2022
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 18 questions.
iii) All questions are compulsory.
iv) Internal & general choice have been provided in some questions.
v) Marks allocated to every question are indicated against it.

N.B: Check to ensure 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) If α and β are the zeroes of the polynomial $f(x) = px^2 - 2x + 3p$ and $\alpha + \beta = \alpha\beta$ then the value of p is **1**

(i) $-\frac{2}{3}$ (ii) $\frac{2}{3}$ (iii) $\frac{1}{3}$ (iv) $-\frac{1}{3}$

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

(i) a unique solution. (ii) exactly two solutions.
(iii) infinitely many solutions. (iv) no solution.

(c) If $x = 1$ is a common root of $ax^2 + ax + 2 = 0$ and $x^2 + x + b = 0$, then ab = **1**

(i) 1 (ii) 2 (iii) 3 (iv) 4

(d) If sum of the first five terms of an AP is 30 and the 5^{th} term is 10, then the sum of the first four terms of the AP is **1**

(i) 5 (ii) 10 (iii) 20 (iv) 30

(e) If $\tan 2\theta = \cot(\theta + 15°)$, where 2θ and $(\theta + 15°)$ are acute, the value of θ is **1**

(i) 22° (ii) 25° (iii) 30° (iv) 35°

(f) y-axis divides the join of P(–4, 2) and Q(8, 3) in the ratio **1**

(i) 3 : 1 (ii) 1 : 3 (iii) 2 : 1 (iv) 1 : 2

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

(i) 50° (ii) 60° (iii) 70° (iv) 80°

(h) An arc of a circle is of length 5π cm and the sector it bounds has an area of 20π cm^2. The radius of the circle is **1**

(i) 16 cm (ii) 12 cm (iii) 8 cm (iv) 4 cm

(i) The ratio of the total surface area to the lateral surface area of a cylinder with base radius 80 cm and height 20 cm is **1**

(i) 2 : 1 (ii) 3 : 1 (iii) 4 : 1 (iv) 5 : 1

(j) Two dice are rolled once. The probability of getting such numbers on two dice, whose product is a perfect square, is **1**

(i) 8 (ii) $\frac{1}{8}$ (iii) $\frac{9}{2}$ (iv) $\frac{2}{9}$

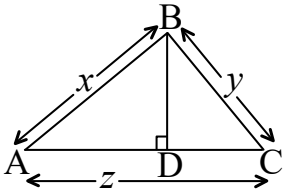
Section – B

2. An army contingent of 616 members is to march behind an army band of 32 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march? **2**

3. Find the value of k for the quadratic equation $kx(x-2)+6=0$ has equal roots. **2**

4. Find the values of y for which the distance between the points P(2, –3) and Q(10, y) is 10 units. **2**

5. In the adjoining figure, ΔABC is a right triangle in which $\angle B = 90°$ and $BD \perp AC$. If AB = x units, BC = y units and AC = z units, then find BD.



2

6. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes. **2**

Section – C

7. **Answer any three from the following questions (a) to (e).** **3 × 3 = 9**

(a) On dividing $x^3 - 3x^2 + x + 2$ by a polynomial g(x), the quotient and remainder were $(x-2)$ and $(-2x+4)$ respectively. Find g(x).

(b) Meena went to a bank to withdraw ₹2000. She asked the cashier to give her ₹50 and ₹100 notes only. Meena got 25 notes in all. Find how many notes of ₹50 and ₹100 she received.

(c) Solve the following pair of linear equations by cross-multiplication method:

$$x - 3y - 7 = 0$$
$$3x - 3y - 15 = 0$$

(d) A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.

(e) A sum of ₹700 is to be used to give seven cash prizes to students of a school for their overall academic performance. If each prize is ₹20 less than its preceding prize, find the value of each of the prizes.

8. **Answer any two from the following questions (a) to (d).** **2 × 3 = 6**

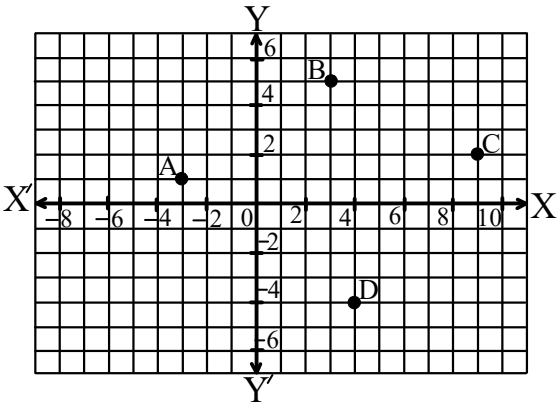
(a) In triangle ABC, right angled at B, if $\tan A = \frac{1}{\sqrt{3}}$, find the value of $\cos A \cos C - \sin A \sin C$, with the help of a right triangle.

(b) If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$, $0° < A + B \leq 90°$, $A > B$, find A and B.

(c) Prove that: $\frac{1 + \sec A}{\sec A} = \frac{\sin^2 A}{1 - \cos A}$, where angle A is an acute angle.

(d) A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with it. The distance between the foot of the tree to the point where the top touches the ground is 8 m. Find the height of the tree.

9. **Case Study based question:** **3**



Four friends are seated at the points A, B, C and D on a lawn keeping social distancing, as shown in the figure above. One more friend wants to join them and sit exactly at the middle position E on a straight line between A and C. Based on the above information, answer the following questions (i) to (iii).

(i) The distance between A and D is

(a) $\sqrt{72}$ units (b) $\sqrt{73}$ units (c) $\sqrt{74}$ units (d) $\sqrt{75}$ units

(ii) The coordinates of the position of E are

(a) $\left(\frac{3}{2}, 3\right)$ (b) $\left(3, \frac{3}{2}\right)$ (c) (6, 3) (d) (3, 6)

(iii) *x*-axis divides the distance/length between B and D in the ratio

(a) 3 : 4 (b) 4 : 3 (c) 5 : 4 (d) 4 : 5

10. **a.** Construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle. (Traces of construction only is required.)

Or **3**

b. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle. (Traces of construction only is required.)

11. **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. How many silver coins, 1.75 cm in diameter and of thickness 2 mm, must be melted to form a cuboid of dimensions 5.5 cm × 10 cm × 3.5 cm?

12. **Answer any two from the following questions (a) to (c).** **2 × 3 = 6**

(a) A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mode of the data:

Number of cars	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	14	13	12	20	11	15	8

(b) The lengths of 40 leaves of a plant are measured correct to the nearest millimeter, and the data obtained is represented in the following table:

Length (in mm)	118-126	127-135	136-144	145-153	154-162	163-171	172-180
Number of leaves	3	5	9	12	5	4	2

Find the median length of the leaves.

(c) 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.

Section – D

13. **a.** Draw the graphs of the equations $x - y + 1 = 0$ and $3x + 2y - 12 = 0$. Determine the coordinates of the vertices of the triangle formed by these lines and the *x*-axis and shade the triangular region.

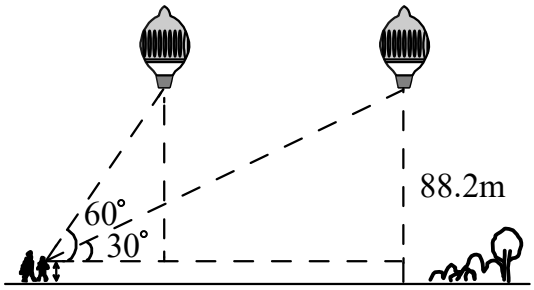
Or **5**

b. Places A and B are 100 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 5 hours. If they travel towards each other, they meet in 1 hour. What are the speeds of the two cars?

14. **a.** A statue, 1.6 m tall, stands on the top of a pedestal. From a point on the ground, the angle of elevation of the top of the statue is 60° and from the same point the angle of elevation of the top of the pedestal is 45°. Find the height of the pedestal.

Or **5**

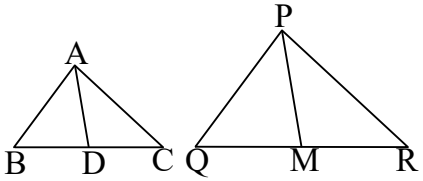
b. A 1.2 m tall girl spots a balloon moving with the wind in a horizontal line at a height of 88.2 m from the ground. The angle of elevation of the balloon from the eyes of the girl at any instant is 60°. After sometime, the angle of elevation reduces to 30°. Find the distance travelled by the balloon during the interval.



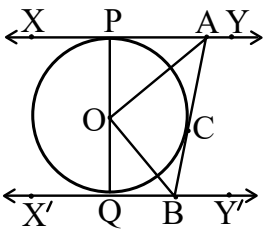
15. **a.** State and Prove Pythagoras Theorem.

Or **5**

b. Sides AB and BC and median AD of a triangle ABC are respectively proportional to sides PQ and QR and median PM of ΔPQR. Show that ΔABC ~ ΔPQR.

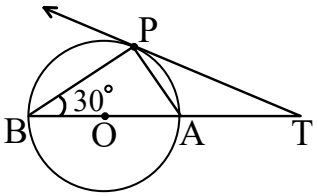


16. **a.** In the adjoining figure, XY and X′Y′ are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting XY at A and X′Y′ at B. Prove that ∠AOB = 90°

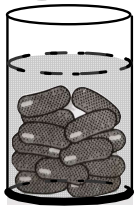


Or **5**

b. In the adjoining figure, O is the centre of the circle and TP is the tangent to the circle from an external point T. If ∠PBT = 30°, prove that BA : AT = 2 : 1



17. **a.** 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.



Or **5**

b. A container, opened from the top and made up of a metal sheet, is in the form of a frustrum of a cone of height 16 cm with radii of its lower and upper ends as 8 cm and 20 cm, respectively. Find the cost of the milk which can completely fill the container @ of ₹20 per litre. Also find the cost of metal sheet used to make the container, if it costs ₹8 per 100 cm^2. [Take $\pi = 3.14$]

18. **a.** The following distribution shows the daily pocket allowance of children of a locality. Find the mean pocket allowance by step-deviation method.

Daily pocket allowance (in ₹)	More than 11	More than 13	More than 15	More than 17	More than 19	More than 21	More than 23
Number of children	64	57	51	42	29	9	4

Or **5**

b. The distribution of heights (in cm) of 96 children is given below:

Height (in cm)	**Number of children**
124-128	5
128-132	8
132-136	17
136-140	24
140-144	16
144-148	12
148-152	6
152-156	4
156-160	3
160-164	1

Draw a less than type cumulative frequency curve for this data and use it to compute median height of the children.

****