GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C2

Paper I

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 permitted to use a graphic 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.**

1. The sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_n = 2^n + kn,$$

where k is a constant.

Given that $u_1 = u_3$,

(i)   find the value of k, [3]

(ii) find the value of u_5. [2]

2. Given that

$$y = 2x^{\frac{3}{2}} - 1,$$

find

$$\int y^2 \, dx. \qquad [6]$$

3. (i)   Sketch the curve $y = \sin x°$ for x in the interval $-180 \le x \le 180$. [2]

(ii) Sketch on the same diagram the curve $y = \sin (x - 30)°$ for x in the interval $-180 \le x \le 180$. [2]

(iii) Use your diagram to solve the equation

$$\sin x° = \sin (x - 30)°$$

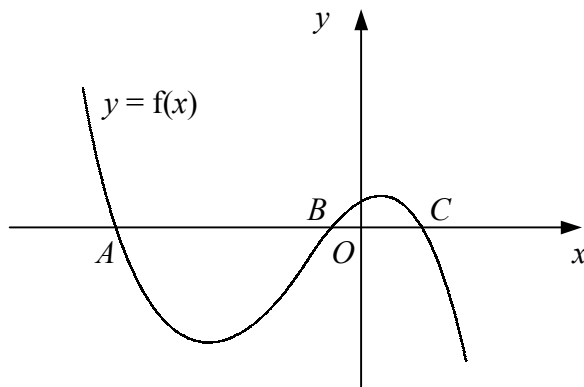for x in the interval $-180 \le x \le 180$. [2]

4. (i)   Solve the inequality

$$x^2 - 13x + 30 < 0. \qquad [3]$$

(ii) Hence find the set of values of y such that

$$2^{2y} - 13(2^y) + 30 < 0. \qquad [3]$$

5.

The diagram shows the curve $y = f(x)$ where

$$f(x) = 4 + 5x + kx^2 - 2x^3,$$

and k is a constant.

The curve crosses the x-axis at the points A, B and C.

Given that A has coordinates $(-4, 0)$,

(i) show that $k = -7$,   [2]

(ii) find the coordinates of B and C.   [5]

6. Given that

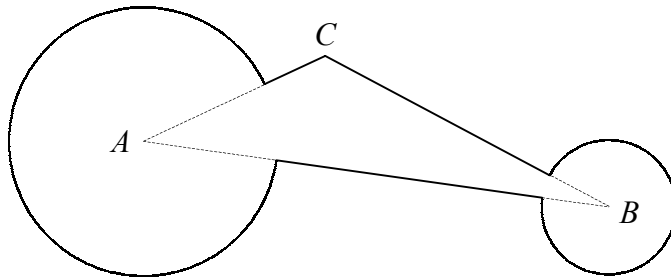$$f'(x) = 5 + \frac{4}{x^2}, \quad x \neq 0,$$

(i) find an expression for f(x).   [3]

Given also that

$$f(2) = 2f(1),$$

(ii) find f(4).   [5]

Turn over

7.

The diagram shows a design painted on the wall at a karting track. The sign consists of triangle *ABC* and two circular sectors of radius 2 metres and 1 metre with centres *A* and *B* respectively.

Given that $AB = 7$ m, $AC = 3$ m and $\angle ACB = 2.2$ radians,

(i) find the size of $\angle ABC$ in radians to 3 significant figures, [2]

(ii) show that $\angle BAC = 0.588$ radians to 3 significant figures, [2]

(iii) find the area of triangle *ABC*, [2]

(iv) find the area of the wall covered by the design. [4]

8. The finite region *R* is bounded by the curve $y = 1 + 3\sqrt{x}$, the *x*-axis and the lines $x = 2$ and $x = 8$.

(i) Use the trapezium rule with three intervals, each of width 2, to estimate to 3 significant figures the area of *R*. [5]

(ii) Use integration to find the exact area of *R* in the form $a + b\sqrt{2}$. [5]

(iii) Find the percentage error in the estimate made in part *(a)*. [2]

9. The first two terms of a geometric progression are 2 and *x* respectively, where $x \neq 2$.

(i) Find an expression for the third term in terms of *x*. [3]

The first and third terms of arithmetic progression are 2 and *x* respectively.

(ii) Find an expression for the 11th term in terms of *x*. [3]

Given that the third term of the geometric progression and the 11th term of the arithmetic progression have the same value,

(iii) find the value of *x*, [3]

(iv) find the sum of the first 50 terms of the arithmetic progression. [3]

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