Name:

Total Marks:

Pure Mathematics 1

Advanced Subsidiary

Practice Paper M9

Time: 2 hours

Information for Candidates

- This practice paper is an adapted legacy old paper for the Edexcel GCE AS Level Specifications
- There are 14 questions in this question paper
- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets.
- Full marks may be obtained for answers to ALL questions

Advice to candidates:

- You must ensure that your answers to parts of questions are clearly labelled.
- You must show sufficient working to make your methods clear to the Examiner
- Answers without working may not gain full credit

Question 1

Giving your answer in set notation, find the set of values of x for which

(a) $4x - 3 > 7 - x$ **(2)**

(b) $2x^2 - 5x - 12 < 0$ **(4)**

(c) **both** $4x - 3 > 7 - x$ **and** $2x^2 - 5x - 12 < 0$ **(1)**

(Total 7 marks)

Question 2

The equation $x^2 + 3px + p = 0$, where p is a non-zero constant, has equal roots.

Find the value of p. **(4)**

(Total 4 marks)

Question 3

The curve C has equation

$$y = x^3 - 2x^2 - x + 9, \quad x > 0$$

The point P has coordinates (2, 7).

(a) Show that P lies on C. **(1)**

(b) Find the equation of the tangent to C at P, giving your answer in the form $y = mx + c$, where m and c are constants. **(5)**

The point Q also lies on C.

Given that the tangent to C at Q is perpendicular to the tangent to C at P,

(c) show that the x-coordinate of Q is $\frac{1}{3}\left(2+\sqrt{6}\right)$. **(5)**

(Total 11 marks)

Question 4

(a) Factorise completely $x^3 - 6x^2 + 9x$ **(3)**

(b) Sketch the curve with equation

$$y = x^3 - 6x^2 + 9x$$

showing the coordinates of the points at which the curve meets the x-axis. **(4)**

Using your answer to part (b), or otherwise,

(c) sketch, on a separate diagram, the curve with equation

$$y = (x - 2)^3 - 6(x - 2)^2 + 9(x - 2)$$

showing the coordinates of the points at which the curve meets the x-axis. **(2)**

(Total 9 marks)

Question 5

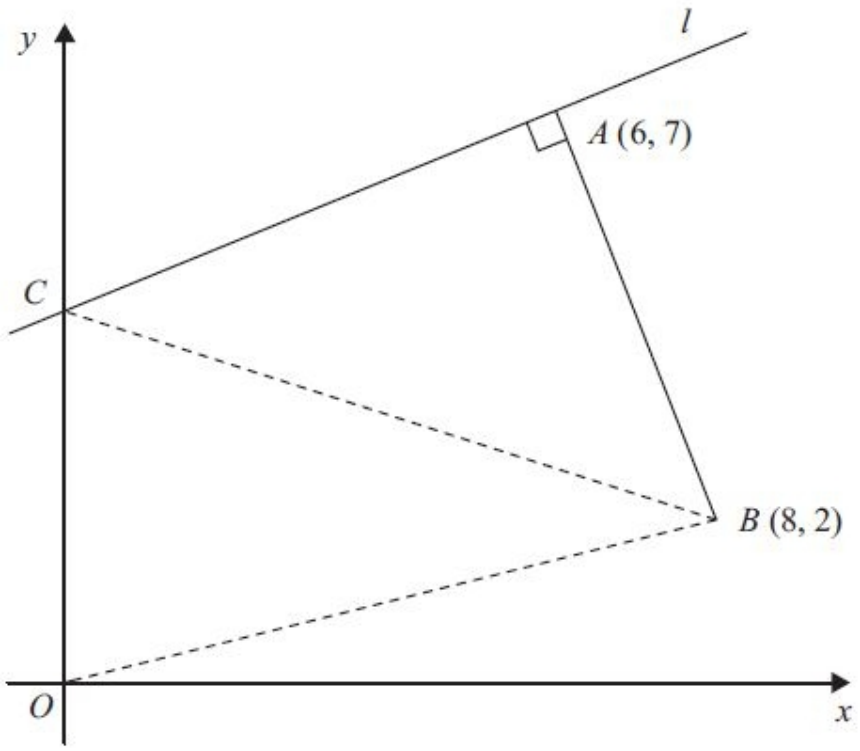


Figure 1

The points A and B have coordinates (6, 7) and (8, 2) respectively.

The line l passes through the point A and is perpendicular to the line AB, as shown in Figure 1.

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

Given that l intersects the y-axis at the point C, find

(b) the coordinates of C, **(2)**

(c) the area of ΔOCB, where O is the origin. **(2)**

(Total 8 marks)

Question 6

The circle C has equation

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

(a) Find the centre and the radius of C. **(5)**

The point $P(-1, 1)$ and the point $Q(7, -5)$ both lie on C.

(b) Show that PQ is a diameter of C. **(2)**

The point R lies on the positive y-axis and the angle $PRQ = 90°$.

(c) Find the coordinates of R. **(4)**

(Total 11 marks)

Question 7

(a) Find the value of y such that

$$\log_2 y = -3$$ **(2)**

(b) Find the values of x such that

$$\frac{\log_2 32 + \log_2 16}{\log_2 x} = \log_2 x$$ **(5)**

(Total 7 marks)

Question 8

Rabbits were introduced onto an island. The number of rabbits, P, t years after they were introduced is modelled by the equation

$$P = 80e^{\frac{1}{5}t}, \qquad t \in \mathbb{R}, t \geqslant 0$$

(a) Write down the number of rabbits that were introduced to the island. **(1)**

(b) Find the number of years it would take for the number of rabbits to first exceed 1000. **(2)**

(c) Find $\frac{dP}{dt} = 50.$ **(2)**

(d) Find P when $\frac{dP}{dt} = 50.$ **(3)**

(Total 8 marks)

Question 9

(i) Solve, for $-180° \leq \theta < 180°$,

$$(1+\tan\theta)(5\sin\theta - 2) = 0.$$

(4)

(ii) Solve, for $0 \leq x < 360°$,

$$4\sin x = 3\tan x.$$

(6)

(Total 10 marks)

Question 10

Use calculus to find the value of

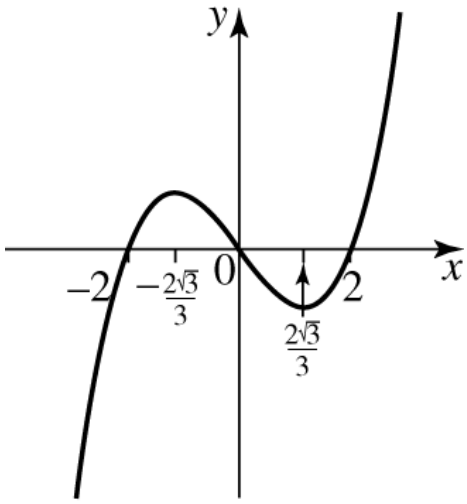
$$\int_1^4 (2x + 3\sqrt{x})\,dx.$$

(5)

(Total 5 marks)

Question 11

Sketch the gradient function for the following graph stating clearly the coordinates of any turning points and where the graph cuts the axes.



(Total 3 marks)

Question 12

Find the set of values for which $\frac{2}{x+3} < 5$, for which $x \neq -3$ **(Total 6 marks)**

Question 13

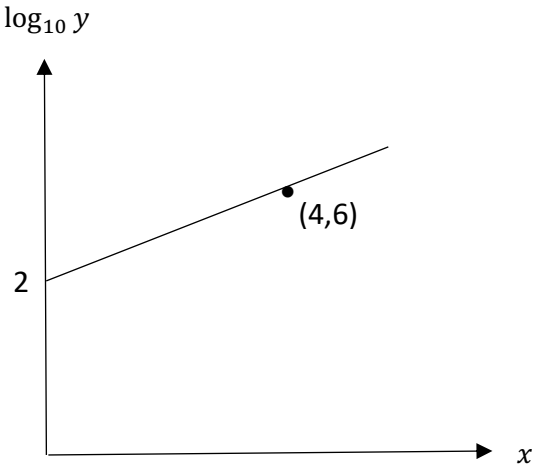


Figure 1

The graph of $\log_{10} y$ against x is a straight line as shown in Figure 1

(i) Find the equation for $\log_{10} y$ in terms of x **(3)**

(ii) Find the equation for y in terms of x **(2)**

(Total 5 marks)

Question 14

Two forces $\mathbf{F_1}$ and $\mathbf{F_2}$ are given by the vectors $\mathbf{F_1} = (-3\mathbf{i} - 4\mathbf{j})$ N and $\mathbf{F_2} = (p\mathbf{i} - 3p\mathbf{j})$ N. The resultant of the forces $\mathbf{F_1}$ and $\mathbf{F_2}$, **R** acts in a direction which is parallel to the vector $(3\mathbf{i} - 4\mathbf{j})$.

(i) Show that $p = -\frac{24}{5}$ **(3)**

(ii) Find the resultant force **R** **(1)**

(iii) Find the angle between **R** and the vector **i** to the nearest degree **(2)**

(Total 6 marks)

TOTAL FOR PAPER IS 100 MARKS