L6 Mathematics Mock

Paper 2 (Teacher Y)

January 2023

2022-2023

Duration: **1 hour 8 minutes**

Total number of marks: **56**

Write your answers on file paper.

You are permitted to use a scientific or graphical calculator in this paper.

Final answers should be given to a degree of accuracy appropriate to the context.

Relevant information from the formula booklet is given below:

Formulae
AS Level Mathematics A (H230)

Binomial series

$$(a+b)^n = a^n + {}^nC_1\, a^{n-1}b + {}^nC_2\, a^{n-2}b^2 + \ldots + {}^nC_r\, a^{n-r}b^r + \ldots + b^n \qquad (n \in \mathbb{N}),$$

where $${}^nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Differentiation from first principles

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

1.

Express $3x^3 + 5x^2 - 27x + 10$ in the form $(x - 2)(ax^2 + bx + c)$, where a, b and c are integers.

[3 marks]

2.

(a) Factorise completely $9x - x^3$

(2)

The curve C has equation

$$y = 9x - x^3$$

(b) Sketch C showing the coordinates of the points at which the curve cuts the x-axis.

(2)

The line l has equation $y = k$ where k is a constant.

Given that C and l intersect at 3 distinct points,

(c) find the range of values for k, writing your answer in set notation.

Solutions relying on calculator technology are not acceptable.

(3)

3.

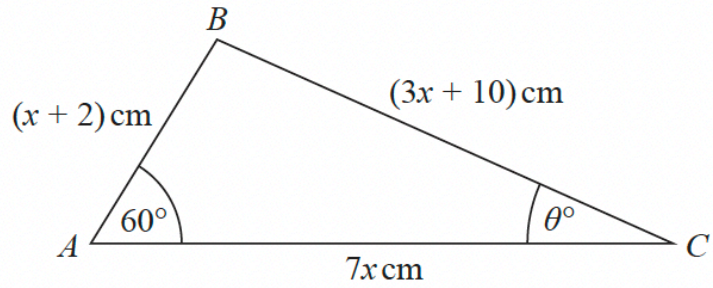


Figure 1

Figure 1 shows a sketch of triangle ABC with $AB = (x + 2)$ cm, $BC = (3x + 10)$ cm, $AC = 7x$ cm, angle $BAC = 60°$ and angle $ACB = \theta°$

(a) (i) Show that $17x^2 - 35x - 48 = 0$

(3)

(ii) Hence find the value of x.

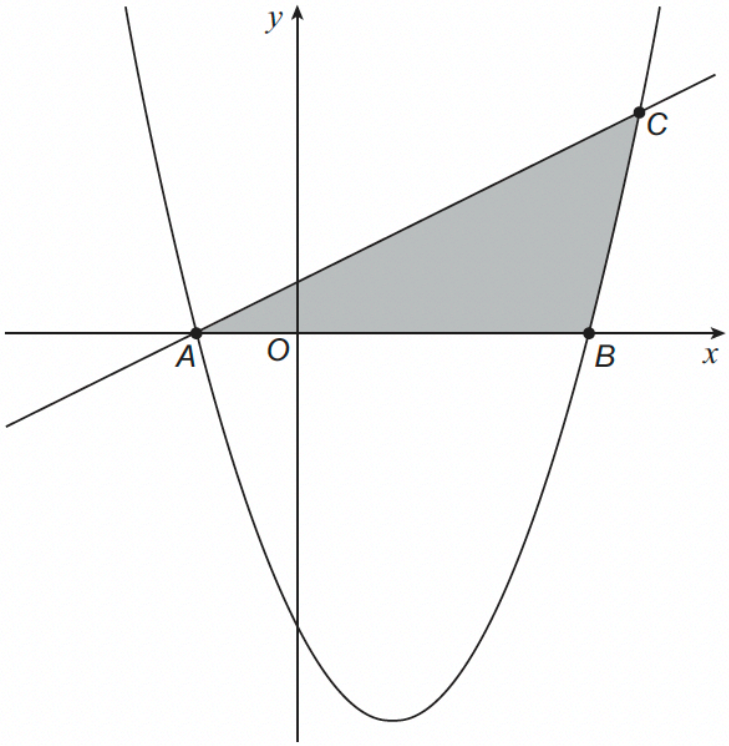
(1)

(b) Hence find the value of θ giving your answer to one decimal place.

(2)

4.

The diagram below shows the graphs of $y = x^2 - 4x - 12$ and $y = x + 2$



(a) Write down three inequalities which together describe the shaded region.

[2 marks]

(b) Find the coordinates of the points *A*, *B* and *C*.

[4 marks]

5.

AB is a diameter of a circle where *A* is (1, 4) and *B* is (7, −2)

(a) Find the coordinates of the midpoint of *AB*.

[1 mark]

(b) Show that the equation of the circle may be written as

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

[4 marks]

(c) The circle has centre *C* and crosses the x-axis at points *D* and *E*.

Find the exact area of triangle *DEC*.

[4 marks]

6.

In this question you must show detailed reasoning.

The cubic polynomial f(x) is defined by $f(x) = 5x^3 - 4x^2 + ax - 2$, where a is a constant.

You are given that $(x-2)$ is a factor of f(x).

(a) Find the value of a. **[2]**

(b) Find all the factors of f(x). **[3]**

7.

(i) Sketch the curve $y = \sqrt{x}$. **[2]**

(ii) Describe the transformation that transforms the curve $y = \sqrt{x}$ to the curve $y = \sqrt{x-4}$. **[2]**

(iii) The curve $y = \sqrt{x}$ is stretched by a scale factor of 5 parallel to the x-axis. State the equation of the transformed curve. **[2]**

8.

(a) Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(3 - \frac{2x}{9}\right)^8$$

giving each term in simplest form.

(4)

$$f(x) = \left(\frac{x-1}{2x}\right)\left(3 - \frac{2x}{9}\right)^8$$

(b) Find the coefficient of x^2 in the series expansion of f(x), giving your answer as a simplified fraction.

(2)

9.

(a) In this question you must show detailed reasoning.

Find the range of values of the constant m for which the simultaneous equations $y = mx$ and $x^2 + y^2 - 6x - 2y + 5 = 0$ have real solutions. **[5]**

(b) Give a geometrical interpretation of the solution in the case where $m = 2$. **[3]**