FOR OCR

GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C2

Sample Paper from Solomon Press

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. A sequence of terms is defined by

$$u_{n+1} = 8 + ku_n, \quad n \geq 1, \quad u_1 = 3,$$

where k is a constant.

Given that $u_3 = 11$,

(i) find the two possible values of k. [5]

Given also that $k < 0$,

(ii) find the value of u_4. [1]

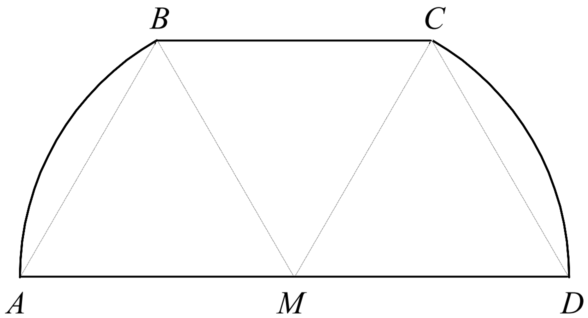
2. *(i)* Find $\int (6x^{\frac{1}{2}} - x) \, dx$. [2]

The curve with equation $y = f(x)$ passes through the point with coordinates $(1, 6\frac{1}{2})$ and is such that

$$f'(x) = 6x^{\frac{1}{2}} - x.$$

(ii) Show that the point with coordinates (4, 27) lies on the curve $y = f(x)$. [4]

3.



The diagram shows the shape *ABCD*. The point *M* is the mid-point of *AD* and triangles *ABM*, *BCM* and *CDM* are all equilateral. *AB* and *CD* are arcs of a circle, centre *M*.

Given that $BC = l$,

(i) find an expression in terms of l and π for the perimeter of *ABCD*, [3]

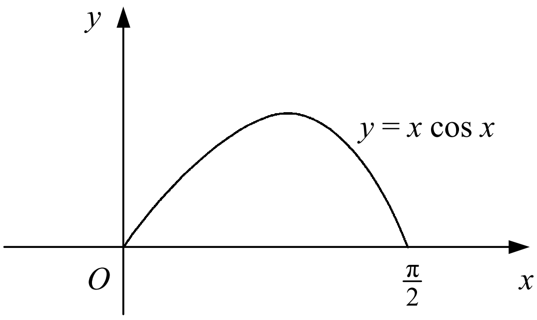
(ii) show that the area of *ABCD* is given by $\frac{1}{12} l^2(4\pi + 3\sqrt{3})$. [4]

4. Find the values of x in the interval $0 \le x \le 360°$ for which

$$5 \sin^2 x + \sin x - \cos^2 x = 0,$$

giving your answers to 1 decimal place where appropriate. [7]

5.



The diagram shows the curve with equation $y = x \cos x$, $0 \le x \le \frac{\pi}{2}$.

(i) Copy and complete the table below for points on the curve, giving the y values to 3 decimal places.

x	0	$\frac{\pi}{8}$	$\frac{\pi}{4}$	$\frac{3\pi}{8}$	$\frac{\pi}{2}$
y	0	0.363			0

[2]

(ii) Use the trapezium rule with four intervals of equal width to estimate the area of the region bounded by the curve and the x-axis. [4]

(iii) State, with a reason, whether your answer to part *(b)* is an under-estimate or an over-estimate of the true value. [2]

6. *(a)* Given that $y = \log_3 x$, find expressions in terms of y for

(i) $\log_3 (27x)$,

(ii) $\log_9 x$. [5]

(b) Hence, or otherwise, solve the equation

$$\log_3 (27x) + \log_9 x = 0,$$

giving your answer as an exact fraction. [3]

Turn over

7. $$f(x) = 2x^3 - 5x^2 + ax + b.$$

Given that when $f(x)$ is divided by $(x - 2)$ the remainder is -9, and that $f(x)$ is exactly divisible by $(x - 3)$,

(i) find the values of the constants a and b, [5]

(ii) solve the equation $f(x) = 0$. [5]

8. A sports club has 400 members when it launches a scheme to recruit new members. In a model of the outcome of the scheme, it is assumed that 20 new members join in the first month, 24 in the second month, 28 in the third month and so on, with the number joining the club increasing by 4 in each subsequent month.

Using this model,

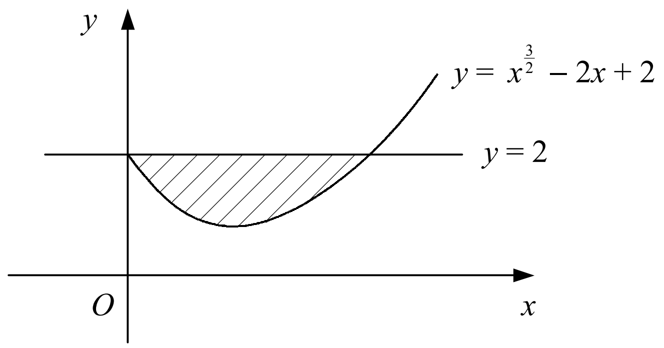
(i) find the number of new members who join the club in the eighth month of the scheme, [2]

(ii) find the total number of new members who join the club during the first year of the scheme. [2]

The model also assumes that the club will lose 8 members each month.

(iii) Find how many months the scheme would have to run for before the total membership of the club is 1000. [6]

9.



The diagram shows the curve with equation $y = x^{\frac{3}{2}} - 2x + 2$ and the straight line with equation $y = 2$.

(i) Find the coordinates of the points where the curve and line intersect. [4]

The shaded region is bounded by the curve and line.

(ii) Show that the area of the shaded region is $3\frac{1}{5}$. [6]