

# MATHEMATICS

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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.***

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*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 and graph papers are to be provided by the school.***

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## SECTION A (40 Marks)

*(Attempt all questions from this Section.)*

### Question 1

Choose the correct answers to the questions from the given options.

[15]

(Do not copy the questions, write the correct answers only.)

- (i) For an Intra-state sale, the CGST paid by a dealer to the Central government is ` 120. If the marked price of the article is ` 2000, the rate of GST is:
- (a) 6%
  - (b) 10%
  - (c) 12%
  - (d) 16.67%

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This paper consists of 12 printed pages.

- (ii) What must be subtracted from the polynomial  $x^3 + x^2 - 2x + 1$ , so that the result is exactly divisible by  $(x - 3)$ ?
- (a)  $-31$   
(b)  $-30$   
(c)  $30$   
(d)  $31$
- (iii) The roots of the quadratic equation  $px^2 - qx + r = 0$  are real and equal if:
- (a)  $p^2 = 4qr$   
(b)  $q^2 = 4pr$   
(c)  $-q^2 = 4pr$   
(d)  $p^2 > 4qr$
- (iv) If matrix  $A = \begin{bmatrix} 2 & 2 \\ 0 & 2 \end{bmatrix}$  and  $A^2 = \begin{bmatrix} 4 & x \\ 0 & 4 \end{bmatrix}$ , then the value of  $x$  is:
- (a)  $2$   
(b)  $4$   
(c)  $8$   
(d)  $10$
- (v) The median of the following observations arranged in ascending order is **64**.  
Find the value of  $x$ :
- $27, 31, 46, 52, x, x+4, 71, 79, 85, 90$
- (a)  $60$   
(b)  $61$   
(c)  $62$   
(d)  $66$
- (vi) Points **A** ( $x, y$ ), **B** (3, -2) and **C** (4, -5) are collinear. The value of  $y$  in terms of  $x$  is:
- (a)  $3x - 11$   
(b)  $11 - 3x$   
(c)  $3x - 7$   
(d)  $7 - 3x$

- (vii) The given table shows the distance covered and the time taken by a train moving at a uniform speed along a straight track.

Distance (in m)	60	90	$y$
Time (in sec)	2	$x$	5

The values of  $x$  and  $y$  are:

- (a)  $x = 4, y = 150$
- (b)  $x = 3, y = 100$
- (c)  $x = 4, y = 100$
- (d)  $x = 3, y = 150$

- (viii) The 7<sup>th</sup> term of the given Arithmetic Progression (A.P.):

$$\frac{1}{a}, \left(\frac{1}{a} + 1\right), \left(\frac{1}{a} + 2\right) \dots \text{is:}$$

- (a)  $\left(\frac{1}{a} + 6\right)$
- (b)  $\left(\frac{1}{a} + 7\right)$
- (c)  $\left(\frac{1}{a} + 8\right)$
- (d)  $\left(\frac{1}{a} + 7^7\right)$

- (ix) The sum invested to purchase 15 shares of a company of nominal value ` 75 available at a discount of 20% is:

- (a) ` 60
- (b) ` 90
- (c) ` 1350
- (d) ` 900

- (x) The circumcentre of a triangle is the point which is:

- (a) at equal distance from the three sides of the triangle.
- (b) at equal distance from the three vertices of the triangle.
- (c) the point of intersection of the three medians.
- (d) the point of intersection of the three altitudes of the triangle.

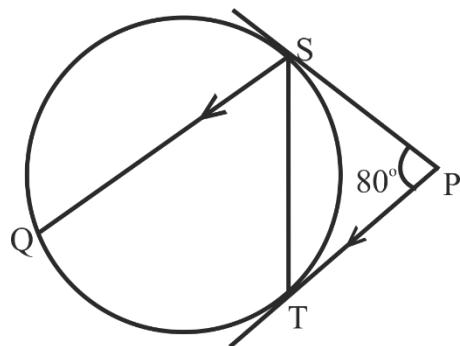
- (xi) Statement 1:  $\sin^2 \theta + \cos^2 \theta = 1$   
 Statement 2:  $\operatorname{cosec}^2 \theta + \cot^2 \theta = 1$

Which of the following is valid?

- (a) only 1
- (b) only 2
- (c) both 1 and 2
- (d) neither 1 nor 2

- (xii) In the given diagram, PS and PT are the tangents to the circle.  $SQ \parallel PT$  and  $\angle SPT = 80^\circ$ . The value of  $\angle QST$  is:

- (a)  $140^\circ$
- (b)  $90^\circ$
- (c)  $80^\circ$
- (d)  $50^\circ$



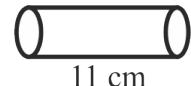
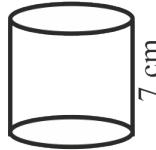
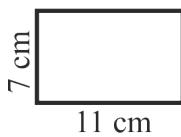
- (xiii) **Assertion (A):** A die is thrown once and the probability of getting an even number is  $\frac{2}{3}$ .

**Reason (R):** The sample space for even numbers on a die is {2, 4, 6}

- (a) A is true, R is false.
- (b) A is false, R is true.
- (c) Both A and R are true.
- (d) Both A and R are false.

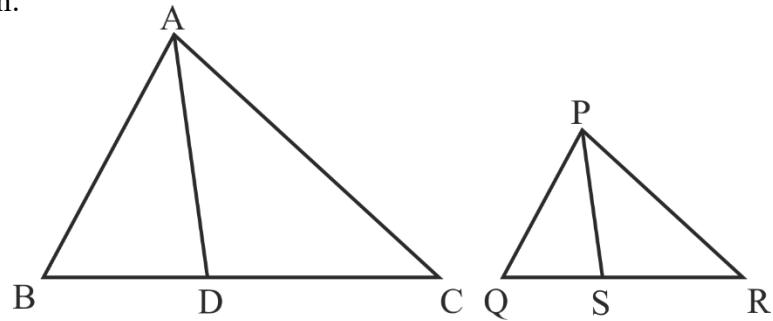
- (xiv) A rectangular sheet of paper of size 11 cm x 7 cm is first rotated about the side **11 cm** and then about the side **7 cm** to form a cylinder, as shown in the diagram. The ratio of their curved surface areas is:

- (a)  $1 : 1$
- (b)  $7 : 11$
- (c)  $11 : 7$
- (d)  $\frac{11\pi}{7} : \frac{7\pi}{11}$



- (xv) In the given diagram,  $\Delta ABC \sim \Delta PQR$ . If AD and PS are bisectors of  $\angle BAC$  and  $\angle QPR$  respectively then:

- (a)  $\Delta ABC \sim \Delta PQS$
- (b)  $\Delta ABD \sim \Delta PQS$
- (c)  $\Delta ABD \sim \Delta PSR$
- (d)  $\Delta ABC \sim \Delta PSR$



### Question 2

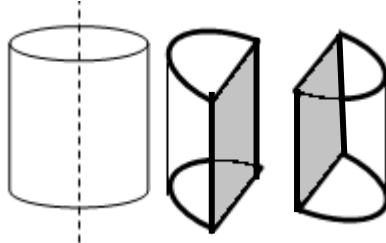
(i)  $A = \begin{bmatrix} x & 0 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & 0 \\ y & 1 \end{bmatrix}$  and  $C = \begin{bmatrix} 4 & 0 \\ x & 1 \end{bmatrix}$  [4]

Find the values of  $x$  and  $y$ , if  $AB = C$ .

- (ii) A solid metallic cylinder is cut into two identical halves along its height (as shown in the diagram). The diameter of the cylinder is **7 cm** and the height is **10 cm**. Find: [4]

- (a) The total surface area (both the halves).
- (b) The total cost of painting the two halves at the rate of ` 30 per  $\text{cm}^2$

*(Use  $\pi = \frac{22}{7}$ )*



- (iii) 15, 30, 60, 120... are in **G.P.** (Geometric Progression). [4]

- (a) Find the  $n^{\text{th}}$  term of this **G.P.** in terms of  $n$ .

- (b) How many terms of the above **G.P.** will give the sum **945**?

### Question 3

(i) Factorize:  $\sin^3\theta + \cos^3\theta$  [4]

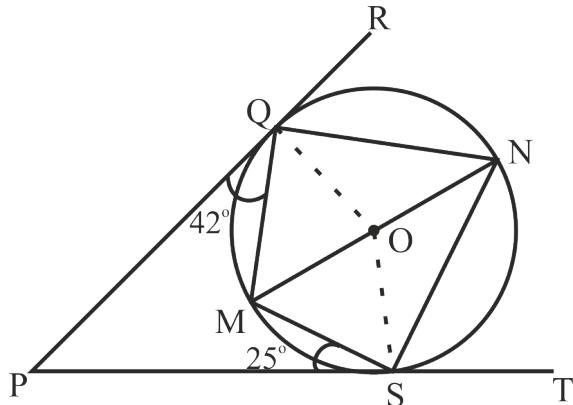
Hence, prove the following identity:

$$\frac{\sin^3\theta + \cos^3\theta}{\sin\theta + \cos\theta} + \sin\theta\cos\theta = 1$$

- (ii) In the given diagram, O is the centre of the circle. PR and PT are two tangents drawn from the external point P and touching the circle at Q and S respectively. MN is a diameter of the circle. Given  $\angle PQM = 42^\circ$  and  $\angle PSM = 25^\circ$ . [4]

Find:

- (a)  $\angle OQM$
- (b)  $\angle QNS$
- (c)  $\angle QOS$
- (d)  $\angle QMS$



- (iii) Use graph sheet for this question. Take 2 cm = 1 unit along the axes. [5]

- (a) Plot A(0, 3), B(2, 1) and C(4, -1).
- (b) Reflect point B and C in **y-axis** and name their images as B' and C' respectively. Plot and write coordinates of the points B' and C'.
- (c) Reflect point A in the line BB' and name its images as A'.
- (d) Plot and write coordinates of point A'.
- (e) Join the points ABA'B' and give the geometrical name of the closed figure so formed.

### **SECTION B (40 Marks)**

*(Attempt **any four** questions from this Section.)*

#### **Question 4**

- (i) Suresh has a recurring deposit account in a bank. He deposits ` 2000 per month and the bank pays interest at the rate of 8% per annum. If he gets ` 1040 as interest at the time of maturity, find in years total time for which the account was held. [3]
- (ii) The following table gives the duration of movies in minutes. [3]

Duration (in minutes)	100 – 110	110 – 120	120 – 130	130 – 140	140 – 150	150 – 160
No. of movies	5	10	17	8	6	4

Using step – deviation method, find the mean duration of the movies.

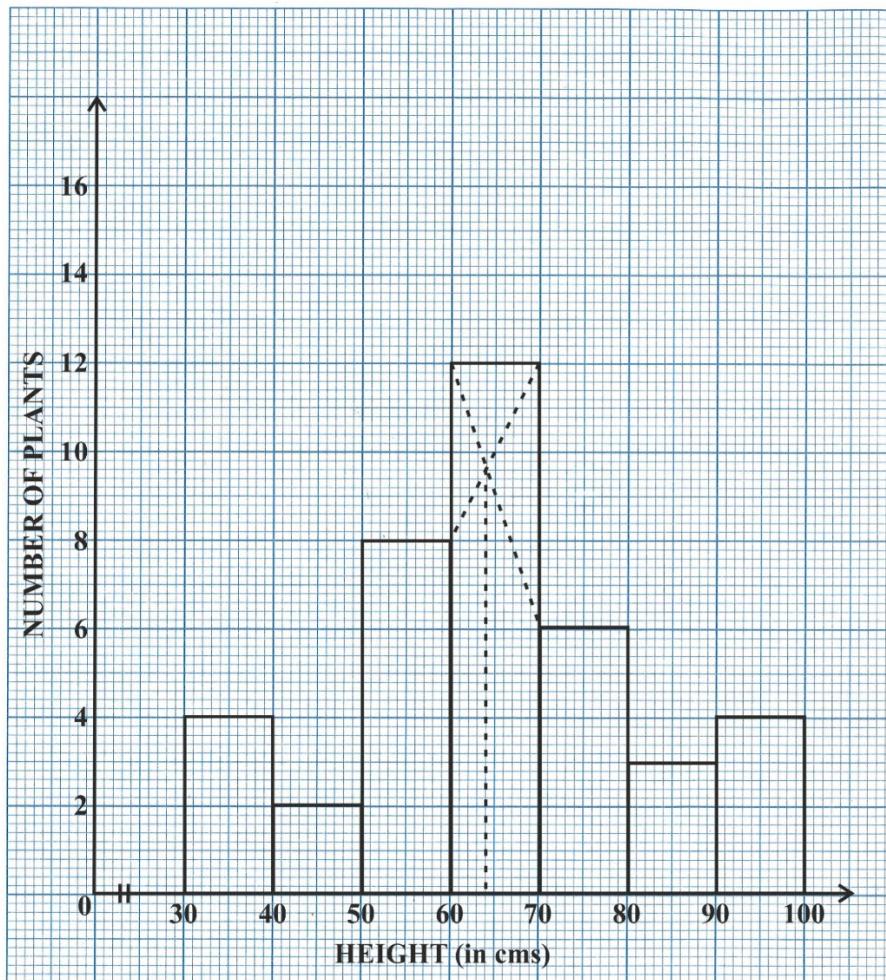
(iii) If  $\frac{(a+b)^3}{(a-b)^3} = \frac{64}{27}$  [4]

(a) Find  $\frac{a+b}{a-b}$

(b) Hence using properties of proportion, find  $a : b$ .

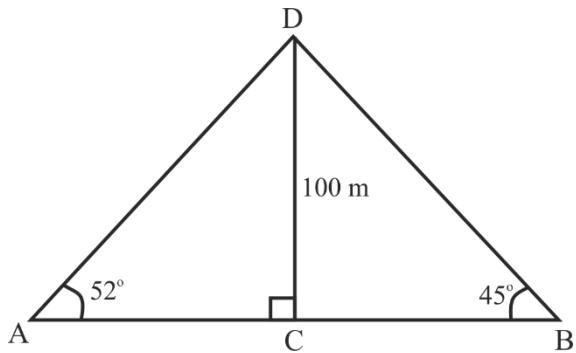
### Question 5

- (i) The given graph with a histogram represents the number of plants of different heights grown in a school campus. Study the graph carefully and answer the following questions: [5]



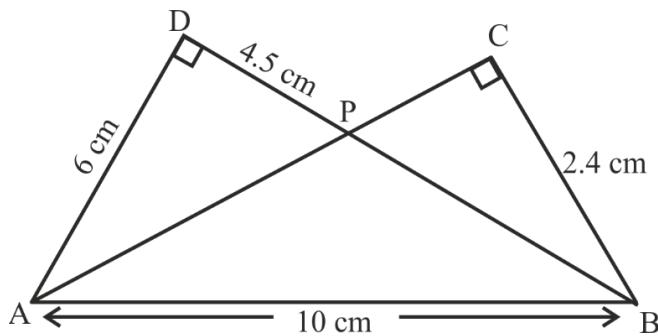
- (a) Make a frequency table with respect to the class boundaries and their corresponding frequencies.
- (b) State the modal class.
- (c) Identify and note down the mode of the distribution.
- (d) Find the number of plants whose height range is between 80 cm to 90 cm.

- (ii) The angle of elevation of the top of a 100 m high tree from two points A and B on the opposite side of the tree are  $52^\circ$  and  $45^\circ$  respectively. Find the distance AB, to the nearest metre. [5]



### Question 6

- (i) Solve the following quadratic equation for  $x$  and give your answer correct to three significant figures:  $2x^2 - 10x + 5 = 0$  [3]  
**(Use mathematical tables if necessary)**
- (ii) The  $n^{\text{th}}$  term of an Arithmetic Progression (A.P.) is given by the relation  $T_n = 6(7 - n)$ . [3]  
Find:  
(a) its first term and common difference  
(b) sum of its first 25 terms
- (iii) In the given diagram  $\Delta ADB$  and  $\Delta ACB$  are two right angled triangles with  $\angle ADB = \angle BCA = 90^\circ$ . If  $AB = 10 \text{ cm}$ ,  $AD = 6 \text{ cm}$ ,  $BC = 2.4 \text{ cm}$  and  $DP = 4.5 \text{ cm}$  [4]



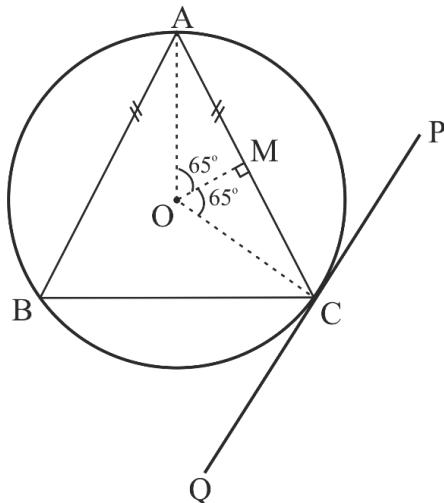
- (a) Prove that  $\Delta APD \sim \Delta BPC$   
(b) Find the length of BD and PB  
(c) Hence, find the length of PA  
(d) Find area  $\Delta APD$  : area  $\Delta BPC$

**Question 7**

- (i) In the given diagram, an isosceles  $\triangle ABC$  is inscribed in a circle with centre O. [3]  
 PQ is a tangent to the circle at C. OM is perpendicular to chord AC and  $\angle COM = 65^\circ$ .

Find:

- (a)  $\angle ABC$
- (b)  $\angle BAC$
- (c)  $\angle BCQ$

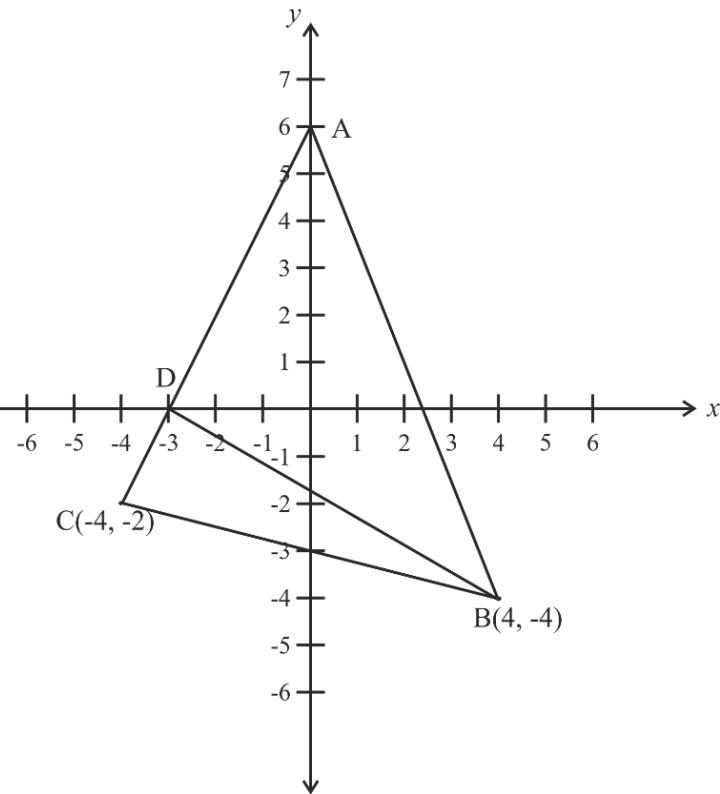


- (ii) Solve the following inequation, write down the solution set and represent it on the real number line. [3]

$$-3 + x \leq \frac{7x}{2} + 2 < 8 + 2x, x \in I$$

- (iii) In the given diagram, ABC is a triangle, where B(4, -4) and C(-4, -2). D is a point on AC. [4]

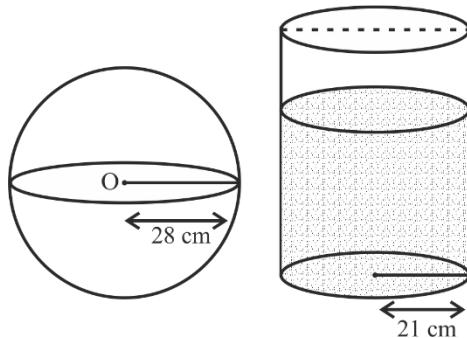
- (a) Write down the coordinates of A and D.
- (b) Find the coordinates of the centroid of  $\triangle ABC$ .
- (c) If D divides AC in the ratio  $k : 1$ , find the value of  $k$ .
- (d) Find the equation of the line BD.



### Question 8

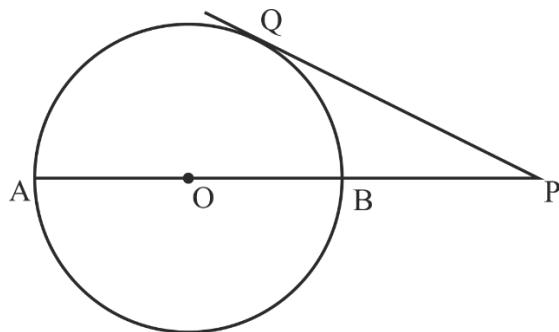
- (i) The polynomial  $3x^3 + 8x^2 - 15x + k$  has  $(x - 1)$  as a factor. Find the value of  $k$ . Hence [3]  
factorize the resulting polynomial completely.
- (ii) The following letters **A, D, M, N, O, S, U, Y** of the English alphabet are written on separate [3]  
cards and put in a box. The cards are well shuffled and one card is drawn at random. What  
is the probability that the card drawn is a letter of the word,
- MONDAY?
  - which does not appear in MONDAY?
  - which appears both in SUNDAY and MONDAY?
- (iii) Oil is stored in a spherical vessel occupying  $\frac{3}{4}$  of its full capacity. Radius of this spherical [4]  
vessel is **28 cm**. This oil is then poured into a cylindrical vessel with a radius of **21 cm**.  
Find the height of the oil in the cylindrical vessel (**correct to the nearest cm**).

**Take  $\pi = \frac{22}{7}$**



### Question 9

- (i) The figure shows a circle of radius 9 cm with O as the centre. The diameter AB produced [3]  
meets the tangent PQ at P. If PA = 24 cm, find the length of tangent PQ.



- (ii) Mr. Gupta invested ` 33000 in buying ` 100 shares of a company at 10% premium. The dividend declared by the company is 12%. Find: [3]
- the number of shares purchased by him.
  - his annual dividend.
- (iii) A life insurance agent found the following data for distribution of ages of 100 policy holders: [4]

Age in years	Policy Holders (frequency)	Cumulative frequency
20 – 25	2	2
25 – 30	4	6
30 – 35	12	18
35 – 40	20	38
40 – 45	28	66
45 – 50	22	88
50 – 55	8	96
55 – 60	4	100

On a graph sheet draw an ogive using the given data. Take 2 cm = 5 years along one axis and 2 cm = 10 policy holders along the other axis. Use your graph to find:

- The median age.
- Number of policy holders whose age is above 52 years.

### Question 10

- (i) Rohan bought the following eatables for his friends : [3]

Soham Sweet Mart : Bill				
S. No.	Item	Price	Quantity	Rate of GST
1	Laddu	` 500 per kg	2 kg	5%
2	Pastries	` 100 per piece	12 pieces	18%

Calculate :

- Total GST paid.
- Total bill amount including GST.

- (ii) (a) If the lines  $kx - y + 4 = 0$  and  $2y = 6x + 7$  are perpendicular to each other, find the value of  $k$ . [3]
- (b) Find the equation of a line parallel to  $2y = 6x + 7$  and passing through  $(-1, 1)$
- (iii) Use ruler and compass to answer this question. Construct  $\angle ABC = 90^\circ$ , where  $AB = 6 \text{ cm}$ ,  $BC = 8 \text{ cm}$ . [4]
- (a) Construct the locus of points equidistant from B and C.
- (b) Construct the locus of points equidistant from A and B.
- (c) Mark the point which satisfies both the conditions (a) and (b) as O. Construct the locus of points keeping a fixed distance OA from the fixed point O.
- (d) Construct the locus of points which are equidistant from BA and BC.