Sample Question Paper - 22
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.*

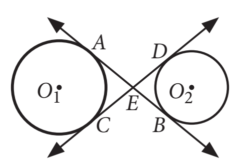
SECTION - A

1. Find the class marks of classes 10-20 and 35-55.

2. What is the distance between two parallel tangents of a circle of radius 4 cm?

OR

In the given figure, common tangents AB and CD to the two circles with centres O_1 and O_2 intersect at E. Prove that $AB = CD$.



3. The radius of the base of a right circular cylinder is halved, keeping the height same. Find the ratio of the volume of the cylinder thus obtained to the volume of original cylinder.

4. Find the 20th term of an A.P. having 7 as its first term and –4 as its common difference.

5. For a certain frequency distribution, if $\Sigma f_i = 50$ and $\Sigma f_i x_i = 2550$, then what is the mean of the distribution?

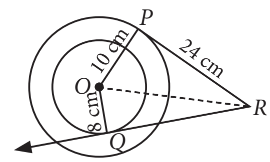
6. Find the value of k, for which the quadratic equation $x^2 - kx + 4 = 0$ has equal roots.

OR

Solve for $x : x^2 + (1+\sqrt{5})x + \sqrt{5} = 0$

SECTION - B

7. Two concentric circles are of radii 10 cm and 8 cm. RP and RQ are tangents to the two circles from R. If the length of RP is 24 cm, then find the length of RQ.



8. In an A.P., if $a = 15$, $d = -3$ and $a_n = 0$, then find the value of n.

OR

If S_n, the sum of the first n terms of an A.P. is given by $S_n = 2n^2 + n$, then find its n^{th} term.

9. A person standing on the bank of a river, observes that the angle of elevation of the top of a tree, standing on the opposite bank is 60°. When he moves 40 m away from the bank, he finds that the angle of elevation to be 30°. Find the height of the tree and width of the river. (Use $\sqrt{3} = 1.732$)

10. The perimeter of a rectangle is 76 cm. Its area is 357 sq. cm. Find the length and breadth of the rectangle.

SECTION - C

11. Rama has an apple orchand with 90 apple trees. A data on number of apples on each tree is collected and is organised as a grouped distribution as shown here.

Number of apples	40-60	60-80	80-100	100-120	120-140	140-160	160-180
Number of trees	12	11	14	16	13	15	9

Find the mode and median of the above data.

OR

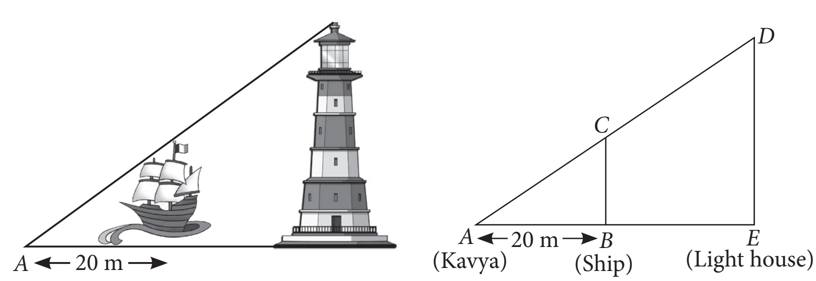
Find the median of the following data :

Class Interval	0-10	10-20	20-30	30-40	40-50	Total
Frequency	8	16	36	34	6	100

12. Draw a circle of diameter $AB = 8$ cm with centre O and then draw a tangent to the circle at point A.

Case Study - 1

13. Kavya went to a beach with her uncle. From a point A where Kavya was standing, a ship and light house come in a straight line as shown in the figure.

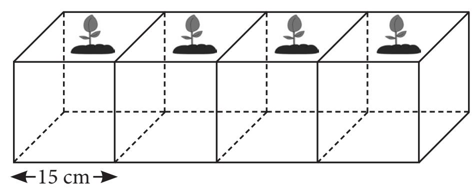


(i) The distance between Kavya and the ship is twice as much as the height of the ship. What is the height of the ship?

(ii) If the ratio of height of ship to that of light house is 1 : 6, then what is the height of the light house?

Case Study - 2

14. Smitha joins four cubical open boxes of edge 15 cm each to make a pot for planting saplings of mint in her kitchen garden. The saplings are cylindrical in shape with diameter 11.2 cm and height 9 cm.



(i) If Smitha wants to paint the outer surface of pots, then how much area she needs to paint?

(ii) What is the volume of the pot formed?

Solution

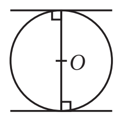
MATHEMATICS BASIC 241

Class 10 - Mathematics

1. Class mark of class 10-20 = $\dfrac{10+20}{2} = 15$;

Class mark of class 35-55 = $\dfrac{35+55}{2} = 45$

2. Distance between two parallel tangents drawn to a circle is the diameter of the circle.



$\therefore$ Distance between two parallel tangents

= 2 × radius of the circle = 2 × 4 = 8 cm

OR

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

$\therefore$ $EA = EC$ ...(i) and $EB = ED$ ...(ii)

Adding (i) and (ii), we get

$EA + EB = EC + ED \Rightarrow AB = CD$

3. Let the radius and height of the original cylinder be r and h respectively.

Also, radius of the new cylinder = $r/2$

Height of the new cylinder = h

Hence, required ratio

$$= \frac{\text{Volume of the new cylinder}}{\text{Volume of original cylinder}} = \frac{\left(\frac{\pi r^2 h}{4}\right)}{\pi r^2 h} = 1:4$$

4. Here, first term, $a = 7$

Common difference, $d = -4$

Since, n^{th} term, $a_n = a + (n-1)d$

$\therefore$ $a_{20} = a + (20-1)d = 7 + 19(-4) = 7 - 76 = -69$

Hence, 20^{th} term of A.P. is – 69.

5. Mean of the distribution $= \dfrac{\Sigma f_i x_i}{\Sigma f_i} = \dfrac{2550}{50} = 51$

6. The given equation is, $x^2 - kx + 4 = 0$

For equal roots, $D = b^2 - 4ac = 0$

$\Rightarrow (-k)^2 - 4(1)(4) = 0 \Rightarrow k^2 = 16 \Rightarrow k = \pm 4$

OR

We have, $x^2 + (1+\sqrt{5})x + \sqrt{5} = 0$

$\Rightarrow x^2 + x + \sqrt{5}x + \sqrt{5} = 0$

$\Rightarrow x(x+1) + \sqrt{5}(x+1) = 0 \Rightarrow (x+1)(x+\sqrt{5}) = 0$

$\Rightarrow x + 1 = 0$ or $x + \sqrt{5} = 0 \Rightarrow x = -1$ or $x = -\sqrt{5}$

Hence, -1 and $-\sqrt{5}$ are the two roots of the given equation.

7. Given that, $OP = 10$ cm, $OQ = 8$ cm and $RP = 24$ cm

In ΔOPR, we have

$OP \perp PR$ [$\because$ Tangent is perpendicular to the radius at the point of contact]

$\therefore$ $OR = \sqrt{PR^2 + OP^2} = \sqrt{24^2 + 10^2}$

$= \sqrt{576 + 100} = \sqrt{676} = 26\,\text{cm}$

In ΔOQR

$OQ \perp QR$ [$\because$ RQ is tangent at Q]

$\therefore$ $OR^2 = RQ^2 + OQ^2 \Rightarrow RQ^2 = OR^2 - OQ^2$

$= (26)^2 - (8)^2 = 676 - 64 = 612$

$\Rightarrow RQ = \sqrt{612} = 6\sqrt{17}$ cm

8. We have, $a = 15$, $d = -3$

Given, $a_n = 0 \Rightarrow a + (n-1)d = 0$

$\Rightarrow 15 + (n-1)(-3) = 0$

$\Rightarrow 15 - 3n + 3 = 0 \Rightarrow -3n = -18 \Rightarrow n = 6$

OR

We have, $S_n = 2n^2 + n$

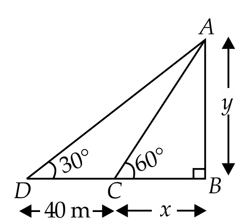
$\therefore$ $S_{n-1} = 2(n-1)^2 + (n-1) = 2(n^2 + 1 - 2n) + n - 1$

$= 2n^2 + 2 - 4n + n - 1 = 2n^2 - 3n + 1$

Now, n^{th} term of the A.P., $a_n = S_n - S_{n-1}$

$= (2n^2 + n) - (2n^2 - 3n + 1) = 4n - 1$

9. Let height of the tree $AB = y$ metres and width of the river $CB = x$ metres



Let C be the point of observation and D be the other point of observation, such that $CD = 40$ m

In ΔABC, right angled at B, we have

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{y}{x} \Rightarrow \sqrt{3}\,x = y$ ...(i)

In ΔABD, right angled at B, we have

$$\tan 30° = \frac{AB}{BD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{y}{x+40} \Rightarrow x + 40 = \sqrt{3}\, y \quad \text{...(ii)}$$

From (i) and (ii), we get

$$x + 40 = \sqrt{3}(\sqrt{3}\,x) \Rightarrow x + 40 = 3x \Rightarrow x = 20$$

Now, putting the value of x in (i), we get

$$y = 20\sqrt{3} = 20(1.732) = 34.64$$

Hence, height of the tree (y) = 34.64 metres and width of the river (x) = 20 metres

10. Let the length of the rectangle be x cm and breadth be y cm.

$\therefore$ Perimeter of rectangle = $2(x + y)$

$\Rightarrow 2(x + y) = 76$ [Given]

$\Rightarrow x + y = 38$

$\Rightarrow y = 38 - x$ ...(i)

Also, area of rectangle = 357 sq. cm [Given]

$\Rightarrow xy = 357$

$\Rightarrow x(38 - x) = 357$ [Using (i)]

$\Rightarrow 38x - x^2 - 357 = 0 \Rightarrow x^2 - 38x + 357 = 0$

$\Rightarrow x^2 - 21x - 17x + 357 = 0$

$\Rightarrow (x - 21)(x - 17) = 0$

$\Rightarrow x = 21$ or $x = 17$

When $x = 21$, $y = 38 - 21 = 17$

When $x = 17$, $y = 38 - 17 = 21$

Hence, length and breadth of rectangle is either 21 cm and 17 cm or 17 cm and 21 cm respectively.

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

Class	**Frequency (f_i)**	**Cumulative frequency ($c.f.$)**
40-60	12	12
60-80	11	23
80-100	14	37
100-120	16	53
120-140	13	66
140-160	15	81
160-180	9	90
Total	90	

Here, highest frequency is 16, which lies in the class interval 100-120.

$\therefore$ 100-120 is the modal class.

Now, $l = 100, f_1 = 16, f_0 = 14, f_2 = 13, h = 20$

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

$$= 100 + \left(\frac{16 - 14}{2 \times 16 - 14 - 13}\right) \times 20 = 100 + \frac{2}{5} \times 20$$

$= 100 + 8 = 108 \quad \therefore$ Mode = 108

Clearly, $\frac{N}{2} = \frac{90}{2} = 45$

Since, cumulative frequency just greater than 45 is 53, which lies in the class interval 100-120. So, 100-120 is the median class.

$\therefore \quad l = 100, c.f. = 37, f = 16, h = 20$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f}\right) \times h$$

$$= 100 + \left(\frac{45 - 37}{16}\right) \times 20 = 100 + \frac{8}{16} \times 20 = 100 + 10 = 110$$

$\therefore$ Median = 110

OR

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

Class Interval	**Frequency (f_i)**	**Cumulative frequency ($c.f.$)**
0-10	8	8
10-20	16	24
20-30	36	60
30-40	34	94
40-50	6	100
Total	100	

Here, $N = 100 \Rightarrow \frac{N}{2} = 50$. Since, cumulative frequency just greater than 50 is 60, which lies in the class interval 20-30.

$\therefore$ Median class is 20-30.

So, $c.f. = 24, f = 36, l = 20$ and $h = 10$

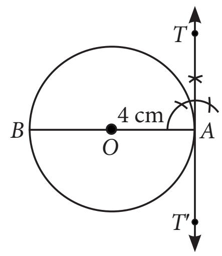
$$\therefore \text{Median} = l + \left[\frac{\frac{N}{2} - c.f.}{f}\right] \times h$$

$$= 20 + \left[\frac{50 - 24}{36}\right] \times 10 = 20 + \left(\frac{26}{36}\right) \times 10$$

$= 20 + 7.22 = 27.22$

12. Steps of construction :

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



Step-II : Draw diameter AOB.

Step-III : Take OA as base and construct $\angle OAT = 90°$.

Step-IV : Produce TA to T' to get the required tangent TAT'.

13. (i) We have, $AB = 2BC$

$\Rightarrow BC = \frac{20}{2} = 10$ m

So, height of ship = 10 m

(ii) Height of light house = DE

Now, $\frac{BC}{DE} = \frac{1}{6}$

$\Rightarrow DE = 6BC = 6 \times 10 = 60$ m

14. (i) Area to be painted = Area of 14 faces

$= 14 \times (15)^2 = 3150$ cm^2

(ii) Height of pot = 15 cm

Length of pot = 15 × 4 = 60 cm

Breadth of pot = 15 cm

$\therefore$ Volume of pot = 15 × 60 × 15 = 13500 cm^3