

MOCK EXAM

AS Unit 1: Pure Mathematics A

This exam is based on 2018 Legacy WJEC C1 and C2 papers

Time allowed 2 ½ hours

Total Marks Available 121

1. The points A , B , C and D have coordinates $(-2, 7)$, $(2, -1)$, $(5, 3)$ and $(3, 7)$ respectively.
 - (a)
 - (i) Show that AB and DC are parallel.
 - (ii) Find the equation of AB . [5]
 - (b) The line L has equation $x - 2y + 11 = 0$ and intersects AB at the point E .
 - (i) Giving a reason, determine whether or not L is perpendicular to AB .
 - (ii) Show that E has coordinates $(-1, 5)$.
 - (iii) Calculate the length of EF , where F denotes the midpoint of AB . [8]

2. Simplify $\sqrt{500} + (\sqrt{12} \times \sqrt{15}) - \frac{7\sqrt{60}}{\sqrt{3}}$. [4]

3. The curve C has equation $y = x^2 - 6x + 7$. The point P , whose x -coordinate is 2, lies on C .
 - (a) Show that the equation of the **normal** to C at P is $y = \frac{1}{2}x - 2$. [6]
 - (b) The normal to C at P intersects C again at the point Q . Find the coordinates of Q . [4]

4. (a) Express $4x^2 + 40x - 69$ in the form $a(x + b)^2 + c$, where the values of the constants a , b and c are to be found. [3]

- (b) **Using your answer to part (a)**, solve the equation

$$4x^2 + 40x - 69 = 0.$$
[3]

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5. (a) Using the binomial theorem, write down and simplify the first four terms in the expansion of $\left(1 - \frac{x}{2}\right)^7$ in ascending powers of x . [4]
- (b) The coefficient of x^2 in the expansion of $(1 + 4x)^n$ is 3360. Given that n is a positive integer, find the value of n . [3]

6. Find the range of values of x satisfying the inequality

$$9x^2 + 16x - 4 > 0. \quad [3]$$

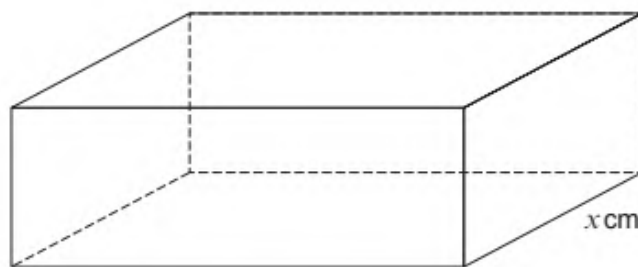
7. (a) Given that $y = 9x^2 - 7x - 8$, find $\frac{dy}{dx}$ from first principles. [5]

- (b) Given that $y = \frac{k}{x} + 14\sqrt{x}$ and that $\frac{dy}{dx} = 2$ when $x = 9$, find the value of the constant k . [4]

8. (a) (i) Find one real root of the equation $8x^3 + 7x^2 - 13x + 10 = 0$.
 (ii) Show that the root you have found is the only real root of the equation

$$8x^3 + 7x^2 - 13x + 10 = 0. \quad [7]$$

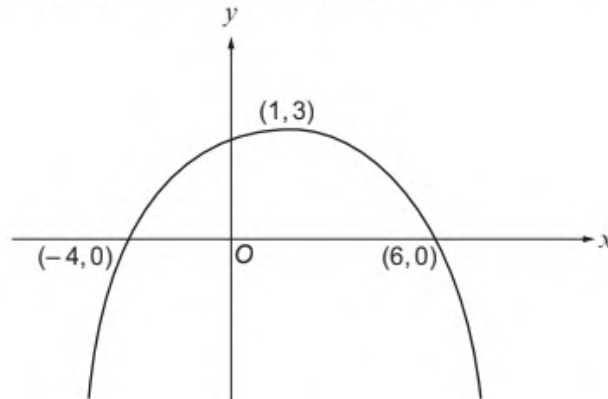
9. A closed box, in the form of a cuboid, is such that the length of its base is three times the width of its base. The volume of the box is 6000 cm^3 . The total length of the twelve edges of the box is denoted by $L \text{ cm}$.



- (a) Show that $L = 16x + \frac{8000}{x^2}$, where $x \text{ cm}$ denotes the width of the base. [3]

- (b) Find the minimum value of L , showing that the value you have found is a minimum value. [5]

10. The diagram shows a sketch of the graph of $y = f(x)$. The graph passes through the points $(-4, 0)$ and $(6, 0)$ and has a maximum point at $(1, 3)$.



- (a) Sketch the graph of $y = f(x + 3)$, indicating the coordinates of the stationary point and the coordinates of the points of intersection of the graph with the x -axis. [3]
- (b) Gwen is asked by her teacher to draw the graph of $y = f(ax)$ for various values of the constant a . Two of Gwen's graphs pass through the point $(2, 0)$. Find the value of a corresponding to each of these two graphs. [2]
11. (a) Find all values of θ in the range $0^\circ \leq \theta \leq 360^\circ$ satisfying
- $$10 \sin^2 \theta + 3 \sin \theta = 4 \cos^2 \theta - 2. \quad [6]$$
- (b) Find all values of ϕ in the range $0^\circ \leq \phi \leq 360^\circ$ satisfying
- $$\frac{3}{\cos \phi} - \frac{5}{\sin \phi} = 0. \quad [3]$$
12. Find all values of x satisfying the equation
- $$\log_a(11x^2 + 16x + 5) - \log_a(4x^2 + 1) = 3 \log_a 2. \quad [5]$$
13. Given that n is an even number, prove that $9n^2 + 6n$ has a factor of 12. [3]

14. The circle C_1 has centre $A(2, -1)$ and passes through the point $P(6, 1)$.

(a) (i) Show that the equation of C_1 is given by

$$x^2 + y^2 - 4x + 2y - 15 = 0.$$

(ii) Given that the point Q is such that PQ is a diameter of C_1 , find the coordinates of Q .

(iii) Find the equation of the tangent to C_1 at P . [9]

(b) The circle C_2 has centre $B(-4, 7)$ and radius $\sqrt{8}$. Find the shortest distance between C_1 and C_2 . Give your answer correct to one decimal place. [3]

15. The points A, B and C have position vectors $-2\mathbf{i} + \mathbf{j}$, $2\mathbf{i} + 5\mathbf{j}$ and $6\mathbf{i} + 3\mathbf{j}$ respectively.

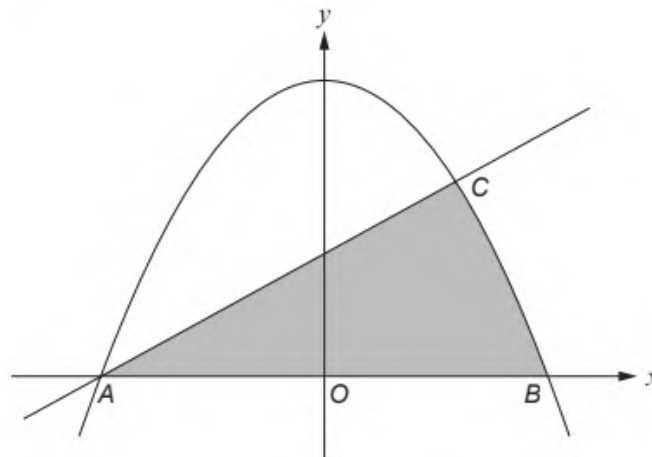
M is the midpoint of BC .

(a) Find the position vector of the point D such that $\overrightarrow{BC} = \overrightarrow{AD}$. [3]

(b) Find the magnitude of \overrightarrow{AM} . [3]

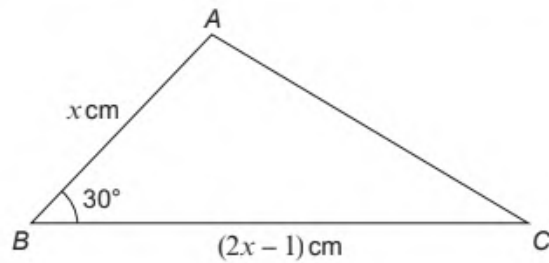
16. (a) Find $\int \left(\sqrt[3]{x} - \frac{4}{x^{\frac{7}{2}}} \right) dx$. [2]

(b)



The diagram shows a sketch of the curve $y = 25 - x^2$ and the line $y = 2x + 10$. The curve and the line intersect at the points A and C . The curve intersects the x -axis at the points A and B . The coordinates of A, B and C are $(-5, 0)$, $(5, 0)$ and $(3, 16)$ respectively. Find the area of the shaded region. [6]

17. (a) The diagram below shows a sketch of the triangle ABC with $AB = x$ cm, $BC = (2x - 1)$ cm and $\hat{A}BC = 30^\circ$. The area of triangle ABC is 11.25 cm².



- (i) Write down and simplify a quadratic equation satisfied by x .
Hence show that $x = 5$.
- (ii) Find the length of AC . Give your answer correct to one decimal place. [6]

END OF PAPER