

OCR Core 1

Coordinate Geometry

Topic assessment

Do not use a calculator in this test.

- A line l_1 has equation $5y + 4x = 3$.
 - Find the gradient of the line. [1]
 - Find the equation of the line l_2 which is parallel to l_1 and passes through the point $(1, -2)$. [3]
- Describe fully the curve whose equation is $x^2 + y^2 = 4$. [2]
- The coordinates of two points are A $(-1, -3)$ and B $(5, 7)$. Calculate the equation of the perpendicular bisector of AB. [4]
- Show that the line $y = 3x - 10$ is a tangent to the circle $x^2 + y^2 = 10$. [4]
- The line $y = 2x - 3$ meets the x -axis at the point P, and the line $3y + 4x = 8$ meets the x -axis at the point Q. The two lines intersect at the point R.
 - Find the coordinates of R. [4]
 - Find the area of triangle PQR. [3]
- The equation of a circle is $x^2 + y^2 - 4x + 2y = 15$
 - Find the coordinates of the centre C of the circle, and the radius of the circle. [3]
 - Show that the point P $(4, -5)$ lies on the circle. [1]
 - Find the equation of the tangent to the circle at the point P. [4]
- The coordinates of four points are P $(-2, -1)$, Q $(6, 3)$, R $(9, 2)$ and S $(1, -2)$.
 - Calculate the gradients of the lines PQ, QR, RS and SP. [4]
 - What name is given to the quadrilateral PQRS? [1]
 - Calculate the length SR. [2]
 - Show that the equation of SR is $2y = x - 5$ and find the equation of the line L through Q perpendicular to SR. [5]
 - Calculate the coordinates of the point T where the line L meets SR. [3]
 - Calculate the area of the quadrilateral PQRS. [3]
- AB is the diameter of a circle. A is $(1, 3)$ and B is $(7, -1)$.
 - Find the coordinates of the centre C of the circle. [2]
 - Find the radius of the circle. [2]
 - Find the equation of the circle. [2]
 - The line $y + 5x = 8$ cuts the circle at A and again at a second point D. Calculate the coordinates of D. [4]
 - Prove that the line AB is perpendicular to the line CD. [3]

Total 60 marks

OCR C1 Coordinate geometry Assessment solutions

Solutions to Topic assessment

1. (i) $5y + 4x = 3$.

$$5y = -4x + 3$$

$$y = -\frac{4}{5}x + \frac{3}{5}$$

$$\text{Gradient of line} = -\frac{4}{5}$$

(ii) l_2 is parallel to l_1 , so it has gradient $-\frac{4}{5}$.

$$\text{Equation of line is } y - (-2) = -\frac{4}{5}(x - 1)$$

$$5(y + 2) = -4(x - 1)$$

$$5y + 10 = -4x + 4$$

$$5y + 4x + 6 = 0$$

2. The curve is a circle, centre O and radius 2.

3. Gradient of $AB = \frac{y_1 - y_2}{x_1 - x_2} = \frac{-3 - 7}{-1 - 5} = \frac{-10}{-6} = \frac{5}{3}$

$$\text{Gradient of line perpendicular to } AB = -\frac{3}{5}.$$

$$\text{The line passes through the midpoint of } AB = \left(\frac{-1 + 5}{2}, \frac{-3 + 7}{2} \right) = (2, 2)$$

$$\text{Equation of line is } y - 2 = -\frac{3}{5}(x - 5)$$

$$5(y - 2) = -3(x - 5)$$

$$5y - 10 = -3x + 6$$

$$5y + 3x = 16$$

4. Substituting $y = 3x - 10$ into $x^2 + y^2 = 10$

$$\text{gives } x^2 + (3x - 10)^2 = 10$$

$$x^2 + 9x^2 - 60x + 100 = 10$$

$$10x^2 - 60x + 90 = 0$$

$$x^2 - 6x + 9 = 0$$

$$(x - 3)^2 = 0$$

Since the equation has a repeated root, the line meets the circle just once, and so the line is a tangent to the circle.

OCR C1 Coordinate geometry Assessment solutions

5. (i) Substituting $y = 2x - 3$ into $3y + 4x = 8$:

$$3(2x - 3) + 4x = 8$$

$$6x - 9 + 4x = 8$$

$$10x = 17$$

$$x = 1.7$$

When $x = 1.7$, $y = 2 \times 1.7 - 3 = 3.4 - 3 = 0.4$

The coordinates of R are (1.7, 0.4)

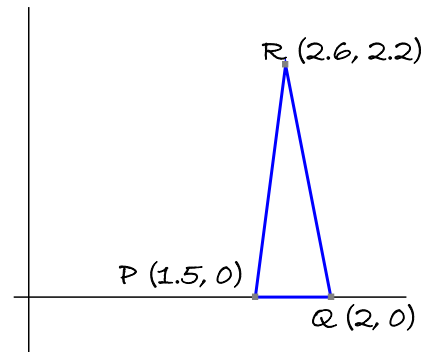
- (ii) P is the point on $y = 2x - 3$ where $y = 0$, so P is (1.5,

Q is the point on $3y + 4x = 8$ where $y = 0$, so Q is (2,

Area = $\frac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} \times 0.5 \times 0.4$$

$$= 0.1$$



6. (i) $x^2 + y^2 - 4x + 2y = 15$

$$x^2 - 4x + y^2 + 2y = 15$$

$$(x - 2)^2 - 4 + (y + 1)^2 - 1 = 15$$

$$(x - 2)^2 + (y + 1)^2 = 20$$

The centre C of the circle is (2, -1) and the radius is $\sqrt{20}$.

- (ii) Substituting $x = 4$ and $y = -5$: $(4 - 2)^2 + (-5 + 1)^2 = 4 + 16 = 20$
so the point (4, -5) lies on the circle.

(iii) Gradient of CP = $\frac{-1 - (-5)}{2 - 4} = \frac{4}{-2} = -2$

Tangent at P is perpendicular to CP, so gradient of tangent = $\frac{1}{2}$.

Equation of tangent is $y - (-5) = \frac{1}{2}(x - 4)$

$$2(y + 5) = x - 4$$

$$2y + 10 = x - 4$$

$$2y = x - 14$$

7. (i) Gradient of PQ = $\frac{y_1 - y_2}{x_1 - x_2} = \frac{-1 - 3}{-2 - 6} = \frac{-4}{-8} = \frac{1}{2}$

Gradient of QR = $\frac{y_1 - y_2}{x_1 - x_2} = \frac{3 - 2}{6 - 9} = \frac{1}{-3} = -\frac{1}{3}$

Gradient of RS = $\frac{y_1 - y_2}{x_1 - x_2} = \frac{2 - (-2)}{9 - 1} = \frac{4}{8} = \frac{1}{2}$

Gradient of SP = $\frac{y_1 - y_2}{x_1 - x_2} = \frac{-2 - (-1)}{1 - (-2)} = \frac{-1}{-3} = \frac{1}{3}$

OCR C1 Coordinate geometry Assessment solutions

(ii) PQ is parallel to RS , and QR is parallel to SP , so the quadrilateral is a parallelogram.

$$(iii) SR = \sqrt{(9-1)^2 + (2-(-2))^2} = \sqrt{64+16} = \sqrt{80}$$

(iv) From (i), gradient of $SR = \frac{1}{2}$

Equation of SR is $y - (-2) = \frac{1}{2}(x - 1)$

$$2(y+2) = x-1$$

$$2y+4 = x-1$$

$$2y = x-5$$

Line perpendicular to SR has gradient -2

Line L has gradient -2 and goes through $(6, 3)$

Equation of L is $y - 3 = -2(x - 6)$

$$y - 3 = -2x + 12$$

$$y + 2x = 15$$

(v) Equation of L is $y = 15 - 2x$

Substituting into equation of SR gives $2(15 - 2x) = x - 5$

$$30 - 4x = x - 5$$

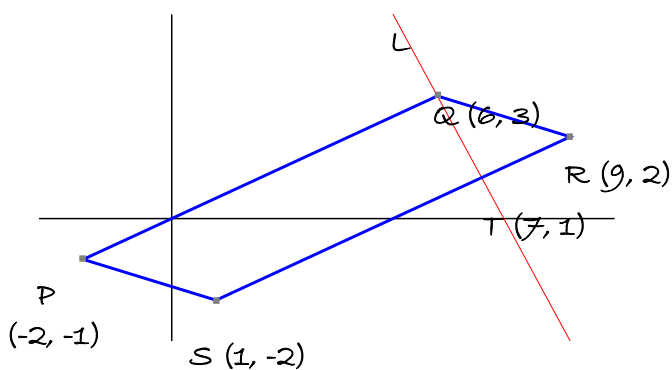
$$35 = 5x$$

$$x = 7$$

When $x = 7$, $y = 15 - 2 \times 7 = 1$

Coordinates of T are $(7, 1)$

(vi)



$$\text{Length } QT = \sqrt{(7-6)^2 + (1-3)^2} = \sqrt{1+4} = \sqrt{5}$$

Area of parallelogram = $SR \times QT$

$$= \sqrt{80} \sqrt{5}$$

$$= \sqrt{16} \sqrt{5} \sqrt{5}$$

$$= 4 \times 5 = 20$$

OCR C1 Coordinate geometry Assessment solutions

8. (i) C is the midpoint of AB.

$$C = \left(\frac{1+7}{2}, \frac{3+(-1)}{2} \right) = (4, 1)$$

(ii) Radius of circle = CA = $\sqrt{(4-1)^2 + (1-3)^2} = \sqrt{9+4} = \sqrt{13}$

(iii) Equation of circle is $(x-4)^2 + (y-1)^2 = 13$

(iv) Substituting $y = -5x + 8$ into equation of circle:

$$(x-4)^2 + (-5x+8-1)^2 = 13$$

$$(x-4)^2 + (-5x+7)^2 = 13$$

$$x^2 - 8x + 16 + 25x^2 - 70x + 49 = 13$$

$$26x^2 - 78x + 52 = 0$$

$$x^2 - 3x + 2 = 0$$

$$(x-1)(x-2) = 0$$

$$x = 1 \text{ or } x = 2$$

$x = 1$ is point A, so point D is $x = 2$

When $x = 2$, $y = -5 \times 2 + 8 = -2$

The coordinates of D are (2, -2)

(v) Gradient of AB = $\frac{3-(-1)}{1-7} = \frac{4}{-6} = -\frac{2}{3}$

$$\text{Gradient of CD} = \frac{1-(-2)}{4-2} = \frac{3}{2}$$

$$\text{Gradient of AB} \times \text{gradient of CD} = -\frac{2}{3} \times \frac{3}{2} = -1$$

so AB is perpendicular to CD.