ICSE 2023 EXAMINATION
MODEL QUESTION PAPER – 1
MATHEMATICS

Maximum Marks: 80
Time allowed: Two and half hours
Answers to this Paper must be written on the paper provided separately.
You will not be allowed to write during first 15 minutes.
This time is to be spent in reading the question paper.
The time given at the head of this Paper is the time allowed for writing the answers.

Attempt ***all*** *questions from* ***Section A*** *and* ***any four*** *questions from* ***Section B.***
All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
The intended marks for questions or parts of questions are given in brackets [ ].
Mathematical tables are provided.

SECTION A

(Answer ***all*** *questions from this Section)*

***Question* 1 :**

Choose the correct answers to the questions from the given options : **[15]**

(a) A shopkeeper buys goods worth ₹ 4,000 and sells at profit of 8%. If the rate of GST is 5%, then the bill amount is :
(i) ₹ 4,020 (ii) ₹ 4,320 (iii) ₹ 4,538 (iv) ₹ 3,864

(b) For the quadratic equation $ax^2 + bx + c = 0$, we have $b^2 \geq 4ac$, then the roots of the equation are :
(i) equal (ii) 0 each (iii) real and unequal (iv) real and equal

(c) On dividing $x^3 + 4x^2 + 5x + 6$ by x, the remainder is :
(i) 16 (ii) 6 (iii) –5 (iv) 5

(d) If a matrix A is of order 5 × 3 and matrix B is of order 2 × 5; then order of matrix BA is :
(i) 5 × 2 (ii) 2 × 3 (iii) 5 × 5 (iv) 5 × 3

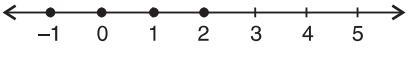
(e) The next two terms of the A.P. , $\sqrt{3}$, $\sqrt{12}$, $\sqrt{27}$,..... are :
(i) 9 and $9\sqrt{3}$ (ii) $6\sqrt{3}$ and $7\sqrt{3}$ (iii) $\sqrt{48}$ and $\sqrt{75}$ (iv) $\sqrt{75}$ and $\sqrt{108}$

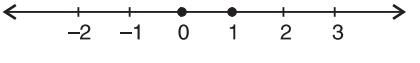
(f) The point P(m, n) is first reflected in x-axis to point P′ and then point P′ is reflected in y-axis to point P″. Then the single transformation that reflects point P to P″ is :
(i) reflection in x-axis (ii) reflection in y-axis
(iii) reflection in origin (iv) invariant

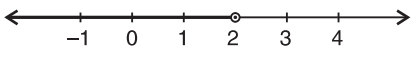
(g) ΔABC and ΔPQR are similar to each other. If ∠A = 45° and ∠R = 55°; then angle C is equal to :
(i) 55° (ii) 80° (iii) 100° (iv) 90°

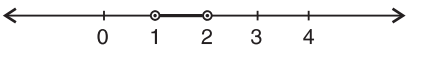
(h) A solid sphere and a solid hemisphere have the same total surface area. The ratio of their diameters is :
(i) $\sqrt{2}$: 3 (ii) 3 : 2 (iii) $\sqrt{3}$: 2 (iv) 3 : $\sqrt{2}$

(i) If $x \in$ W (whole numbers) and $-4x > -2 - 3x$, the solution set on the number line is :

(i) 

(ii) 

(iii) 

(iv) 

(j) A die is tossed once, the probability of getting a number smaller than 8 is :

(i) 0 (ii) 1 (iii) $\frac{1}{2}$ (iv) $\frac{3}{4}$

(k) If matrix $P = \begin{bmatrix} -2 & 0 \\ 4 & -3 \end{bmatrix}$, then P^2 is :

(i) $\begin{bmatrix} 4 & 0 \\ -20 & 9 \end{bmatrix}$ (ii) $\begin{bmatrix} 4 & 0 \\ -20 & -9 \end{bmatrix}$ (iii) $\begin{bmatrix} -4 & 0 \\ -20 & 9 \end{bmatrix}$ (iv) $\begin{bmatrix} 4 & 0 \\ 20 & -9 \end{bmatrix}$

(l) Point P divides join of points A = (0, –5) and B = (10, –5) internally in the ratio 3 : 2 such that point P is nearer to point A. The co-ordinates of point P are :

(i) (4, 0) (ii) (0, –5) (iii) (–4, –5) (iv) (4, –5)

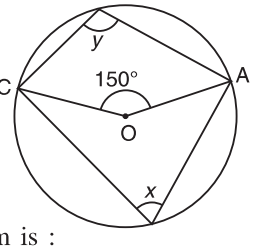
(m) In the adjoining figure, O is centre of the circle and $\angle AOC = 150°$, then the value of $2y - x$ is :

(i) 60°

(ii) 135°

(iii) 45°

(iv) 285°



(n) The sum of three consecutive terms in AP is 48, then the middle term is :

(i) 16 (ii) 12 (iii) 15 (iv) 18

(o) The mean height of 9 students is 1·6 m. If one more student of height 1·56 m joins, the mean height of resulting number of students is :

(i) 1·50 m (ii) 1·956 m (iii) 1·93 m (iv) 1·596 m

***Question* 2 :**

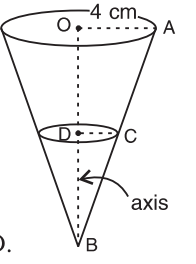
(a) Rohit has a recurring deposit account in a bank for 3 years at the rate of 8% per annum. Find the maturity value of the account, if he gets ₹ 4,995 as interest. **[4]**

(b) If the mean proportion between x and z is y, find the mean proportion between $x^2 + y^2$ and $y^2 + z^2$. **[4]**

(c) Prove that : $\frac{\cos^2 A + \tan^2 A - 1}{\sin^2 A} = \tan^2 A$. **[4]**

***Question* 3 :**

(a) A cone of radius 4 cm is divided into two parts by drawing a plane through the mid-point of its axis and parallel to its base. Compare the volumes of the two parts. **[4]**



(b) ABCD is a parallelogram in which vertices B = (5, 8), C = (4, 7) and D = (2, –4). Find : **[4]**

(i) the co-ordinates of vertex A. (ii) the equation of diagonal BD.

(c) On a graph paper plot the triangle ABC whose vertices are at points A(5, 4), B(7, 5) and C(–3, 6). On the same graph, draw the image of the triangle ABC under reflection in the line $y = 3$. Mark any two points on the graph paper which are invariant under this reflection. Also, write the co-ordinates of points marked. **[5]**

SECTION B

*(Attempt **any four** questions from this section)*

***Question* 4 :**

(a) Rita went to a shop to purchase an article A with MRP = ₹ 850 and rate of GST = 12%. How much will Rita pay for this article ? **[3]**

If instead of article A, Rita purchases some other article B with MRP = ₹ 1,200 and rate of GST = 18%, find how much extra money will she pay to the shopkeeper ?

(b) Solve the equation $3x^2 - 4x - 4 = 0$ by using formula giving answer correct to three decimal places. **[3]**

(c) The following table shows the marks obtained (out of 100) by different students of class X. **[4]**

Marks	50-60	60-70	70-80	80-90	90-100
No. of students	8	16	28	38	10

Taking suitable scales on both the axes, draw a histogram and use it to estimate mode.

***Question* 5 :**

(a) If matrix $M = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, find $M^2 + 3$. **[3]**

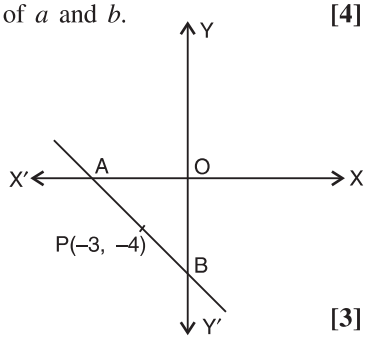
(b) The radii of two concentric circles are 6 cm and 10 cm respectively. Find the length of the chord of the bigger circle which is tangent to smaller circle. **[3]**

(c) If $x^2 - 3x + 2$ is a factor of $x^3 - ax^2 + b$, find the values of a and b. **[4]**

***Question* 6 :**

(a) In the given figure, P(–3, –4) is the mid-point of the line-segment AB. **[3]**

Find the co-ordinates of points A and B. Also, find the equation of the line passing through the point P and also perpendicular to line-segment AB.



(b) Prove that : $\left(1 + \frac{1}{\tan^2 A}\right)\left(1 + \frac{1}{\cot^2 A}\right) = \frac{1}{\sin^2 A - \sin^4 A}$. **[3]**

(c) If the 3rd and the 9th terms of an arithmetic progression are 4 and –8 respectively. Which term of it is zero ? **[4]**

***Question* 7 :**

(a) A and B are two events such that P(A) = 0·56 and P(B) = 0·64, find : **[3]**

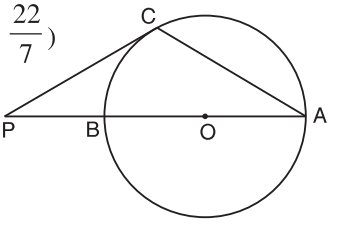
(i) P(not A) (ii) P(not B)

(b) A largest possible sphere is carved out from a solid wooden cube of side 7 cm. Find : **[3]**

(i) the volume of sphere

(ii) the percentage of wood wasted in the process (Take $\pi = \frac{22}{7}$)

(c) As shown in the figure, the tangent at point C of the circle and diameter AB when produced intersect at point P. If angle PCA = 110°, find the angle CBA. **[4]**



***Question* 8 :**

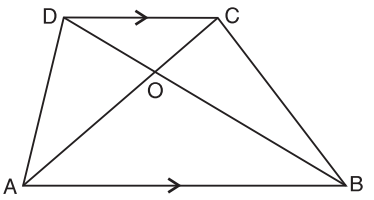
(a) Calculate the mean, by step-deviation method, for the frequency distribution given below : **[3]**

Class-interval	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	6	14	30	48	32	16	10	4

(b) Solve $\frac{x}{4} > \frac{5x-2}{3} - \frac{7x-3}{5}$, $x \in R$. Also represent the solution set on the number line. **[3]**

(c) The given figure shows a quadrilateral ABCD in which AB is parallel to CD. **[4]**

If OA = $3x - 19$, OB = $x - 3$, OC = $x - 5$ and OD = 3, find the value of x.



***Question* 9 :**

(a) A trader buys x identical articles for ₹ 600. If the cost per article were ₹ 5 more, the number of articles that can be bought for ₹ 600 would be four less. Find the value of x. **[4]**

(b) The marks obtained by 120 students in a Mathematics test are given below : **[6]**

Marks	No. of students	Marks	No. of students
0-10	5	50-60	18
10-20	9	60-70	11
20-30	16	70-80	6
30-40	22	80-90	4
40-50	26	90-100	3

Using the informations, given above, draw an ogive on a graph sheet. Take a suitable scale for your ogive. Use the ogive drawn to estimate :

(i) the median marks.

(ii) the number of students who obtained more than 75% marks in the test.

(iii) the number of students who did not pass in the test if the pass percentage was 40.

***Question* 10 :**

(a) If $x = \dfrac{\sqrt{2a+1}+\sqrt{2a-1}}{\sqrt{2a+1}-\sqrt{2a-1}}$, prove that : $x^2 - 4ax + 1 = 0$. **[3]**

(b) Construct a cyclic quadrilateral ABCD in which AC = 4·5 cm, $\angle ABC = 45°$, AB = 3 cm and AD = 2·3 cm. **[3]**

(c) From the top of a cliff, the angles of depression of the top and bottom of a tower are observed to be 45° and 60° respectively. If the height of the tower is 20 m, find : **[4]**

(i) the height of the cliff. (ii) the distance between the cliff and the tower.

MODEL QUESTION PAPER – 2

SECTION A

*(Answer **all** questions from this Section)*

***Question* 1 :**

Choose the correct answers to the questions from the given options : **[15]**

(a) An article is bought for ₹ 60,000 and sold at a discount of 10%. If the rate of GST is 18%, then the bill amount is :

(i) ₹ 60,720 (ii) ₹ 77,880 (iii) ₹ 54,120 (iv) ₹ 63,720

(b) If the discriminant of quadratic equation $ax^2 + bx + c = 0$ is equal to zero, then the roots of the equation are :

(i) $-\dfrac{b}{2a}$ each (ii) $\dfrac{b}{2a}$ each (iii) $-\dfrac{a}{2b}$ each (iv) $\dfrac{b}{2b}$ each

(c) If the polynomial $x^{33} - x^{22} + 3$ is divided by $x + 1 = 0$, the remainder is :

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

(d) If matrix $M = \begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix}$, then the matrix $-2M + 2$ is :

(i) $\begin{bmatrix} 0 & -6 \\ 4 & -8 \end{bmatrix}$ (ii) $\begin{bmatrix} 0 & -4 \\ 6 & 8 \end{bmatrix}$ (iii) $\begin{bmatrix} 4 & 12 \\ 0 & -4 \end{bmatrix}$ (iv) $\begin{bmatrix} -4 & 0 \\ -8 & 6 \end{bmatrix}$

(e) If the 23rd term of an A.P. exceeds its 32nd term by –18, then its common difference is :

(i) 3 (ii) 2 (iii) –2 (iv) 5

(f) The point A(5, 4) is reflected in line $2(x + 1) = 12$ to point A′. The co-ordinates of point A′ are :

(i) (5, 4) (ii) (–5, 4) (iii) (–5, –4) (iv) (5, –4)

(g) If in ΔABC and ΔDEF, $\frac{AB}{DE} = \frac{BC}{FD}$, then the two triangles will be similar to each other, if:

(i) $\angle A = \angle F$ (ii) $\angle B = \angle D$ (iii) $\angle B = \angle E$ (iv) $\angle A = \angle D$

(h) From a solid cylinder of height h cm and base radius r cm, a conical cavity of the same height and same radius is drilled out.

If the slant height of the conical cavity is l cm, the surface area of the remaining solid is :

(i) $2\pi rh + \pi rl$ (ii) $2\pi rh - \pi r^2 + \pi rl$

(iii) $2\pi rh + \pi rl + \pi r^2$ (iv) $2\pi rh - \pi rl + \pi r^2$

(i) If x is a positive integer and $15 - 2(2x - 1) < 15$, the solution set is :

(i) {–2, –1} (ii) {1, 2, 3, 4, 5, ...}

(iii) {0, 1, 2, 3, 4, ...} (iv) {1, 2, 3, 4, 5, 6}

(j) Mohit and Arjun are friends and were born in the year 2005. The probability that they were born on different days is :

(i) 1 (ii) 0 (iii) $\frac{1}{365}$ (iv) $\frac{364}{365}$

(k) If $m \times \begin{bmatrix} 2 \\ 3 \end{bmatrix} + n\begin{bmatrix} -1 \\ 1 \end{bmatrix} = \begin{bmatrix} 10 \\ 5 \end{bmatrix}$, then the values of m and n are :

(i) $m = -3, n = -4$ (ii) $m = 3, n = -4$

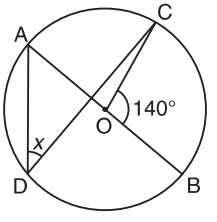
(iii) $m = -3, n = 4$ (iv) $m = 3, n = 4$

(l) The centroid of triangle ABC is G = (6, –3). If A = (–6, –3), B = (x, 6) and C = (9, y), then the values of x and y are :

(i) $x = 6, y = 15$ (ii) $x = 15, y = -12$

(iii) $x = 15, y = 6$ (iv) $x = -15, y = 6$

(m) In the adjoining figure, O is centre of the circle. If angle BOC = 140°, the value of x is :



(i) 70°

(ii) 30°

(iii) 40°

(iv) 20°

(n) The next two terms of the arithmetic progression (A.P.) $\sqrt{3}, \sqrt{12}, \sqrt{27}, ...$ are :

(i) 9 and $9\sqrt{3}$ (ii) $4\sqrt{3}$ and $5\sqrt{3}$

(iii) $2\sqrt{3}$ and $5\sqrt{3}$ (iv) 2 and $3\sqrt{3}$

(o) The mean of 6 different data is 12. If 5 of these data are 16, 18, 12, 13 and 8; the sixth data is :

(i) 63 (ii) 6 × 12 (iii) 5 (iv) 12 × 3

***Question* 2 :**

(a) A man deposits ₹ 1,800 per month in a recurring deposit account for 2 years. If he gets ₹ 3,600 as interest at the time of maturity, find the rate of interest. **[4]**

(b) Find the value of x so that $2x - 1$, $5x - 6$, $6x + 2$ and $15x - 9$ are in continued proportion. **[4]**

(c) Prove that : $\dfrac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \dfrac{\cos\theta}{1 - \sin\theta}$. **[4]**

***Question* 3 :**

(a) Solid metallic spheres of diameters 12 cm, 16 cm and 20 cm respectively, are melted to form a single solid sphere. Find the radius of the resulting sphere. **[4]**

(b) Find the equation of the line through the point (–1, –2) and perpendicular to line $3x + 4y = 5$. **[4]**

(c) On a graph paper, plot the triangle ABC whose vertices are at the points A(4, 2), B(4, –1) and C(6, 3). On the same graph, draw the image of the triangle ABC under reflection in the line $x = 2$. Mark any two points on the graph paper which are invariant under this reflection. Also, write the co-ordinates of points marked. **[5]**

SECTION B

*(Attempt **any four** questions from this section)*

***Question* 4 :**

(a) A dealer from Banaras supplies goods/services, worth ₹ 1,00,000 to a dealer in Banglore at 30% discount. If the rate of GST is 5%, find the amount of bill in Banglore. **[3]**

(b) Solve the equation $3x^2 - x - 7 = 0$ and give your answer correct to two decimal places. **[3]**

(c) For the following frequency distribution and taking suitable scales on both the axes, draw a histogram. **[4]**

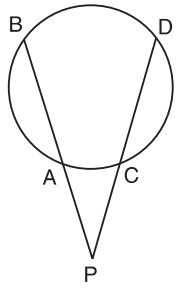
Class-interval	45-60	60-75	75-90	90-105	105-120	120-135
Frequency	8	6	16	22	12	4

Use the graph drawn to estimate the value of the mode.

***Question* 5 :**

(a) If matrix $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$ and matrix $B = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$, find : AB – B. **[3]**

(b) In the given figure, PA = 14 cm, PC = 16 cm and CD = 18 cm, find the length of AB. **[3]**



(c) If $2x^3 + ax^2 + bx - 6$ has a factor $(2x + 1)$ and leaves the remainder 12 when divided by $(x + 2)$. Calculate the values of a and b hence factorise the given expression completely. **[4]**

***Question* 6 :**

(a) Points A, B and C divide the line segment joining the points D(8, –4) and E(–12, 16) in four equal parts. Find the equation of the line that passes through point A and is perpendicular to DE. **[3]**

(b) Prove that : $\dfrac{\tan A}{1 - \cot A} + \dfrac{\cot A}{1 - \tan A} = \sec A \cdot \text{cosec } A + 1$. **[3]**

(c) Which term of the arithmetic progression 3, 15, 27, 39, ... will be 132 more than its 54th term ? **[4]**

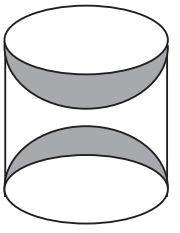
***Question* 7 :**

(a) Five cards Ten, Jack, Queen, King and Ace of diamonds are shuffled face downwards. Then one card is picked at random. **[3]**

(i) What is the probability that the card picked is queen ?

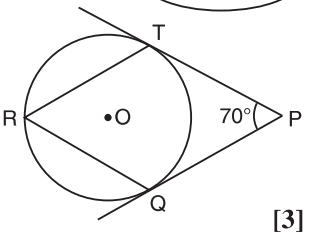
(ii) If a king is drawn first and put aside, what is the probability that the second card picked up is the ace ?

(b) A wooden article was made by scooping out a hemisphere from each side of a solid cylinder as shown in the figure. **[3]**



If the height of the cylinder is 12 cm and its base is of radius 4·2 cm, find the total surface area of the article. (Take $\pi = \frac{22}{7}$).

(c) In the given figure, O is the centre of the circle. PT and PQ are tangents to the circle from an exterior point P. If angle TPQ = 70°, find angle TRQ. **[4]**



***Question* 8 :**

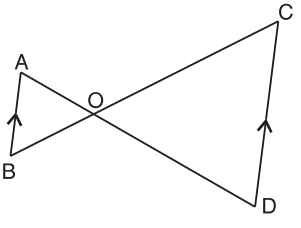
(a) The weights of 150 mangoes were recorded as given below : **[3]**

Weight in gms	Number of mangoes
160-170	15
170-180	24
180-190	30
190-200	36
200-210	24
210-220	12
220-230	9

Calculate the mean weight (to the nearest gram) by step-deviation method.

(b) Solve : $-\frac{1}{5} \leq \frac{3x}{10} + 1 < \frac{2}{5}$, $x \in R$. Graph the solution set on the number line. **[3]**

(c) In the given figure, AB//CD, AB = 12 cm, OB = $(3x + 3)$ cm, CD = $5x$ cm and OC = $(6x + 1)$ cm. Find the value of x. **[4]**



***Question* 9 :**

(a) A piece of cloth costs ₹ 200. If the piece were 5 m longer and each metre of cloth costs ₹ 2 less, the cost of piece would have remained unchanged. How long is the piece and what is its original rate per metre ? **[4]**

(b)

Monthly income (in ₹ thousand)	6-7	7-8	8-9	9-10	10-11	11-12	12-13
No. of workers	40	68	86	120	90	40	26

Draw an ogive for the given data and from it, determine : **[6]**

(i) the median income.

(ii) the number of employees whose income exceeds ₹ 11,800.

[Take 2 cm = ₹ 1,000 on one axis and 2 cm = 50 employees on the other].

***Question* 10 :**

(a) If $x = \dfrac{12mn}{m+n}$, find the value of : $\dfrac{x+6m}{x-6m} + \dfrac{x+6n}{x-6n}$. **[3]**

(b) Construct a triangle BCP with BC = 5 cm, BP = 4 cm and ∠PBC = 45°. **[3]**

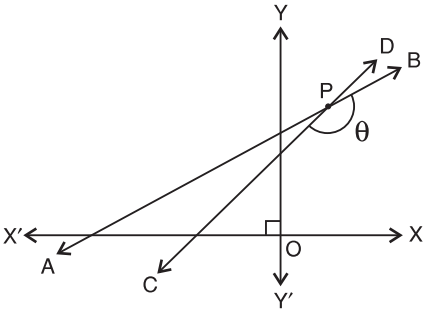
Complete the rectangle ABCD, such that :

(i) P is equidistant from AB and BC.

(ii) P is equidistant from C and D.

Measure and record the length of AB.

(c) The figure drawn alongside (not drawn to scale) shows two straight lines AB and CD. If the equation of line AB is : $x - \sqrt{3}\,y + 5 = 0$ and the equation of line CD is : $x - y = 2$; write down the inclinations of lines AB and CD; also find the angle θ *i.e.*, angle CPB. **[4]**



MODEL QUESTION PAPER – 3

SECTION A

*(Answer **all** questions from this Section)*

***Question* 1 :**

Choose the correct answers to the questions from the given options : **[15]**

(a) The marked price of an essential item is ₹ 1,500. If it is sold at 14% discount, then the bill amount including GST is :

(i) ₹ 1,290 (ii) ₹ 1,710 (iii) ₹ 1795.50 (iv) ₹ 1354.50

(b) Which of the following equations has two real and distinct roots ?

(i) $2x^2 - 3\sqrt{2}\,x + \dfrac{9}{4} = 0$ (ii) $x^2 + x - 5 = 0$

(iii) $x^2 + 3x + 2\sqrt{2} = 0$ (iv) $7x^2 - 3x + 1 = 0$

(c) The value of the polynomial $x^2 - 2\sqrt{2}\,x + 3$ when $x = 2\sqrt{2}$ is :

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

(d) $\begin{bmatrix} 7 & -4 \\ 3 & 8 \end{bmatrix} = \begin{bmatrix} p & q \\ r & s \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, the values of p, q, r and s are respectively :

(i) $p = 7$, $q = 3$, $r = -4$ and $s = 8$ (ii) $p = 7$, $q = -4$, $r = 3$ and $s = 8$

(iii) $p = -4$, $q = 7$, $r = 8$ and $s = 3$ (iv) $p = 3$, $q = 8$, $r = 7$ and $s = -4$

(e) If the sum of three numbers in A.P. is 48; then the middle term is :

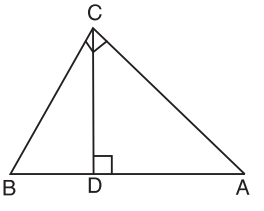
(i) 16 (ii) 18 (iii) 12 (iv) 6

(f) The point P(–6, –3) is reflected in line $y + 3 = 0$ to point P′. The co-ordinates of point P′ are:

(i) (–6, 3) (ii) (–6, –3) (iii) (6, 3) (iv) (6, –3)

(g) In the given figure, ∠BCA = ∠CDA = 90°, then the value of $\dfrac{CD}{AD}$ is :

(i) $\dfrac{BC}{CA}$ (ii) $\dfrac{BD}{AD}$ (iii) $\dfrac{BD}{CD}$ (iv) $\dfrac{CA}{BC}$



(h) A cylindrical can with radius 10 cm and height 20 cm, is kept on a horizontal surface and then filled with water upto 10 cm. The total wetted surface of the can is. (Take $\pi = 3{\cdot}14$).

(i) 871 cm^2 (ii) 624 cm^2 (iii) 314 cm^2 (iv) 942 cm^2

(i) The solution set for $-3 < x - 2 \leq 9$, $x \in Z$ (integers) is :

(i) {0, 1, 2, 3, 4, ..., 11} (ii) {1, 2, 3, 4, ..., 10}

(iii) {–1, 0, 1, 2, 3, ..., 10} (iv) {1, 2, 3, 4, 5, ..., 11}

(j) If 55% of the population of a small town is purely vegetarian, 36% of the population is purely non-vegetarian and the rest are both. The probability, that a person chosen at random from the town is vegetarian and non-vegetarian both, will be :

(i) 0·91 (ii) 0·55 (iii) 0·36 (iv) 0·09

(k) If $\begin{bmatrix} 2b & 8 \\ 9 & a+b \end{bmatrix} = \begin{bmatrix} 6 & 8 \\ 9 & 8 \end{bmatrix}$, then the value of a is :

(i) 5 (ii) 11 (iii) 8 (iv) 9

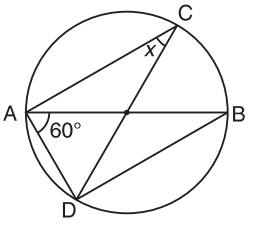
(l) Line $3x + 4y = 24$ meets x-axis at point A and y-axis at point B. If the point P divides line segment AB internally in the ratio 2 : 1, the co-ordinates of point P are :

(i) (3, 4) (ii) (4, 3) (iii) $(4, 2\frac{2}{3})$ (iv) $(2\frac{2}{3}, 4)$

(m) In the adjoining figure, AB is diameter of the given circle and $\angle BAD = 60°$, then the value of x is :

(i) 30° (ii) 60°

(iii) 45° (iv) 20°



(n) Which term of the A.P. 1, 4, 7, 10, ... is 88 ?

(i) 28th (ii) 30th (iii) 32nd (iv) 40th

(o) Given :

Marks obtained	Less than 20	Less than 30	Less than 40
Number of students	20	30	40

For the data, given above, the less than cumulative frequency for less than 40 is :

(i) 90 (ii) 40 (iii) 50 (iv) 70

***Question* 2 :**

(a) Govinda opened a R.D. account in a bank for 2 years 4 months. If the rate of interest is 8% per year and the bank pays him ₹ 7,369.60 on maturity, find how much per month did Govinda deposit ? **[4]**

(b) If $x + 5$ is the mean proportion of $x + 2$ and $x + 9$, find the value of x. **[4]**

(c) Prove that : $\tan A + \cot A = \sec A \cdot \text{cosec } A$. **[4]**

***Question* 3 :**

(a) A cylindrical vessel of diameter 14 cm and height 42 cm is fixed symmetrically inside a similar vessel of radius 8 cm and height 42 cm. The total space between the two vessels is filled with glass-wool for heat insulation. Find the volume of the glass-wool required. **[4]**

(b) In square ABCD, the vertex A = (2, 8) and vertex C = (8, 3). Find the equation of the diagonal BD. **[4]**

(c) Use graph paper for this question. Take 1 cm = 1 unit on both x and y axes. **[5]**

(i) Plot the following points on your graph sheets : A(–4, 0), B(–3, 2), C(0, 4), D(4, 1) and E(7, 3)

(ii) Reflect the points B, C, D and E on the x-axis and name them as B′, C′, D′ and E′ respectively.

(iii) Join the points A, B, C, D, E, E′, D′, C′, B′ and A in order.

(iv) Name the closed figure formed.

SECTION B

*(Attempt **any four** questions from this section)*

***Question* 4 :**

(a) For the inter-state supply of the following goods/services, find the amount of bill : **[3]**

MRP (in ₹)	2,500	3,000	4,000	5,000
GST%	12	18	5	12
Discount%	20	30	25	40

(b) Solve the quadratic equation $x^2 - 3(x + 3) = 0$ and give your answer correct to two significant figures. **[3]**

(c) The following table shows the distribution of the marks obtained by 50 students in an aptitude test. **[4]**

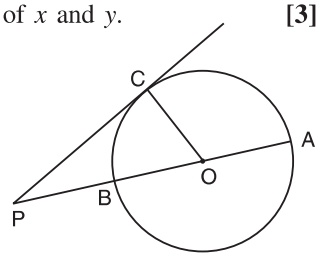
Marks obtained	15	18	21	24	27	30
No. of students	6	18	12	8	4	2

Find the mean, the median and the mode of the distribution.

***Question* 5 :**

(a) If $2\times\begin{bmatrix} x & 6 \\ y & 8 \end{bmatrix} + 3\times\begin{bmatrix} 1 & -1 \\ 0 & 2 \end{bmatrix} = 3\times\begin{bmatrix} 3 & 3 \\ 4 & 6 \end{bmatrix}$, find the values of x and y. **[3]**

(b) In the given figure, AB is diameter and PC is tangent to the circle with centre O. If AP = 40 cm, CP = 20 cm, find the radius of the circle. **[3]**



(c) Using remainder theorem, factorise $6x^3 - 11x^2 - 3x + 2$ completely. **[4]**

***Question* 6 :**

(a) In rhombus ABCD, the co-ordinates of point A and C are (2, –6) and (–4, 8) respectively. Find the equation of the diagonal BD. **[3]**

(b) Prove that : $\sqrt{\frac{\sec A - 1}{\sec A + 1}} + \sqrt{\frac{\sec A + 1}{\sec A - 1}} = 2 \text{ cosec } A$. **[3]**

(c) For what value of n, the nth term of A.P. 63, 65, 67, ... and nth term of A.P. 3, 10, 17, ... are equal ? **[4]**

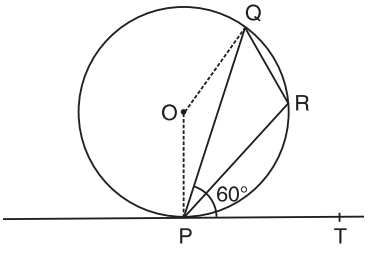
***Question* 7 :**

(a) Three coins are tossed once. Find the probability of getting : **[3]**

(i) 3 heads (ii) exactly 2 heads (iii) atleast 2 heads

(b) 504 metallic cones, each of diameter 3·5 cm and height 3 cm, are melted and recast into a sphere. Find the diameter of sphere so formed. **[3]**

(c) In the given figure, PQ is a chord of a circle with centre O and PT is the tangent at point P. If angle QPT = 60°, then find angle PRQ where R is a point on the circle. **[4]**



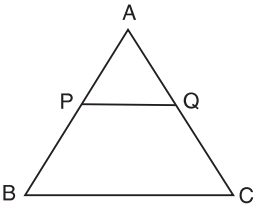
***Question* 8 :**

(a) The following table shows a record of the weights, in kilogram, of 100 pupil. Find the mean weight. **[3]**

Weight	Number of pupils
50-53	15
53-56	18
56-59	20
59-62	25
62-65	16
65-68	6

(b) Solve : $13x - 5 < 15x + 4 < 7x + 12$, $x \in R$. Represent the solution set on a real number line. **[3]**

(c) P and Q are points on the sides AB and AC of triangle ABC. If AP = 3 cm, PB = 6 cm, AQ = 4·5 cm and QC = 9 cm, show that BC = 3 × PQ. **[4]**



***Question* 9 :**

(a) The speed of a boat in still water is 11 km per hour. It can go 12 km upstream and return downstream to the original point in 2 hours 45 minutes. Find the speed of stream. **[4]**

(b) The marks obtained (out of 100) by 400 students in an examination are given below : **[6]**

Marks	No. of students	Marks	No. of students
0-10	10	50-60	76
10-20	20	60-70	80
20-30	22	70-80	58
30-40	40	80-90	28
40-50	54	90-100	12

Using a graph paper, draw an ogive for the above distribution. Use your ogive to estimate :

(i) the median marks.

(ii) the number of students who obtained more than 80% marks in the examination.

(iii) the number of students who did not pass, if the pass percentage was 35.

***Question* 10 :**

(a) If $\frac{7a+8b}{7c+8d} = \frac{7a-8b}{7c-8d}$, prove that : **[3]**

(i) $a : b = c : d$ (ii) $\frac{4a-5b}{4c-5d} = \frac{3a+4b}{3c+4d}$

(b) Construct a regular hexagon of side 3 cm. Draw its circumcircle and measure its circumradius. **[3]**

(c) The horizontal distance between two towers is 150 m. The angle of depression of the top of one tower as observed from the top of other tower, which is 120 m in height, is 30°. Find the height of the first tower. **[4]**

MODEL QUESTION PAPER – 4

SECTION A

*(Answer **all** questions from this Section)*

***Question* 1 :**

Choose the correct answers to the questions from the given options : **[15]**

(a) A dealer in Lucknow (U.P.) sells goods worth ₹ 50,000 to a dealer in Agra (U.P.). If the rate of GST is 18%, the CGST is :

(i) ₹ 3,000 (ii) ₹ 6,000 (iii) ₹ 4,500 (iv) Nil

(b) If $x = 3$ is a root of the quadratic equation $x^2 - 2kx - 6 = 0$, then the value of k is :

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

(c) If on dividing $4x^2 - 3kx + 3$ by $(x + 2)$, the remainder is $k - 1$, then the value of k is :

(i) 4 (ii) –4 (iii) 3 (iv) –3

(d) If $A = \begin{bmatrix} 3 & 4 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 9 & 16 \\ 0 & -x \end{bmatrix}$ such that $A^2 = B$, then the value of x is :

(i) 4 (ii) –1 (iii) 1 (iv) –4

(e) If $a - 1$, $a + 3$ and $3a - 1$ are in A.P. then the value of a is :

(i) 2 (ii) 4 (iii) –2 (iv) –4

(f) The point A(4, 2) is reflected in x-axis to point A′. Point A′ is further reflected in the line $y + 2 = 0$ to point A″. The co-ordinates of the point A″ are :

(i) (–4, –2) (ii) (–4, 2) (iii) (4, 2) (iv) (4, –2)

(g) The perimeters of two similar triangles ABC and LMN are 120 cm and 96 cm respectively. If LM = 16 cm, then the length of AB is :

(i) 20 cm (ii) 16 cm (iii) 15 cm (iv) 12 cm

(h) The total surface area of a hemisphere with radius 10 cm, taking $\pi = 3{\cdot}14$, is :

(i) 942 cm^2 (ii) 94·2 cm^2 (iii) 9420 cm^2 (iv) 1882 cm^2

(i) The solution for $1 < 3 - 2x \leq 7$; $x \in N$ (natural numbers) is :

(i) {8} (ii) {–1, –2} (iii) { } (iv) {1}

(j) A game of cards has cards marked with number x such that $9 < x \leq 43$. If a card is drawn at random, the probability of the number to be a perfect square is :

(i) $\frac{1}{34}$ (ii) $\frac{3}{43}$ (iii) $\frac{3}{34}$ (iv) $\frac{40}{43}$

(k) If matrix $\begin{bmatrix} m-n & 8 \\ 7 & m+n \end{bmatrix}$ = matrix $\begin{bmatrix} 2 & 8 \\ 7 & 8 \end{bmatrix}$, then the values of m and n are :

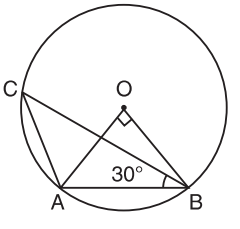
(i) $m = 2$, $n = 2$ (ii) $m = 5$, $n = 3$ (iii) $m = 3$, $n = 3$ (iv) $m = 3$, $n = 2$

(l) P$(m, m - 2)$ is the mid-point of the line segment AB, where A = (4, 6) and B = (–4, –10), then the value of m is :

(i) 0 (ii) –2 (iii) 2 (iv) 4

(m) In the given figure, O is centre of the circle, ∠AOB = 90° and ∠ABC = 30°, the measure of ∠CAO is :

(i) 45°
(ii) 90°
(iii) 60°
(iv) 75°



(n) Which term of the A.P. 27, 24, 21, 18, ... is the first negative term ?

(i) 10th (ii) 11th (iii) 12th (iv) 9th

(o) For the following distribution, the upper quartile is :

Number	20	25	30	35	40	45	50
Frequency	1	2	5	6	3	2	1

(i) 35 (ii) 30 (iii) 45 (iv) 40

***Question* 2 :**

(a) A cummulative deposit account of monthly instalment of ₹ 3,600 at 9% p.a. simple interest earns an interest of ₹ 17,982. Find the number of instalments paid. **[4]**

(b) Find the mean proportion between $\frac{a-b}{a+b}$ and $\frac{a^2b^2}{a^2-b^2}$. **[4]**

(c) Prove that : $(\sin A + \sec A)^2 + (\cos A + \text{cosec } A)^2 = (1 + \sec A \cdot \text{cosec } A)^2$. **[4]**

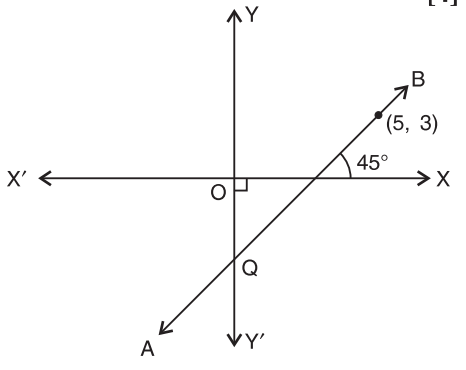
***Question* 3 :**

(a) Two equal cones are touching each other completely at the base circle. Given that the distance between the two vertices is 16 cm and the diameter of the base circle is 12 cm, find the total surface area of this solid. **[4]**

(b) Use the information given in the figure alongside and find : **[4]**

(i) the equation of line AB.

(ii) the co-ordinates of point Q.



(c) Points (4, 0) and (–3, 0) are invariant points under reflection in line L_1; points (0, 5) and (0, –2) are invariant under reflection in line L_2. **[5]**

(i) Name and write the equations of lines L_1 and L_2.

(ii) Write P′, the reflection of P(6, –8) in L_1 and P″ the image of P in L_2.

(iii) State a single transformation that maps P′ onto P″.

SECTION B

*(Attempt **any four** questions from this section)*

***Question* 4 :**

(a) For the following intra-state supply of goods/services, find the amount of bill, if the rate of GST is 12%. **[3]**

No. of items	25	40	30	50
MRP (in ₹) of each item	60	75	80	50
Discount%	30	40	20	50

(b) Solve the quadratic equation $\frac{1}{2}x^2 - \sqrt{11}\,x + 1 = 0$ by using formula giving the answer correct to three significant figures. **[3]**

(c) For the following frequency distribution, draw a histogram on a graph paper. **[4]**

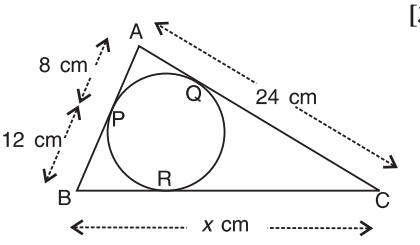
Class interval	80-100	100-120	120-140	140-160	160-180	180-200
Frequency	4	16	24	28	16	12

Use the graph drawn to estimate the mode for the given data.

***Question* 5 :**

(a) If matrix P = $\begin{bmatrix} \text{cosec}^2\theta & 0 \\ \tan^2\theta & \cos^2\theta \end{bmatrix}$ and matrix Q = $\begin{bmatrix} -\cot^2\theta & -1 \\ -\sec^2\theta & \sin^2\theta \end{bmatrix}$, find the matrix P + Q. **[3]**

(b) In the given figure, triangle ABC is circumscribed by the given circle. Use the given information to find the value of x. **[3]**



(c) Factorise completely using factor theorem : $6x^3 - 11x^2 - 3x + 2$. **[4]**

***Question* 6 :**

(a) A(8, 6), B(10, –10) and C(4, –4) are the vertices of triangle ABC. If P is mid-point of side AB and Q is mid-point of side AC, show that PQ is parallel to side BC also show 2 × PQ = BC. **[3]**

(b) Prove that : $\tan^2 A + \cot^2 A + 2 = \sec^2 A \cdot \text{cosec}^2 A$. **[3]**

(c) In an A.P., eight times of 8th term is equal to fifteen times the fifteenth term. Find the 23rd term of the A.P. **[4]**

***Question* 7 :**

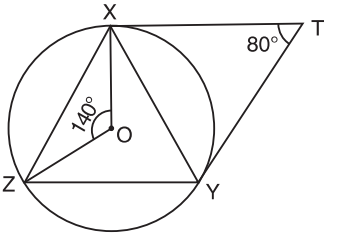
(a) Cards numbered 11 to 60 are kept in a box. If a card is drawn at random from the box, find the probability that the number on the drawn card is : **[3]**

(i) a perfect square number (ii) divisible by 5

(iii) a prime number less than 20.

(b) A cylindrical vessel with internal diameter 10 cm and height 10·5 cm is full of water. A solid cone of base diameter 7 cm and height 6 cm is completely immersed in water in the vessel. Find the volume of water left in the cylinder. (Take $\pi = \frac{22}{7}$) **[3]**

(c) In the given figure, O is the centre of the circumcircle of triangle XYZ. Tangents at points X and Y intersect at point T. If angle XTY = 80° and angle XOZ = 140°, find the angle ZXY. **[4]**



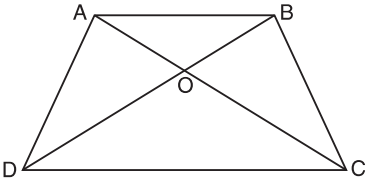
***Question* 8 :**

(a) Using assumed mean method, calculate the mean. **[3]**

Class-interval	Frequency
0-30	22
30-60	30
60-90	40
90-120	36
120-150	28
150-180	20

(b) Find the set of values of x satisfying $7x + 3 \geq 3x - 5$ and $\frac{x}{4} - 5 \leq \frac{5}{4} - x$, $x \in N$. **[3]**

(c) In the given figure, $\frac{OA}{OC} = \frac{OB}{OD} = \frac{2}{5}$. Find AB if DC = 24 cm. **[4]**



***Question* 9 :**

(a) If two pipes function simultaneously, the empty reservior will be filled in 12 hours. One pipe fills the empty reservior 10 hours faster than the other. How many hours does it take the second pipe to fill the empty reservior ? **[4]**

(b) The marks of 200 students are as given below : **[6]**

Marks	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99
No. of students	7	11	20	46	57	37	15	7

Draw a cumulative frequency curve and find :

(i) median marks.

(ii) if 80% of the students passed, find the passing marks.

***Question* 10 :**

(a) Solve for x : $\frac{5x + (x^2 - 1)}{5x - (x^2 - 1)} = \frac{7}{5}$. **[3]**

(b) Using ruler and compasses only, construct **[3]**

(i) a triangle ABC in which angle ABC = 45°, AB = 8·6 cm and BC = 9·8 cm

(ii) construct a circle of radius 2·5 cm which touches the arms of the angle BAC of Δ ABC given above.

(c) The angle of elevation of a cloud from a point h metres above the surface of a lake is θ and the angle of depression of its reflection in the lake is ϕ. Prove that the height of the cloud above the lake surface is : $h\left(\frac{\tan\phi + \tan\theta}{\tan\phi - \tan\theta}\right)$. **[4]**

SECTION A

*(Answer **all** questions from this Section)*

***Question* 1 :**

Choose the correct answers to the questions from the given options : **[15]**

(a) 20 identical articles are sold at ₹ 350 with GST = 12%. 10 other types of identical articles are sold at ₹ 500 each with GST = 18%. Total amount of bill is :

(i) ₹ 12,000 (ii) ₹ 13,440 (iii) ₹ 13,740 (iv) ₹ 14,160

(b) The roots of the quadratic equation $ax^2 + x + b = 0$ are equal, if :

(i) $b^2 = 4a$ (ii) $b^2 > 4a$ (iii) $b^2 > 4b$ (iv) $b = \frac{1}{4a}$

(c) When $x^2 - 5x + p$ is divided by $(x - 2)$, the remainder is 3. Then the value of of p is :

(i) 9 (ii) –9 (iii) –6 (iv) 6

(d) If $\begin{bmatrix} 8 & 0 \\ 0 & 8 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 24 \\ -24 \end{bmatrix}$ then the values of x and y are :

(i) $x = 3, y = -3$ (ii) $x = 48, y = 0$ (iii) $x = 0, y = 48$ (iv) $x = 16, y = -32$

(e) Which term of the A.P. 30, 27, 24, 21, ... is the first negative term ?

(i) 10th (ii) 11th (iii) 14th (iv) 12th

(f) Points A and B have co-ordinates A(3, 6) and B(1, 4). A′ is the reflection of point A in the x-axis and B′ is the reflection of point B in the line AA′. Then the co-ordinates of point B′ are :

(i) (5, 4) (ii) (5, –4) (iii) (–5, 4) (iv) (–5, –4)

(g) If triangle ABC and PQR are similar, PQ = 10·4 cm, AB = 6·5 cm and perimeter of triangle ABC = 60 cm, then the perimeter of triangle PQR is :

(i) 120 cm (ii) 96 cm (iii) 108 cm (iv) 72 cm

(h) A solid cylinder, made of iron is melted and recasted into solid cones of the same radius of cross-section and height. Then the number of cones obtained is :

(i) 2 (ii) 6 (iii) 3 (iv) 4

(i) If x is a negative integer, then the solution set for the linear inequation $\frac{2}{5} + \frac{1}{5}(x + 1) > 0$ is :

(i) {0, –1, –2} (ii) {–2, –1} (iii) {–1, –2, –3} (iv) {–2, –3, –4}

(j) A die is tossed once, the probability of getting a number not divisible by 2 or 3 is :

(i) $\frac{2}{3}$ (ii) $\frac{5}{6}$ (iii) $\frac{1}{6}$ (iv) $\frac{1}{3}$

(k) If matrix A is of order 3 × 2 and matrix B is of order 2 × 3, then the order of matrix AB is :

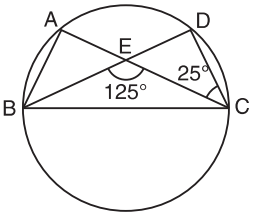
(i) 3 × 2 (ii) 3 × 3 (iii) 2 × 3 (iv) 2 × 2

(l) Line segment AB joining the points A = (0, –10) and B = (20, 5) is divided internally into five equal parts by points P, Q, R and S. The co-ordinates of point Q are :

(i) (8, –4) (ii) (4, –8) (iii) (–8, –4) (iv) (–4, – 8)

(m) In the adjoining figure, $\angle BEC = 125°$ and $\angle ACD = 25°$; then the angle BAC is :

(i) 100°
(ii) 110°
(iii) 90°
(iv) 65°



(n) If the nth term of an A.P. is $3n + 2$, then the sum of its first three terms is :

(i) $9n - 6$ (ii) 30 (iii) 48 (iv) 24

(o) The median of the data : 45, 60, 52, 115, 69, 26, 70, 81 and 94 is :

(i) 5th term (ii) 69 (iii) 68 (iv) $\frac{60+70}{2}$

***Question* 2 :**

(a) Ramesh deposits ₹ 2,400 per month in a recurring deposit scheme of a bank for one year. If he gets ₹ 1,248 as interest at the time of maturity, find the rate of interest. Also, find the maturity value of this deposit. **[4]**

(b) If x, 6, 18 and y are in continued proportion, find the values of x and y. **[4]**

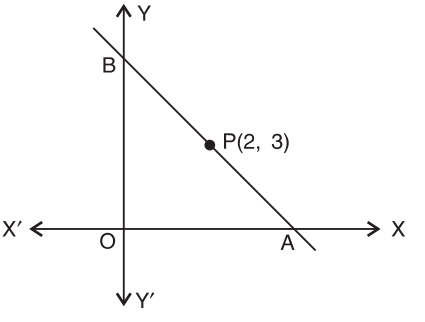
(c) Prove that : $\frac{1+\cos A}{1-\cos A} = (\text{cosec } A + \cot A)^2$. **[4]**

***Question* 3 :**

(a) A solid is in the form of a right circular cylinder with a hemispherical shape at one end and a cone at the other end. Their common diameter is 4·2 cm and the heights of the cylindrical and conical portions are 12 cm and 7 cm respectively. Find the volume of the solid. **[4]**

(b) If 2PA = 3PB, find : **[4]**

(i) co-ordinates of points A and B.
(ii) equation of line AB.



(c) A(−2, 4) and B(−4, 2) are reflected in the y-axis. If A′ and B′ are images of A and B respectively. **[5]**

(i) Find the co-ordinates of A′ and B′.
(ii) Assign a special name to quadrilateral AA′B′B.
(iii) State whether AB′ = BA′.

SECTION B

*(Attempt **any four** questions from this section)*

***Question* 4 :**

(a) Find the amount of bill for the following inter-state transaction of goods/services : **[3]**

MRP (in ₹)	950	1,200	1,500	1,800
Discount%	32	30	28	40
GST%	28	12	18	5

(b) Solve the following equation by using quadratic formula : **[3]**

$x + \frac{1}{x} = 3$, $x \neq 0$, giving the answer correct to two significant figures.

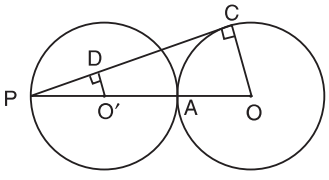
(c) On a graph paper, draw histogram (taking suitable scales) for the following data and then using the histogram drawn, find the mode. **[4]**

Monthly wages	No. of workers
1850-1900	32
1900-1950	64
1950-2000	84
2000-2050	100
2050-2100	70

***Question* 5 :**

(a) If matrix $M = \begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix}$, find $M^2 - 4M - 4$. **[3]**

(b) The given figure shows two congruent circles touching each other externally and with centres O′ and O as shown. PC is tangent to the circle with centre O. Find : **[3]**



(i) $\frac{PO'}{PO}$ (ii) $\frac{\text{area } (\Delta PDO')}{\text{area } (\Delta PCO)}$

(c) Using remainder theorem factorise $4x^3 + 7x^2 - 36x - 63$ completely. **[4]**

***Question* 6 :**

(a) Vertex A of triangle ABC is (–3, 5) and mid-points of the sides AB and AC are (–4, 4) and (2, –2) respectively. Find : **[3]**

(i) co-ordinates of vertices B and C.

(ii) equation of line through vertex C and parallel to side AB.

(b) Prove that : $\sin A(1 + \tan A) + \cos A(1 + \cot A) = \sec A + \text{cosec } A$. **[3]**

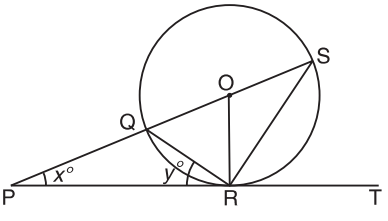
(c) If the ninth term of an A.P. is zero. Show that its 29th term is twice the 19th term. **[4]**

***Question* 7 :**

(a) A bag contains white, black and red balls only. A ball is drawn at random from the bag. If the probability of getting a white ball is $\frac{3}{10}$ and that of a black ball is $\frac{2}{5}$, then find the probability of getting a red ball. If the bag contains 20 black balls, then find the number of balls in the bag. **[3]**

(b) A solid, in the form of a right circular cone, is mounted on a hemisphere of the same radius. The radius of the hemisphere is 2·1 cm and the height of the cone is 4 cm. The solid is placed in a cylindrical tub full of water in such a way that the whole solid is submerged in water. If the radius of the tub is 5 cm and its height is 9·8 cm, find the volume of water left in the tub. (Take $\pi = 3\frac{1}{7}$) **[3]**

(c) In the given figure, PT touches the circle, whose centre is at point O, at point R. Diameter SQ produced meets tangent PT at point P. If angle SPR = $x°$ and angle QRP = $y°$; find : **[4]**



(i) angle ORQ in terms of $y°$.

(ii) a relation between x and y.

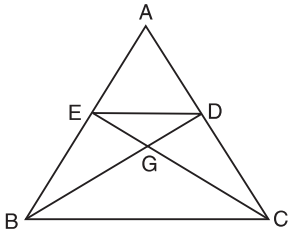
***Question* 8 :**

(a) If the mean of following distribution is $68\frac{1}{3}$. Find the missing frequency p. **[3]**

C.I.	25-35	35-45	45-55	55-65	65-75	75-85	85-95
f	10	6	4	p	4	12	26

(b) Solve the inequation $3 \geq \frac{x-4}{2} + \frac{x}{3} \geq 2$, $x \in$ I (integers). Graph the solution on a real number line. **[3]**

(c) In the given figure, the medians BD and CE of triangle ABC meet at point G. Show that BG = 2GD. **[4]**



***Question* 9 :**

(a) The sides of a right-angled triangle, containing the right angle, are $3(x + 1)$ cm and $(2x - 1)$ cm. If the area of the triangle is 30 cm^2, find the lengths of the sides of the triangle. **[4]**

(b) The daily wages of 160 workers in a factory are given below : **[6]**

Wages (in ₹)	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
No. of workers	12	20	30	38	24	16	12	8

Draw a cumulative frequency curve and estimate :

(i) median wage, (ii) inter-quartile range,

(iii) percentage of workers who earn more than ₹ 95 per day.

***Question* 10 :**

(a) Solve for x : $\frac{1+x+x^2}{1-x+x^2} = \frac{49}{63}\left(\frac{1+x}{1-x}\right)$. **[3]**

(b) Construct a triangle PQR, in which PR = 6 cm and PQ = QR = 6·8 cm. **[3]**

(i) Mark S the mid-point of PQ.

(ii) Construct the circle which touches QR at R and passes through S.

(c) The lower window of a house is at a height of 2 m above the ground and its upper window is 4 m vertically above the lower window. At a certain instant, the angles of elevation of a balloon from these windows are observed to be 60° and 30° respectively. Find the height of the balloon above the ground. **[4]**