

Geometry and Differentiation

Difficulty: Hard

Question Paper 6

Level	AS & A Level
Subject	Maths - Pure
Exam Board	Edexcel
Topic	Geometry and Differentiation
Sub-Topic	
Difficulty	Hard
Booklet	Question Paper 6

Time allowed: 61 minutes

Score: /51

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>76%	61%	52%	42%	33%	23%	<23%

Question 1

The line l_1 has equation $y = -2x + 3$

The line l_2 is perpendicular to l_1 and passes through the point $(5, 6)$.

(a) Find an equation for l_2 in the form $ax + by + c = 0$, where a , b and c are integers. (3)

The line l_2 crosses the x -axis at the point A and the y -axis at the point B .

(b) Find the x -coordinate of A and the y -coordinate of B . (2)

Given that O is the origin,

(c) find the area of the triangle OAB . (2)

(Total 7 marks)

Question 2

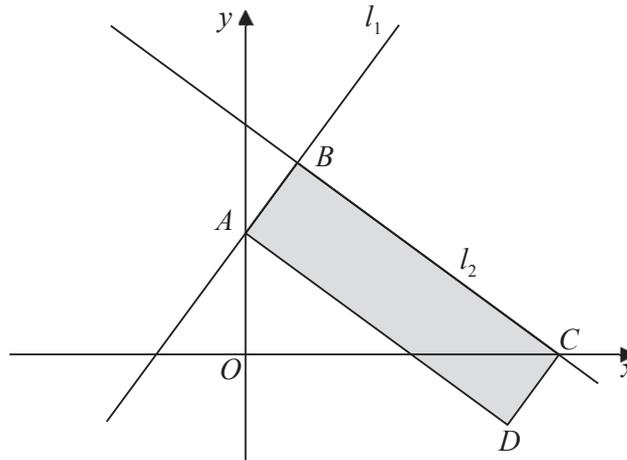


Figure 2

The straight line l_1 has equation $2y = 3x + 7$

The line l_1 crosses the y -axis at the point A as shown in Figure 2.

(a) (i) State the gradient of l_1

(ii) Write down the coordinates of the point A .

(2)

Another straight line l_2 intersects l_1 at the point $B(1, 5)$ and crosses the x -axis at the point C , as shown in Figure 2.

Given that $\angle ABC = 90^\circ$,

(b) find an equation of l_2 in the form $ax + by + c = 0$, where a , b and c are integers. **(4)**

The rectangle $ABCD$, shown shaded in Figure 2, has vertices at the points A , B , C and D .

(c) Find the exact area of rectangle $ABCD$. **(5)**

(Total 11 marks)

Question 3

A circle with centre $A(3, -1)$ passes through the point $P(-9, 8)$ and the point $Q(15, -10)$

(a) Show that PQ is a diameter of the circle.

(2)

(b) Find an equation for the circle.

(3)

A point R also lies on the circle.

Given that the length of the chord PR is 20 units,

- (c) find the length of the shortest distance from A to the chord PR .
Give your answer as a surd in its simplest form.

(2)

- (d) Find the size of angle ARQ , giving your answer to the nearest 0.1 of a degree.

(2)

(Total 9 marks)

Question 4

A pencil holder is in the shape of an open circular cylinder of radius r cm and height h cm. The surface area of the cylinder (including the base) is 250 cm^2 .

(a) Show that the volume, $V \text{ cm}^3$ of the cylinder is given by $V = 125r - \frac{\pi r^3}{2}$ (4)

(b) Use calculus to find the value of r for which V has a stationary value. (3)

(c) Prove that the value of r you found in part (b) gives a maximum value for V . (2)

(d) Calculate, to the nearest cm^3 , the maximum volume of the pencil holder. (2)

(Total 11 marks)

Question 5

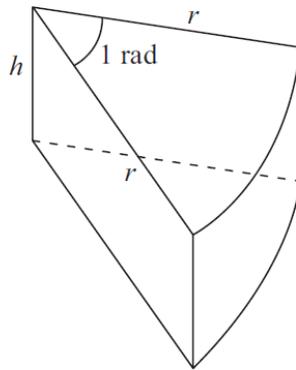


Figure 2

Figure 2 shows a closed box used by a shop for packing pieces of cake. The box is a right prism of height h cm. The cross section is a sector of a circle. The sector has radius r cm and angle 1 radian.

The volume of the box is 300 cm^3 .

(a) Show that the surface area of the box, $S \text{ cm}^2$, is given by

$$S = r^2 + \frac{1800}{r} \quad (5)$$

(b) Use calculus to find the value of r for which S is stationary. (4)

(c) Prove that this value of r gives a minimum value of S . (2)

(d) Find, to the nearest cm^2 , this minimum value of S . (2)

(Total 13 marks)