

**MATHEMATICS***(Two hours and a half)*

*Answers to this Paper must be written on the paper provided separately.*

*You will **not** be allowed to write during the 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 (40 Marks)**

*Attempt **all** questions from this Section.*

**Question 1**

- (a) If  $b$  is the mean proportion between  $a$  and  $c$ , show that: [3]

$$\frac{a^4 + a^2b^2 + b^4}{b^4 + b^2c^2 + c^4} = \frac{a^2}{c^2}$$

- (b) Solve the equation  $4x^2 - 5x - 3 = 0$  and give your answer correct to two decimal places. [4]

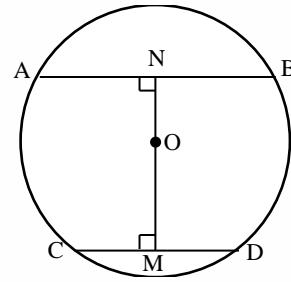
**This paper consists of 7 printed pages and 1 blank page.**

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**Turn over**

- (c) AB and CD are two parallel chords of a circle such that  $AB = 24$  cm and  $CD = 10$  cm. If the radius of the circle is 13 cm, find the distance between the two chords.



[3]

### Question 2

- (a) Evaluate without using trigonometric tables,

[3]

$$\sin^2 28^\circ + \sin^2 62^\circ + \tan^2 38^\circ - \cot^2 52^\circ + \frac{1}{4} \sec^2 30^\circ$$

- (b) If  $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$  and  $B = \begin{bmatrix} -2 & 1 \\ -3 & 2 \end{bmatrix}$  and  $A^2 - 5B^2 = 5C$ . Find matrix C where C is a 2 by 2 matrix.

[4]

- (c) Jaya borrowed ₹ 50,000 for 2 years. The rates of interest for two successive years are 12% and 15% respectively. She repays ₹33,000 at the end of the first year. Find the amount she must pay at the end of the second year to clear her debt.

[3]

### Question 3

- (a) The catalogue price of a computer set is ₹ 42000. The shopkeeper gives a discount of 10% on the listed price. He further gives an off-season discount of 5% on the discounted price. However, sales tax at 8% is charged on the remaining price after the two successive discounts. Find:

[3]

- the amount of sales tax a customer has to pay
- the total price to be paid by the customer for the computer set.

- (b) P(1, -2) is a point on the line segment A(3, -6) and B(x, y) such that AP : PB is equal to 2 : 3. Find the coordinates of B.

[4]

- (c) The marks of 10 students of a class in an examination arranged in ascending order is as follows:

[3]

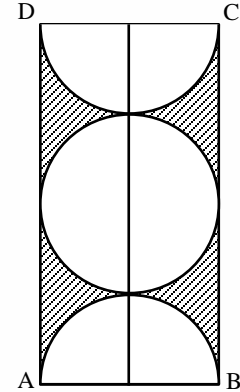
13, 35, 43, 46, x, x+4, 55, 61, 71, 80

If the median marks is 48, find the value of x. Hence find the mode of the given data.

**Question 4**

- (a) What must be subtracted from  $16x^3 - 8x^2 + 4x + 7$  so that the resulting expression has  $2x + 1$  as a factor? [3]

- (b) In the given figure ABCD is a rectangle. It consists of a circle and two semi circles each of which are of radius 5 cm. Find the area of the shaded region. Give your answer correct to three significant figures. [4]



- (c) Solve the following inequation and represent the solution set on a number line. [3]

$$-8\frac{1}{2} < -\frac{1}{2} - 4x \leq 7\frac{1}{2}, x \in I$$

**SECTION B (40 Marks)**

*Attempt any four questions from this Section*

**Question 5**

- (a) Given matrix  $B = \begin{bmatrix} 1 & 1 \\ 8 & 3 \end{bmatrix}$ . Find the matrix X if,  $X = B^2 - 4B$ . [4]

Hence solve for  $a$  and  $b$  given  $X \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 5 \\ 50 \end{bmatrix}$

- (b) How much should a man invest in ₹ 50 shares selling at ₹60 to obtain an income of ₹ 450, if the rate of dividend declared is 10%. Also find his yield percent, to the nearest whole number. [3]

- (c) Sixteen cards are labelled as  $a, b, c, \dots, m, n, o, p$ . They are put in a box and shuffled. [3]  
 A boy is asked to draw a card from the box. What is the probability that the card drawn is:  
 (i) a vowel.  
 (ii) a consonant.  
 (iii) none of the letters of the word *median*.

**Question 6**

(a) Using a ruler and a compass construct a triangle ABC in which  $AB = 7\text{cm}$ ,  $\angle CAB = 60^\circ$  and  $AC = 5\text{cm}$ . Construct the locus of: [4]

(i) points equidistance from AB and AC.

(ii) points equidistant from BA and BC.

Hence construct a circle touching the three sides of the triangle internally.

(b) A conical tent is to accommodate 77 persons. Each person must have  $16\text{m}^3$  of air to breathe. Given the radius of the tent as  $7\text{m}$  find the height of the tent and also its curved surface area. [3]

(c) If  $\frac{7m + 2n}{7m - 2n} = \frac{5}{3}$ , use properties of proportion to find [3]

(i)  $m : n$

(ii)  $\frac{m^2 + n^2}{m^2 - n^2}$

**Question 7**

(a) A page from a saving bank account passbook is given below: [5]

Date	Particulars	Amount Withdrawn (₹)	Amount Deposited (₹)	Balance (₹)
Jan. 7, 2016	B/F			3000.00
Jan 10, 2016	By Cheque		2600.00	5600.00
Feb. 8, 2016	To Self	1500.00		4100.00
Apr. 6, 2016	By Cheque	2100.00		2000.00
May 4, 2016	By cash		6500.00	8500.00
May 27, 2016	By Cheque		1500.00	10000.00

(i) Calculate the interest for the 6 months from January to June 2016, at 6% per annum.

(ii) If the account is closed on 1<sup>st</sup> July 2016, find the amount received by the account holder.

- (b) Use a graph paper for this question (Take 2 cms = 1 unit on both  $x$  and  $y$  axis) [5]
- (i) Plot the following points:  
 $A(0,4)$ ,  $B(2,3)$ ,  $C(1,1)$  and  $D(2,0)$ .
- (ii) Reflect points  $B$ ,  $C$ ,  $D$  on the  $y$ -axis and write down their coordinates. Name the images as  $B'$ ,  $C'$ ,  $D'$  respectively.
- (iii) Join the points  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $D'$ ,  $C'$ ,  $B'$  and  $A$  in order, so as to form a closed figure. Write down the equation of the line of symmetry of the figure formed.

### Question 8

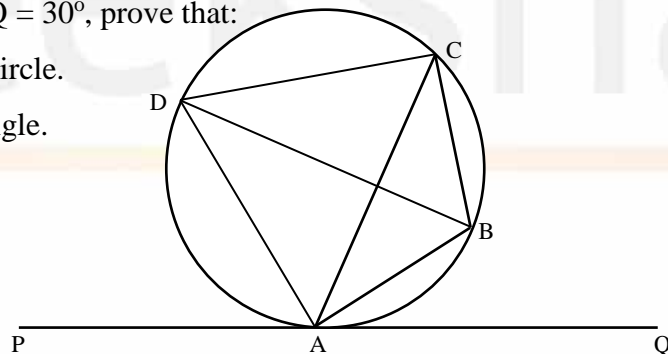
- (a) Calculate the mean of the following distribution using step deviation method. [4]

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Number of Students	10	9	25	30	16	10

- (b) In the given figure  $PQ$  is a tangent to the circle at  $A$ .  $AB$  and  $AD$  are bisectors of  $\angle CAQ$  and  $\angle PAC$ . IF  $\angle BAQ = 30^\circ$ , prove that: [3]

(i)  $BD$  is a diameter of the circle.

(ii)  $ABC$  is an isosceles triangle.

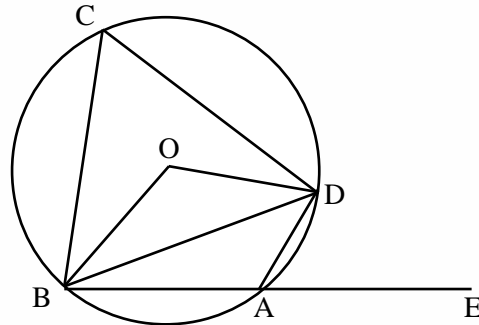


- (c) The printed price of an air conditioner is ₹ 45,000/-. The wholesaler allows a discount of 10% to the shopkeeper. The shopkeeper sells the article to the customer at a discount of 5% of the marked price. Sales tax (under VAT) is charged at the rate of 12% at every stage. Find: [3]
- (i) VAT paid by the shopkeeper to the government.
- (ii) The total amount paid by the customer inclusive of tax.

**Question 9**

- (a) In the figure given, O is the centre of the circle.  $\angle DAE = 70^\circ$ . Find giving suitable reasons, the measure of: [4]

- (i)  $\angle BCD$   
 (ii)  $\angle BOD$   
 (iii)  $\angle OBD$



- (b)  $A(-1, 3)$ ,  $B(4, 2)$  and  $C(3, -2)$  are the vertices of a triangle. [3]

- (i) Find the coordinates of the centroid G of the triangle.  
 (ii) Find the equation of the line through G and parallel to AC.

- (c) Prove that [3]

$$\frac{\sin \theta - 2\sin^3 \theta}{2\cos^3 \theta - \cos \theta} = \tan \theta$$

**Question 10**

- (a) The sum of the ages of Vivek and his younger brother Amit is 47 years. The product of their ages in years is 550. Find their ages. [4]

- (b) The daily wages of 80 workers in a project are given below. [6]

Wages (in ₹)	400-450	450-500	500-550	550-600	600-650	650-700	700-750
No. of workers	2	6	12	18	24	13	5

Use a graph paper to draw an ogive for the above distribution. (Use a scale of 2 cm = ₹ 50 on  $x$ -axis and 2 cm = 10 workers on  $y$ -axis). Use your ogive to estimate:

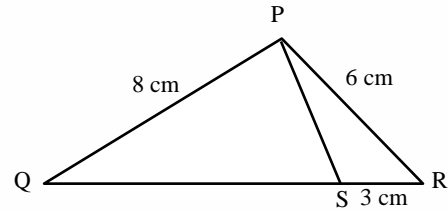
- (i) the median wage of the workers.  
 (ii) the lower quartile wage of workers.  
 (iii) the number of workers who earn more than ₹ 625 daily.

**Question 11**

- (a) The angles of depression of two ships A and B as observed from the top of a light house 60 m high are  $60^\circ$  and  $45^\circ$  respectively. If the two ships are on the opposite sides of the light house, find the distance between the two ships. Give your answer correct to the nearest whole number. [4]

- (b) PQR is a triangle. S is a point on the side QR of  $\Delta PQR$  such that  $\angle PSR = \angle QPR$ . [3]  
Given  $QP = 8$  cm,  $PR = 6$  cm and  $SR = 3$  cm

- (i) Prove  $\Delta PQR \sim \Delta SPR$   
(ii) Find the length of QR and PS  
(iii)  $\frac{\text{area of } \Delta PQR}{\text{area of } \Delta SPR}$



- (c) Mr. Richard has a recurring deposit account in a bank for 3 years at 7.5% p. a. simple interest. If he gets ₹ 8325 as interest at the time of maturity, find: [3]

- (i) The monthly deposit  
(ii) The maturity value.