Name:

Total Marks:

Pure Mathematics 1

Advanced Subsidiary

Practice Paper M7

Time: 2 hours

Information for Candidates

- This practice paper is an adapted legacy old paper for the Edexcel GCE AS Level Specifications
- There are 13 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

(a) By eliminating y from the equations

$$y = x - 4$$

$$2x^2 - xy = 8,$$

show that

$$x^2 + 4x - 8 = 0$$

(2)

(b) Hence, or otherwise, solve the simultaneous equations

$$y = x - 4,$$

$$2x^2 - xy = 8,$$

giving your answers in the form $a \pm b\sqrt{3}$, where a and b are integers.

(5)

(Total 7 marks)

Question 2.

The equation $x^2 + kx + (k + 3) = 0$, where k is a constant, has different real roots.

(a) Show that $k^2 - 4k - 12 > 0$.

(2)

(b) Find the set of possible values of k.

(4)

(Total 6 marks)

Question 3.

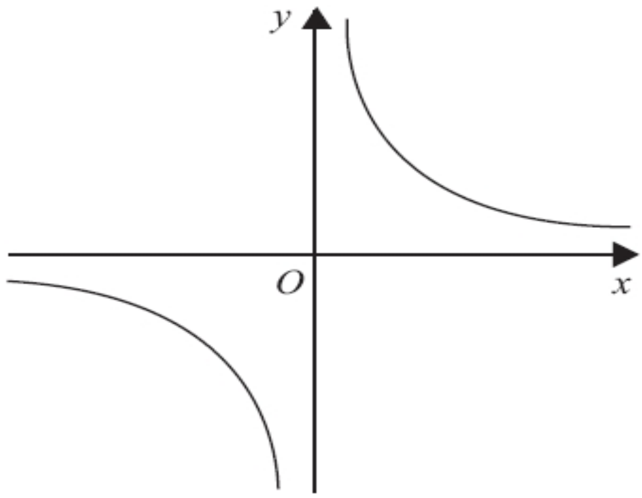

Figure 1

Figure 1 shows a sketch of the curve with equation = $y = \frac{3}{x}$, $x \neq 0$.

(a) On a separate diagram, sketch the curve with equation $y = \frac{3}{x+2}, \; x \neq -2$,
showing the coordinates of any point at which the curve crosses a coordinate axis.

(3)

(b) Write down the equations of the asymptotes of the curve in part (a).

(2)

(Total 5 marks)

Question 4.

The line l_1 has equation $y = 3x + 2$ and the line l_2 has equation $3x + 2y - 8 = 0$.

(a) Find the gradient of the line l_2 .

(2)

The point of intersection of l_1 and l_2 is *P*.

(b) Find the coordinates of *P*.

(3)

The lines l_1 and l_2 cross the line $y = 1$ at the points *A* and *B* respectively.

(c) Find the area of triangle *ABP*.

(4)

(Total 9 marks)

Question 5.

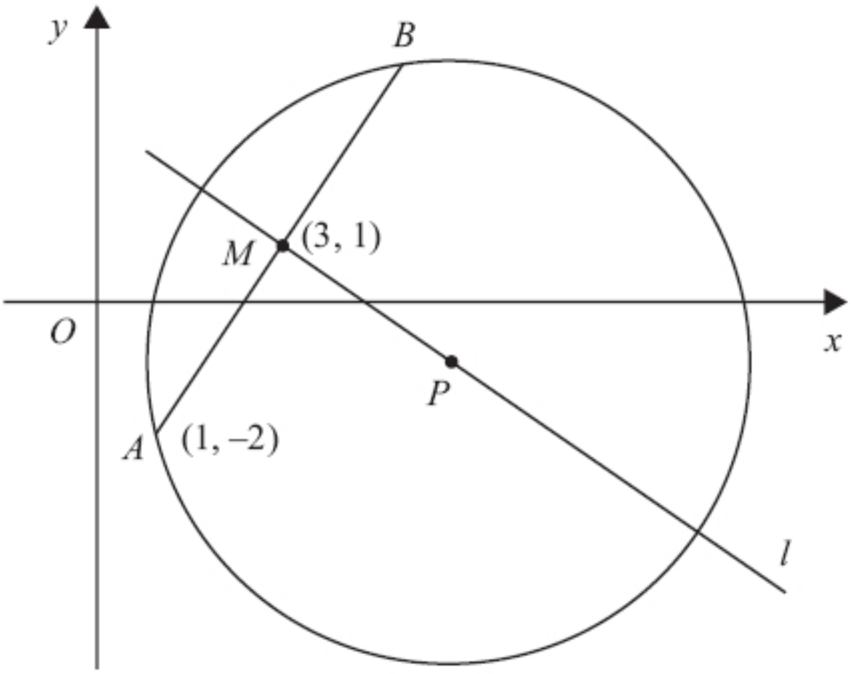

Figure 3

The points A and B lie on a circle with centre P, as shown in Figure 3.
The point A has coordinates (1, –2) and the mid-point M of AB has coordinates (3, 1).
The line l passes through the points M and P.

(a) Find an equation for l.

(4)

Given that the x-coordinate of P is 6,

(b) use your answer to part (a) to show that the y-coordinate of P is –1,

(1)

(c) find an equation for the circle.

(4)

(Total 9 marks)

Question 6.

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)

Question 7.

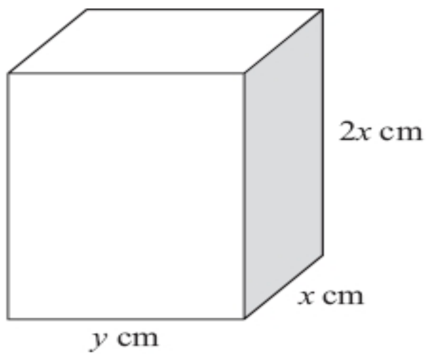

Figure 4

Figure 4 shows a solid brick in the shape of a cuboid measuring $2x$ cm by x cm by y cm.

The total surface area of the brick is 600 cm^2.

(a) Show that the volume, V cm^3, of the brick is given by

$$V = 200x - \frac{4x^3}{3}.$$

(4)

Given that x can vary,

(b) use calculus to find the maximum value of V, giving your answer to the nearest cm^3.

(5)

(c) Justify that the value of V you have found is a maximum.

(2)

(Total 11 marks)

Question 8.

Given that $y = 3x^2 + 4\sqrt{x}$, $x > 0$, find

(a) $\frac{dy}{dx}$, **(2)**

(b) $\frac{d^2y}{dx^2}$ **(2)**

(c) $\int y\,dx$, **(3)**

(Total 7 marks)

Question 9.

(a) Find, to 3 significant figures, the value of x for which $8^x = 0.8$.

(2)

(b) Solve the equation

$$2\log_3 x - \log_3 7x = 1.$$

(4)

(Total 6 marks)

Question 10.

The curve C with equation $y = f(x)$ passes through the point (5, 65).

Given that $f'(x) = 6x^2 - 10x - 12$,

(a) use integration to find $f(x)$.

(4)

(b) Hence show that $f(x) = x(2x + 3)(x - 4)$.

(2)

(c) Sketch C, showing the coordinates of the points where C crosses the x-axis.

(3)

(Total 9 marks)

Question 11.

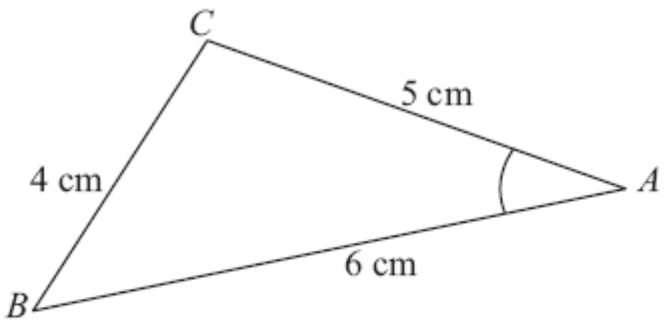

Figure 1

Figure 1 shows the triangle *ABC*, with *AB* = 6 cm, *BC* = 4 cm and *CA* = 5 cm.

(a) Show that cos *A* = $\frac{3}{4}$.

(3)

(b) Hence, or otherwise, find the exact value of sin *A*.

(2)

(Total 5 marks)

Question 12.

(a) Sketch, for $0 \leq x \leq 360^0$, the graph of $\sin(x + 30^0)$.

(2)

(b) Write down the exact coordinates of the points where the graph meets the coordinate axes.

(3)

(c) Solve, for $0 \leq x \leq 360^0$, the equation

$$\sin(x + 30^0) = 0.65$$

giving your answers in degrees to 2 decimal places.

(5)

(Total 10 marks)

Question 13.

The temperature, T^0 C, of a room is given by $T = 45e^{\frac{-t}{6}}$ + 25, where $t \geq 0$ and t is the time in minutes at the start when measurements began.

(a) Find the rate of at which the temperature T is decreasing at the instant when $t =$ 15. **(2)**

(b) Explain why the temperature can never drop to 20^0 C. **(1)**

(Total 3 marks)

TOTAL FOR PAPER IS 100 MARKS