\Rightarrow \quad d = 2 \quad \therefore \quad a = 9 - 3(2) = 3$

Thus, the A.P. is 3, 5, 7, 9 …

**OR**

Given, sum of first seven terms of an A.P., $S_7 = 182$

$\Rightarrow \quad 182 = \frac{7}{2}[2a + (7-1)d]$

$\Rightarrow \quad 364 = 14a + 42d \Rightarrow 26 = a + 3d$ ...(i)

Also, $\frac{a_4}{a_{17}} = \frac{1}{5} \quad \Rightarrow \quad \frac{a+3d}{a+16d} = \frac{1}{5}$

$\Rightarrow \quad 5(a + 3d) = a + 16d$

$\Rightarrow \quad 5a + 15d = a + 16d$

$\Rightarrow \quad 4a - d = 0 \Rightarrow d = 4a$ ...(ii)

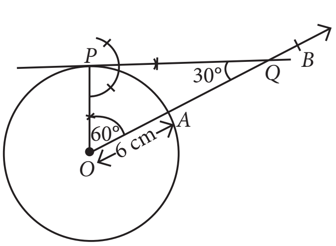
Substituting (ii) in (i), we get

$26 = a + 3(4a) \Rightarrow 13a = 26 \Rightarrow a = 2$

$\therefore \quad d = 4(2) = 8$

Hence, the A.P. is formed as 2, 10, 18, ...

**12. Steps of construction :**




**Step-I :** Draw a circle with centre $O$ and radius 6 cm.

**Step-II :** Draw a radius $OA$ and produce it to $B$.

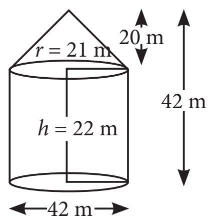
**Step-III :** Construct an $\angle AOP$ equal to the complement of 30° *i.e.*, 60°.

**Step-IV :** Draw a perpendicular to $OP$ at $P$ which intersects $OB$ at $Q$.

Hence, $PQ$ is the required tangent such that $\angle OQP = 30°$.

**13.** (i) Required area of canvas = Curved surface area of cone + Curved surface area of cylinder

$= \pi rl + 2\pi rh = \pi r(l + 2h)$




$= \frac{22}{7} \times 21\ (29 + 44) = 4818\ \text{m}^2$

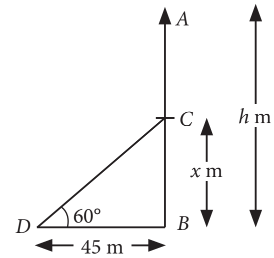
$$\left[\because\ l = \sqrt{r^2 + h_1^2} = \sqrt{(21)^2 + (20)^2} = \sqrt{841} = 29\ \text{m}\right]$$

(ii) Area of floor $= \pi r^2$

$= \frac{22}{7} \times 21 \times 21 = 1386\ \text{m}^2$

$\therefore$ Number of persons that can be accommodated in the tent $= \frac{1386}{126} = 11$

**14.** (i) Let $AB$ be the tree of height $h$ m and let it broken at height of $x$ m, as shown in figure.




Clearly $CD = AC = (h - x)$ m

Now, in $\Delta CBD$, we have

$$\tan 60° = \frac{x}{45}$$

$\Rightarrow\ x = 45\sqrt{3}$ m

Thus, the height of remaining part of the tree is $45\sqrt{3}$ m.

(ii) Clearly, $BD = AB - AD$

$= \left(10\sqrt{3} - 2\sqrt{3}\right)\text{m} = 8\sqrt{3}\ \text{m}$

Now, in $\Delta BCD$, we have

$$\sin 60° = \frac{BD}{DC}$$

$\Rightarrow\ \frac{\sqrt{3}}{2} = \frac{8\sqrt{3}}{DC}\ \Rightarrow\ DC = 16$ m