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Mathematics

9709/12

Paper 1 Pure Mathematics 1

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Question No (1)

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1 Points A and B have coordinates $(5, 2)$ and $(10, -1)$ respectively.

(a) Find the equation of the perpendicular bisector of AB .

(b) Find the equation of the circle with centre A which passes through B .

Solution:

(a)

$$A(5, 2), B(10, -1)$$

Mid-point formula for two points

$$A(x_1, y_1), B(x_2, y_2)$$

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Mid-point of the line joining AB =

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$= \left(\frac{5 + 10}{2}, \frac{2 - 1}{2} \right)$$

$$= \left(\frac{15}{2}, \frac{1}{2} \right)$$

$$\text{Gradient of line AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{-1 - 2}{10 - 5}$$

$$= -3/5$$

⇒ gradient of perpendicular bisector of

$$AB = 5/3$$

$$\therefore m_1 \times m_2 = -1$$

Equation of perpendicular bisector

$$y - y_1 = m(x - x_1)$$

$$y - \frac{1}{2} = \frac{5}{3} \left(x - \frac{15}{2} \right)$$

$$y - \frac{1}{2} = \frac{5x}{3} - \frac{75}{6}$$

$$\frac{2y - 1}{2} = \frac{10x - 75}{6}$$

$$2y - 1 = 2 \left(\frac{10x - 75}{6} \right)$$

$$2y - 1 = \frac{10x - 75}{3}$$

$$3(2y - 1) = 10x - 75$$

$$6y - 3 = 10x - 75$$

$$6y = 10x - 75 + 3$$

$$6y = 10x - 72$$

$$6y = 2(5x - 36)$$

$$3y = 5x - 36$$

(b) radius of circle, $r = |OB| = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$$= \sqrt{(10 - 5)^2 + (-1 - 2)^2}$$

$$= \sqrt{(5)^2 + (-3)^2}$$

$$= \sqrt{25 + 9}$$

$$r = \sqrt{34}$$

∴ Equation of circle

$$(x-5)^2 + (y-2)^2 = (\sqrt{34})^2$$

$$x^2 - 10x + 25 + y^2 - 4y + 4 = 34$$

Equation of circle with centre (h, k)
and radius r :

$$(x-h)^2 + (y-k)^2 = r^2$$

$$x^2 + y^2 - 10x - 4y + 29 = 34$$

$$x^2 + y^2 - 10x - 4y - 5 = 0$$