



## EXAM PAPERS PRACTICE

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2002

# XVIII

1583

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## Maths

AQA  
AS & A LEVEL

### Topic Questions

Coordinate geometry in the  $(x, y)$  plane



- 2 The point  $A$  has coordinates  $(1, 1)$  and the point  $B$  has coordinates  $(5, k)$ .

The line  $AB$  has equation  $3x + 4y = 7$ .

- (a) (i) Show that  $k = -2$ . *(1 mark)*
- (ii) Hence find the coordinates of the mid-point of  $AB$ . *(2 marks)*
- (b) Find the gradient of  $AB$ . *(2 marks)*
- (c) The line  $AC$  is perpendicular to the line  $AB$ .
- (i) Find the gradient of  $AC$ . *(2 marks)*
- (ii) Hence find an equation of the line  $AC$ . *(1 mark)*
- (iii) Given that the point  $C$  lies on the  $x$ -axis, find its  $x$ -coordinate. *(2 marks)*
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- (b) The line  $L$  has equation  $y + 2x = 12$  and the curve  $C$  has equation  $y = x^2 - 4x + 9$ .

- (i) Show that the  $x$ -coordinates of the points of intersection of  $L$  and  $C$  satisfy the equation

$$x^2 - 2x - 3 = 0 \quad (1 \text{ mark})$$

- (ii) Hence find the coordinates of the points of intersection of  $L$  and  $C$ . *(4 marks)*
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5 A circle with centre  $C$  has equation  $x^2 + y^2 - 8x + 6y = 11$ .

(a) By completing the square, express this equation in the form

$$(x - a)^2 + (y - b)^2 = r^2 \quad (3 \text{ marks})$$

(b) Write down:

(i) the coordinates of  $C$ ; (1 mark)

(ii) the radius of the circle. (1 mark)

(c) The point  $O$  has coordinates  $(0, 0)$ .

(i) Find the length of  $CO$ . (2 marks)

(ii) Hence determine whether the point  $O$  lies inside or outside the circle, giving a reason for your answer. (2 marks)

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1 The point  $A$  has coordinates  $(1, 7)$  and the point  $B$  has coordinates  $(5, 1)$ .

(a) (i) Find the gradient of the line  $AB$ . (2 marks)

(ii) Hence, or otherwise, show that the line  $AB$  has equation  $3x + 2y = 17$ . (2 marks)

(b) The line  $AB$  intersects the line with equation  $x - 4y = 8$  at the point  $C$ . Find the coordinates of  $C$ . (3 marks)

(c) Find an equation of the line through  $A$  which is perpendicular to  $AB$ . (3 marks)

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7 A circle has equation  $x^2 + y^2 - 4x - 14 = 0$ .

(a) Find:

(i) the coordinates of the centre of the circle; (3 marks)

(ii) the radius of the circle in the form  $p\sqrt{2}$ , where  $p$  is an integer. (3 marks)

(b) A chord of the circle has length 8. Find the perpendicular distance from the centre of the circle to this chord. (3 marks)

(c) A line has equation  $y = 2k - x$ , where  $k$  is a constant.

(i) Show that the  $x$ -coordinate of any point of intersection of the line and the circle satisfies the equation

$$x^2 - 2(k + 1)x + 2k^2 - 7 = 0 \quad (3 \text{ marks})$$

(ii) Find the values of  $k$  for which the equation

$$x^2 - 2(k + 1)x + 2k^2 - 7 = 0$$

has equal roots. (4 marks)

(iii) Describe the geometrical relationship between the line and the circle when  $k$  takes either of the values found in part (c)(ii). (1 mark)

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2 The line  $AB$  has equation  $3x + 5y = 8$  and the point  $A$  has coordinates  $(6, -2)$ .

(a) (i) Find the gradient of  $AB$ . (2 marks)

(ii) Hence find an equation of the straight line which is perpendicular to  $AB$  and which passes through  $A$ . (3 marks)

(b) The line  $AB$  intersects the line with equation  $2x + 3y = 3$  at the point  $B$ . Find the coordinates of  $B$ . (3 marks)

(c) The point  $C$  has coordinates  $(2, k)$  and the distance from  $A$  to  $C$  is 5. Find the two possible values of the constant  $k$ . (3 marks)

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4 A circle with centre  $C$  has equation  $x^2 + y^2 + 2x - 12y + 12 = 0$ .

(a) By completing the square, express this equation in the form

$$(x - a)^2 + (y - b)^2 = r^2 \quad (3 \text{ marks})$$

(b) Write down:

(i) the coordinates of  $C$ ; (1 mark)

(ii) the radius of the circle. (1 mark)

(c) Show that the circle does **not** intersect the  $x$ -axis. (2 marks)

(d) The line with equation  $x + y = 4$  intersects the circle at the points  $P$  and  $Q$ .

(i) Show that the  $x$ -coordinates of  $P$  and  $Q$  satisfy the equation

$$x^2 + 3x - 10 = 0 \quad (3 \text{ marks})$$

(ii) Given that  $P$  has coordinates  $(2, 2)$ , find the coordinates of  $Q$ . (2 marks)

(iii) Hence find the coordinates of the midpoint of  $PQ$ . (2 marks)

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1 The points  $A$  and  $B$  have coordinates  $(6, -1)$  and  $(2, 5)$  respectively.

(a) (i) Show that the gradient of  $AB$  is  $-\frac{3}{2}$ . (2 marks)

(ii) Hence find an equation of the line  $AB$ , giving your answer in the form  $ax + by = c$ , where  $a$ ,  $b$  and  $c$  are integers. (2 marks)

(b) (i) Find an equation of the line which passes through  $B$  and which is perpendicular to the line  $AB$ . (2 marks)

(ii) The point  $C$  has coordinates  $(k, 7)$  and angle  $ABC$  is a right angle.

Find the value of the constant  $k$ . (2 marks)

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5 A circle with centre  $C$  has equation  $(x + 3)^2 + (y - 2)^2 = 25$ .

- (a) Write down:
- (i) the coordinates of  $C$ ; *(2 marks)*
  - (ii) the radius of the circle. *(1 mark)*
- (b) (i) Verify that the point  $N(0, -2)$  lies on the circle. *(1 mark)*
- (ii) Sketch the circle. *(2 marks)*
- (iii) Find an equation of the normal to the circle at the point  $N$ . *(3 marks)*
- (c) The point  $P$  has coordinates  $(2, 6)$ .
- (i) Find the distance  $PC$ , leaving your answer in surd form. *(2 marks)*
  - (ii) Find the length of a tangent drawn from  $P$  to the circle. *(3 marks)*