FOR OCR

GCE Examinations
Advanced / Advanced Subsidiary

Core Mathematics C2

Paper L

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.**

Written by Shaun Armstrong

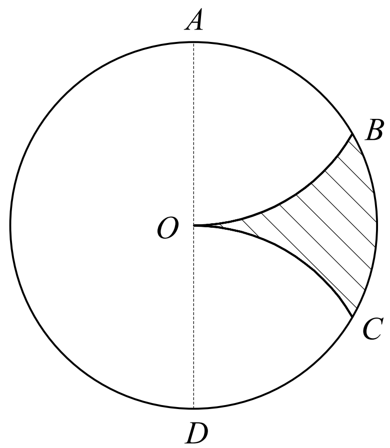
1. *(i)* Sketch on the same diagram the graphs of $y = \sin 2x$ and $y = \tan \frac{x}{2}$ for x in the interval $0 \leq x \leq 360°$. [4]

(ii) Hence state how many solutions exist to the equation

$$\sin 2x = \tan \frac{x}{2},$$

for x in the interval $0 \leq x \leq 360°$ and give a reason for your answer. [2]

2.



The diagram shows a circle of radius r and centre O in which AD is a diameter.

The points B and C lie on the circle such that OB and OC are arcs of circles of radius r with centres A and D respectively.

Show that the area of the shaded region OBC is $\frac{1}{6}r^2(3\sqrt{3} - \pi)$. [6]

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

$$u_{n+1} = (u_n)^2 - 1, \quad n \geq 1.$$

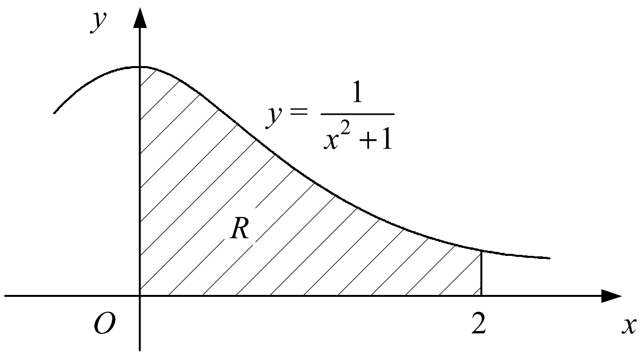
Given that $u_1 = k$, where k is a constant,

(i) find expressions for u_2 and u_3 in terms of k. [3]

Given also that $u_2 + u_3 = 11$,

(ii) find the possible values of k. [4]

4.



The diagram shows the curve with equation $y = \dfrac{1}{x^2+1}$.

The shaded region R is bounded by the curve, the coordinate axes and the line $x = 2$.

(i) Use the trapezium rule with four strips of equal width to estimate the area of R. [5]

The cross-section of a support for a bookshelf is modelled by R with 1 unit on each axis representing 8 cm. Given that the support is 2 cm thick,

(ii) find an estimate for the volume of the support. [2]

5. *(i)* Find the value of a such that

$$\log_a 27 = 3 + \log_a 8.$$ [3]

(ii) Solve the equation

$$2^{x+3} = 6^{x-1},$$

giving your answer to 3 significant figures. [4]

6. *(i)* Evaluate

$$\int_2^4 \left(2 - \frac{1}{x^2}\right)\, dx.$$ [4]

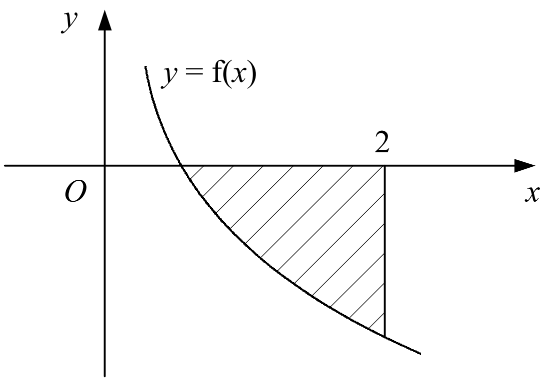
(ii) Given that

$$\frac{dy}{dx} = 2x^3 + 1,$$

and that $y = 3$ when $x = 0$, find the value of y when $x = 2$. [5]

Turn over

7.



The diagram shows part of the curve $y = \text{f}(x)$ where $\text{f}(x) = \dfrac{1 - 8x^3}{x^2}$, $x \neq 0$.

(i) Solve the equation $\text{f}(x) = 0$. [3]

(ii) Find $\int \text{f}(x)\ \text{d}x$. [3]

(iii) Find the area of the shaded region bounded by the curve $y = \text{f}(x)$, the x-axis and the line $x = 2$. [3]

8. A store begins to stock a new range of DVD players and achieves sales of £1500 of these products during the first month. In a model it is assumed that sales will decrease by £x in each subsequent month, forming an arithmetic sequence.

Given that sales total £8100 during the first six months, use the model to

(i) find the value of x, [4]

(ii) find the expected value of sales in the eighth month, [2]

(iii) show that the expected total of sales in pounds during the first n months is given by $kn(51 - n)$, where k is an integer to be found. [3]

(iv) Explain why this model cannot be valid over a long period of time. [1]

9.
$$\text{f}(x) = 2x^3 - 5x^2 + x + 2.$$

(i) Show that $(x - 2)$ is a factor of $\text{f}(x)$. [2]

(ii) Fully factorise $\text{f}(x)$. [4]

(iii) Solve the equation $\text{f}(x) = 0$. [1]

(iv) Find, in terms of π, the values of θ in the interval $0 \leq \theta \leq 2\pi$ for which

$$2\sin^3\theta - 5\sin^2\theta + \sin\theta + 2 = 0.$$ [4]