Geometry and Differentiation Difficulty: Hard

Question Paper 3

Level	AS & A Level
Subject	Maths - Pure
Exam Board	Edexcel
Topic	Geometry and Differentiation
Sub-Topic	
Difficulty	Hard
Booklet	Question Paper 3

Time allowed: **68 minutes**

Score: **/57**

Percentage: **/100**

Grade Boundaries:

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

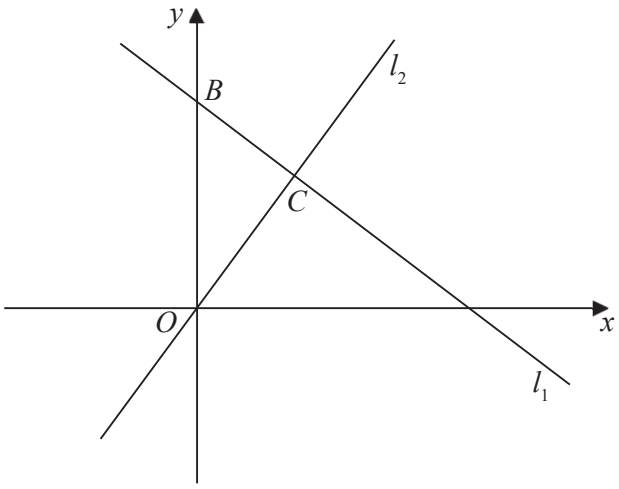


Figure 2

The line l_1, shown in Figure 2 has equation $2x + 3y = 26$

The line l_2 passes through the origin O and is perpendicular to l_1

(a) Find an equation for the line l_2 **(4)**

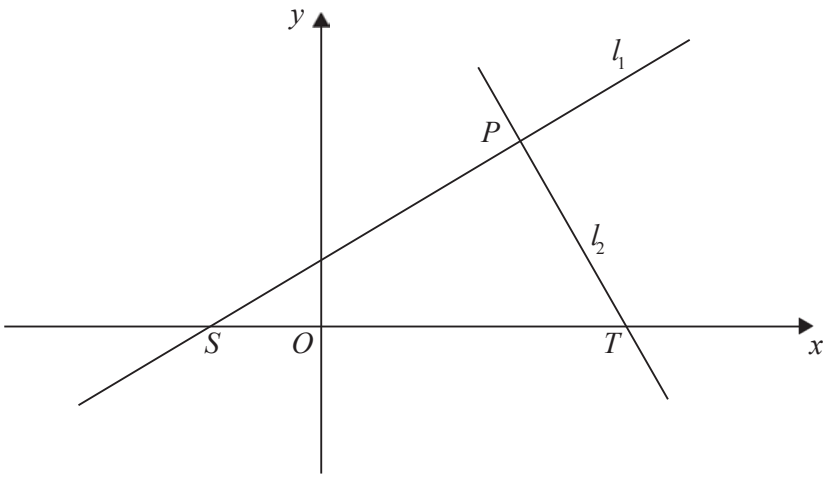
The line l_2 intersects the line l_1 at the point C.

Line l_1 crosses the y-axis at the point B as shown in Figure 2.

(b) Find the area of triangle OBC.

Give your answer in the form $\frac{a}{b}$, where a and b are integers to be determined. **(6)**

(Total 10 marks)



Not to scale

Figure 1

The straight line l_1, shown in Figure 1, has equation $5y = 4x + 10$

The point P with x coordinate 5 lies on l_1

The straight line l_2 is perpendicular to l_1 and passes through P.

(a) Find an equation for l_2, writing your answer in the form $ax + by + c = 0$ where a, b and c are integers. **(4)**

The lines l_1 and l_2 cut the x-axis at the points S and T respectively, as shown in Figure 1.

(b) Calculate the area of triangle SPT.

(4)

(Total 8 marks)

The circle C has equation

$$x^2 + y^2 - 20x - 24y + 195 = 0$$

The centre of C is at the point M.

(a) Find

(i) the coordinates of the point M,

(ii) the radius of the circle C. **(5)**

N is the point with coordinates (25, 32).

(b) Find the length of the line MN. **(2)**

The tangent to C at a point P on the circle passes through point N.

(c) Find the length of the line NP. **(2)**

(Total 9 marks)

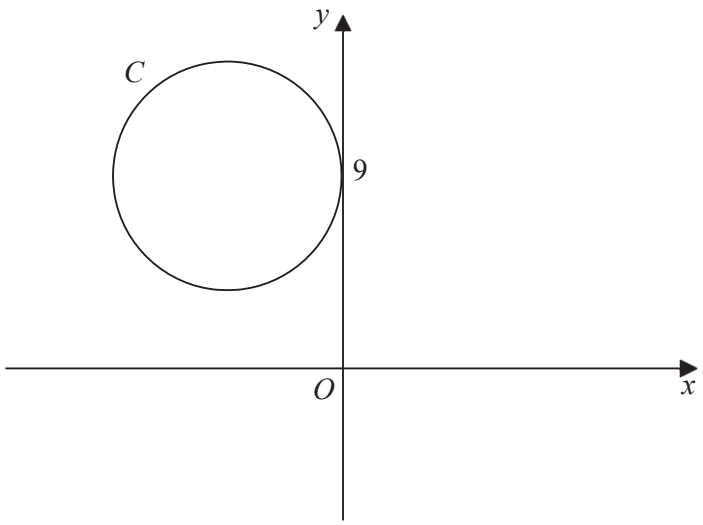


Figure 4

The circle C has radius 5 and touches the y-axis at the point (0, 9), as shown in Figure 4.

(a) Write down an equation for the circle C, that is shown in Figure 4. **(3)**

A line through the point $P(8, -7)$ is a tangent to the circle C at the point T.

(b) Find the length of PT. **(3)**

(Total 6 marks)

Question 5

The curve C has equation $y = x^2(x - 6) + \frac{4}{x}, x > 0$.

The points P and Q lie on C and have x-coordinates 1 and 2 respectively.

(a) Show that the length of PQ is $\sqrt{170}$.

(4)

(b) Show that the tangents to C at P and Q are parallel.

(5)

(c) Find an equation for the normal to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(Total 13 marks)

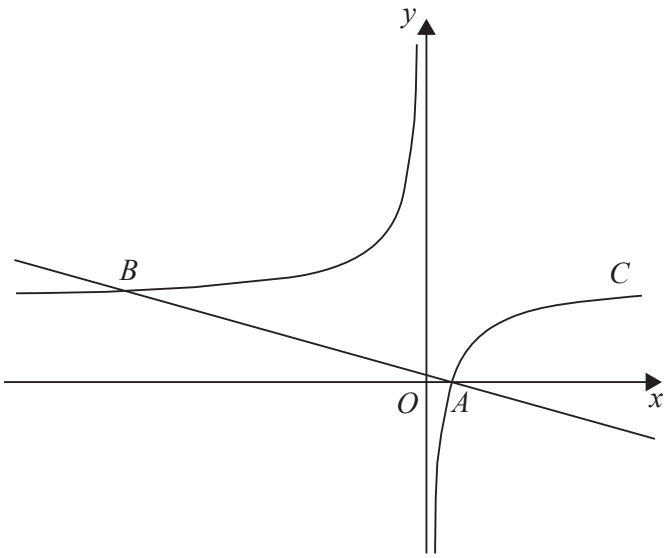


Figure 2

Figure 2 shows a sketch of the curve C with equation

$$y = 2 - \frac{1}{x}, \quad x \neq 0$$

The curve crosses the x-axis at the point A.

(a) Find the coordinates of A. **(1)**

(b) Show that the equation of the normal to C at A can be written as

$$2x + 8y - 1 = 0$$

(6)

The normal to C at A meets C again at the point B, as shown in Figure 2.

(c) Find the coordinates of B.

(4)

(Total 11 marks)