Straight Lines

Question Paper 1

Level	A Level
Subject	Mathematics (Pure)
Exam Board	AQA
Module	Core 1
Topic	Co-ordinate geometry
Sub Topic	Straight lines
Booklet	Question Paper 1

Time Allowed: **88 minutes**

Score: **/73**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 The point A has coordinates $(-3, 2)$ and the point B has coordinates $(7, k)$.

The line AB has equation $3x + 5y = 1$.

(a) (i) Show that $k = -4$.

(1)

(ii) Hence find the coordinates of the midpoint of AB.

(2)

(b) Find the gradient of AB.

(2)

(c) A line which passes through the point A is perpendicular to the line AB. Find an equation of this line, giving your answer in the form $px + qy + r = 0$, where p, q and r are integers.

(3)

(d) The line AB, with equation $3x + 5y = 1$, intersects the line $5x + 8y = 4$ at the point C. Find the coordinates of C.

(3)
(Total 11 marks)

2 The gradient, $\frac{dy}{dx}$, of a curve at the point (x, y) is given by

$$\frac{dy}{dx} = 10x^4 - 6x^2 + 5$$

The curve passes through the point $P(1, 4)$.

(a) Find the equation of the tangent to the curve at the point P, giving your answer in the form $y = mx + c$.

(3)

(b) Find the equation of the curve.

(5)
(Total 8 marks)

3 A circle with centre $C(-3, 2)$ has equation

$$x^2 + y^2 + 6x - 4y = 12$$

(a) Find the y-coordinates of the points where the circle crosses the y-axis.

(3)

(b) Find the radius of the circle.

(3)

(c) The point $P(2, 5)$ lies outside the circle.

(i) Find the length of CP, giving your answer in the form $\sqrt{n}$, where n is an integer.

(2)

(ii) The point Q lies on the circle so that PQ is a tangent to the circle. Find the length of PQ.

(2)
(Total 10 marks)

4 The line AB has equation $3x - 4y + 5 = 0$.

(a) The point with coordinates $(p, p + 2)$ lies on the line AB. Find the value of the constant p.

(2)

(b) Find the gradient of AB.

(2)

(c) The point A has coordinates (1, 2). The point $C(-5, k)$ is such that AC is perpendicular to AB. Find the value of k.

(3)

(d) The line AB intersects the line with equation $2x - 5y = 6$ at the point D. Find the coordinates of D.

(3)
(Total 10 marks)

5 (a) (i) Express $2x^2 + 6x + 5$ in the form $2(x + p)^2 + q$, where p and q are rational numbers.

(2)

(ii) Hence write down the minimum value of $2x^2 + 6x + 5$.

(1)

(b) The point A has coordinates $(-3, 5)$ and the point B has coordinates $(x, 3x + 9)$.

(i) Show that $AB^2 = 5(2x^2 + 6x + 5)$.

(3)

(ii) Use your result from part (a)(ii) to find the minimum value of the length AB as x varies, giving your answer in the form $\frac{1}{2}\sqrt{n}$, where n is an integer.

(2)
(Total 8 marks)

6 A curve has equation $y = x^5 - 2x^2 + 9$. The point P with coordinates $(-1, 6)$ lies on the curve.

(a) Find the equation of the tangent to the curve at the point P, giving your answer in the form $y = mx + c$.

(5)

(b) The point Q with coordinates $(2, k)$ lies on the curve.

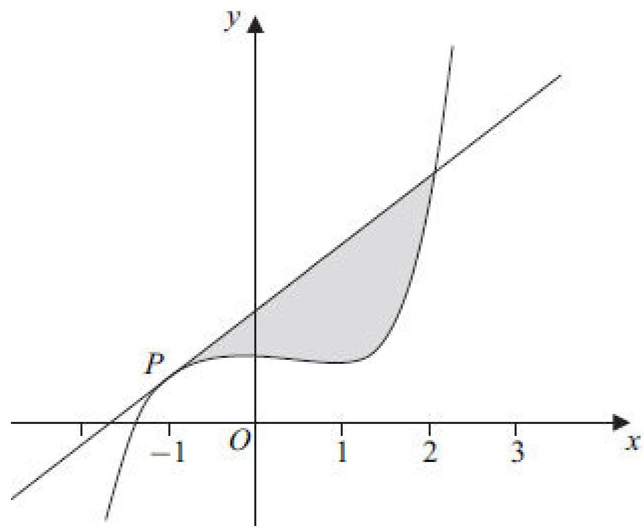
(i) Find the value of k.

(1)

(ii) Verify that Q also lies on the tangent to the curve at the point P.

(1)

(c) The curve and the tangent to the curve at P are sketched below.



(i) Find $\int_{-1}^{2} (x^5 - 2x^2 + 9)\,dx$.

(5)

(ii) Hence find the area of the shaded region bounded by the curve and the tangent to the curve at P.

(3)
(Total 15 marks)

7 The point A has coordinates (6, −4) and the point B has coordinates (−2, 7).

(a) Given that the point O has coordinates (0, 0), show that the length of OA is less than the length of OB.

(3)

(b) (i) Find the gradient of AB.

(2)

(ii) Find an equation of the line AB in the form $px + qy = r$, where p, q and r are integers.

(3)

(c) The point C has coordinates (k, 0). The line AC is perpendicular to the line AB.
Find the value of the constant k.

(3)
(Total 11 marks)