2021

MATHEMATICS

Total marks : 80 **Time : 3 hours**

General Instructions:

i) Approximately 15 minutes is allotted to read the question paper and revise the answers.

ii) The question paper consists of 22 questions.

iii) All questions are compulsory.

iv) Internal choice has been provided in some questions.

v) Marks allocated to every question are indicated against it.

N.B: Check that all pages of the question paper is complete as indicated on the top left side.

Section – A

1. **Choose the correct answer from the given alternatives.**

(a) The sum and product respectively of zeros of the polynomial $x^2 - 4x + 3$ are **1**

(i) 3, 3 (ii) 4, 3 (iii) 3, –4 (iv) 4, $\frac{1}{3}$

(b) The pair of equations $x + y - 40 = 0$ and $x - 2y + 14 = 0$ have **1**

(i) a unique solution (ii) infinitely many solutions

(iii) exactly two solutions (iv) no solution

(c) The values of k for which the quadratic equation $16x^2 + 4kx + 9 = 0$ has real and equal roots are **1**

(i) 6, $-\frac{1}{6}$ (ii) 36, –36 (iii) 6, –6 (iv) $\frac{3}{4}, -\frac{3}{4}$

(d) 30^{th} term of the A.P. 10, 7, 4, … , is **1**

(i) 97 (ii) 77 (iii) –77 (iv) –87

(e) If $\cot A = \frac{12}{5}$, then the value of $(\sin A + \cos A)\operatorname{cosec} A$ is **1**

(i) $\frac{12}{5}$ (ii) $\frac{5}{17}$ (iii) $\frac{17}{5}$ (iv) $\frac{5}{13}$

(f) A is a point on y-axis at a distance of 4 units from x-axis lying below x-axis. The coordinates of A are **1**

(i) (4, 0) (ii) (0, 4) (iii) (–4, 0) (iv) (0, –4)

(g) If the tangents PA and PB from a point P to a circle with centre O are inclined to each other at an angle of 80°, then $\angle POA$ is equal to **1**

(i) 50° (ii) 60° (iii) 70° (iv) 80°

(h) The perimeter of quadrant of a circle whose radius is $\frac{7}{2}$ cm is **1**

(i) 3.5 cm (ii) 5.5 cm (iii) 7.5 cm (iv) 12.5 cm

(i) The radius of the sphere whose surface area is 154 cm^2 is **1**

(i) 14 cm (ii) 7 cm (iii) 3.5 cm (iv) 3 cm

(j) Which of the following cannot be the probability of an event? **1**

(i) $\frac{2}{3}$ (ii) –1.5 (iii) 15% (iv) 0.7

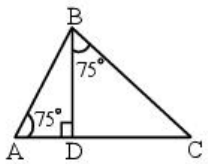
Section – B

2. Use Euclid's division algorithm to find the HCF of 135 and 225. **2**

3. Find the roots of the quadratic equation $2x^2 + x - 6 = 0$ by factorisation. **2**

4. Find the coordinates of the point which divides the join of (–1, 7) and (4, –3) in the ratio 2 : 3 **2**

5. In $\triangle ABC$, $\angle B = 90°$, $BD \perp AC$, $\angle BAD = \angle DBC = 75°$. If AD = 6 cm and DC = 12 cm, then find the length of BD.



2

6. The radii of two circles are 19 cm and 9 cm respectively. Find the radius of the circle which has circumference equal to the sum of the circumferences of the two circles. **2**

Section – C

7. If α and β are the zeros of the quadratic polynomial $x^2 - 5x + 6$, find a quadratic polynomial whose zeros are $(2\alpha - 1)$ and $(2\beta - 1)$ **3**

8. **a.** Solve the following pair of linear equations by substitution method:
$x + y = 14$ and $x - y = 4$.

Or **3**

b. Find the roots of the quadratic equation $2x^2 - 7x + 3 = 0$ by the method of completing the square.

9. **a.** How many three-digit numbers are divisible by 7?

Or **3**

b. An A.P. consists of 50 terms of which 3rd term is 12 and the last term is 106. Find the 29th term.

10. If 3 cot A = 4, then prove that $\frac{1-\tan^2 A}{1+\tan^2 A} = \cos^2 A - \sin^2 A$ with the help of a right triangle. **3**

11. **a.** Prove that $(\text{cosec}\,\theta - \cot\theta)^2 = \frac{1-\cos\theta}{1+\cos\theta}$, where the angles involved are acute.

Or **3**

b. If $\tan(A+B) = \sqrt{3}$ and $\tan(A-B) = \frac{1}{\sqrt{3}}$; $0° < A+B \le 90°; A > B$, then find A and B.

12. **a.** Find the ratio in which the line segment joining the points (–3, 10) and (6, –8) is divided by (–1, 6).

Or **3**

b. Find the area of a rhombus if its vertices are (3, 0), (4, 5), (–1, 4) and (–2, –1) taken in order.

13. Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths. (Traces of construction only is required.) **3**

14. **a.** A chord of a circle of radius 15 cm subtends an angle of 60° at the centre. Find the areas of the corresponding minor and major segments of the circle. (Use $\pi = 3.14$ and $\sqrt{3} = 1.73$)

Or **3**

b. A well of diameter 3 m is dug 14 m deep. The earth taken out of it has been spread evenly all around it in the shape of a circular ring of width 4 m to form an embankment. Find the height of the embankment.

15. The following data gives the information on the observed lifetimes (in hours) of 225 electrical components: **3**

Lifetimes (in hours)	0-20	20-40	40-60	60-80	80-100	100-120
Frequency	10	35	52	61	38	29

Determine the modal lifetimes of the components.

16. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears: (i) a two-digit number (ii) a perfect square number (iii) a number divisible by 5. **3**

Section – D

17. **a.** The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is ₹105 and for a journey of 15 km, the charge paid is ₹155. What are the fixed charges and the charge per km? How much does a person have to pay for travelling a distance of 25 km? **5**

Or

b. If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes $\frac{1}{2}$ if we only add 1 to the denominator. What is the fraction?

18. **a.** State and prove Basic Proportionality theorem. **5**

Or

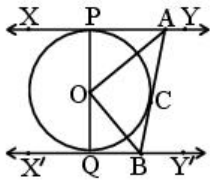
b. ABCD is a trapezium in which AB ∥ DC and its diagonals intersect each other at the point O. Show that $\frac{AO}{BO} = \frac{CO}{DO}$

19. **a.** The angles of elevation and depression of the top and bottom of a lighthouse from the top of a 60 m high building are 30° and 60° respectively. Find:
(i) the difference between the height of the lighthouse and the building.
(ii) the distance between the tops of the lighthouse and the building.
(Use $\sqrt{3} = 1.732$) **5**

Or

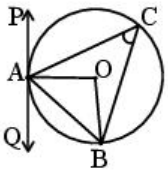
b. The angle of elevation of an aeroplane from a point A on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the plane is flying at a constant height of $3600\sqrt{3}$ m, find the speed of the aeroplane in m/s.

20. **a.** In the adjoining figure, XY and X′Y′ are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting XY at A and X′Y′ at B. Prove that ∠AOB = 90° **5**

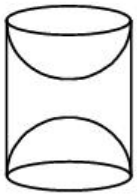


Or

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



21. **a.** A wooden article was made by scooping out a hemisphere from each end of a solid cylinder as shown in the adjoining figure. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the total surface area of the article. Also, find the cost of painting the wooden article at the rate of ₹15 per cm^2



Or **5**

b. A *gulab jamun*, contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 *gulab jamuns*, each shaped like a cylinder with two hemispherical ends with length 5 cm and diameter 2.8 cm.

22. **a.** The following table gives production yield per hectare of wheat of 100 farms of a village. Change the distribution to a more than type distribution and draw its ogive.

Production yield(in kg/ha)	50-55	55-60	60-65	65-70	70-75	75-80
Number of farms	2	8	12	24	38	16

Or **5**

b. The median of the following data is 525. Find the values of x and y, if the total frequency is 100.

Class interval	Frequency
0-100	2
100-200	5
200-300	x
300-400	12
400-500	17
500-600	20
600-700	y
700-800	9
800-900	7
900-1000	4

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