

GCE Examinations
Advanced / Advanced Subsidiary

Core Mathematics C1

Paper H

Time: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.
- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.
- **You are not permitted to use a calculator in this paper.**

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 72.
- **You are reminded of the need for clear presentation in your answers.**



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1.
$$f(x) = (\sqrt{x} + 3)^2 + (1 - 3\sqrt{x})^2.$$

Show that $f(x)$ can be written in the form $ax + b$ where a and b are integers to be found. [3]

2. Find in exact form the real solutions of the equation

$$x^4 = 5x^2 + 14. \quad [4]$$

3.
$$f(x) = x^3 + 4x^2 - 3x + 7.$$

Find the set of values of x for which $f(x)$ is increasing. [5]

4. Express each of the following in the form $p + q\sqrt{2}$ where p and q are rational.

(i) $(4 - 3\sqrt{2})^2$ [2]

(ii) $\frac{1}{2 + \sqrt{2}}$ [3]

5. Given that the equation

$$x^2 + 4kx - k = 0$$

has no real roots,

(i) show that

$$4k^2 + k < 0, \quad [3]$$

(ii) find the set of possible values of k . [3]

6. The curve with equation $y = x^2 + 2x$ passes through the origin, O .

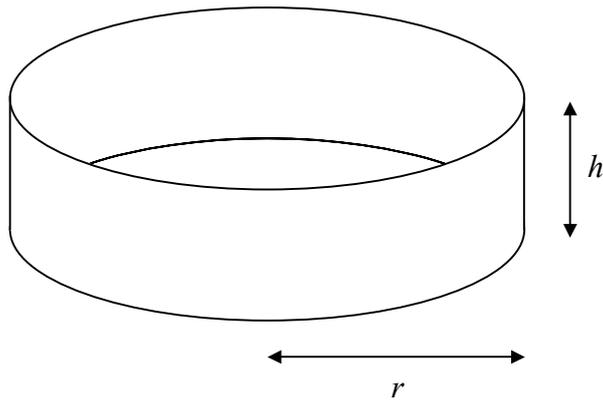
(i) Find an equation for the normal to the curve at O . [4]

(ii) Find the coordinates of the point where the normal to the curve at O intersects the curve again. [3]

7. A circle has centre $(5, 2)$ and passes through the point $(7, 3)$.
- (i) Find the length of the diameter of the circle. [2]
- (ii) Find an equation for the circle. [2]
- (iii) Show that the line $y = 2x - 3$ is a tangent to the circle and find the coordinates of the point of contact. [5]
8. (i) Sketch the graphs of $y = 2x^4$ and $y = 2\sqrt{x}$, $x \geq 0$ on the same diagram and write down the coordinates of the point where they intersect. [4]
- (ii) Describe fully the transformation that maps the graph of $y = 2\sqrt{x}$ onto the graph of $y = 2\sqrt{x-3}$. [2]
- (iii) Find and simplify the equation of the graph obtained when the graph of $y = 2x^4$ is stretched by a factor of 2 in the x -direction, about the y -axis. [3]
9. The straight line l_1 passes through the point $A(-2, 5)$ and the point $B(4, 1)$.
- (i) Find an equation for l_1 in the form $ax + by = c$, where a , b and c are integers. [4]
- The straight line l_2 passes through B and is perpendicular to l_1 .
- (ii) Find an equation for l_2 . [3]
- Given that l_2 meets the y -axis at the point C ,
- (iii) show that triangle ABC is isosceles. [4]

Turn over

10.



The diagram shows an open-topped cylindrical container made from cardboard. The cylinder is of height h cm and base radius r cm.

Given that the area of card used to make the container is 192π cm²,

(i) show that the capacity of the container, V cm³, is given by

$$V = 96\pi r - \frac{1}{2}\pi r^3. \quad [5]$$

(ii) Find the value of r for which V is stationary. [4]

(iii) Find the corresponding value of V in terms of π . [2]

(iv) Determine whether this is a maximum or a minimum value of V . [2]