

GCE Examinations
Advanced Subsidiary

Core Mathematics C4

Paper C

Time: 1 hour 30 minutes

Instructions and Information

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration.

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has seven questions.

Advice to Candidates

You must show sufficient working to make your methods clear to an examiner.
Answers without working may gain no credit.



Written by Shaun Armstrong

© Solomon Press

These sheets may be copied for use solely by the purchaser's institute.

1. Use integration by parts to show that

$$\int_1^2 x \ln x \, dx = 2 \ln 2 - \frac{3}{4}. \quad (6)$$

2. (a) Use the trapezium rule with two intervals of equal width to find an approximate value for the integral

$$\int_0^2 \arctan x \, dx. \quad (5)$$

- (b) Use the trapezium rule with four intervals of equal width to find an improved approximation for the value of the integral. (2)

3. A curve has the equation

$$3x^2 - 2x + xy + y^2 - 11 = 0.$$

The point P on the curve has coordinates $(-1, 3)$.

- (a) Show that the normal to the curve at P has the equation $y = 2 - x$. (7)
- (b) Find the coordinates of the point where the normal to the curve at P meets the curve again. (4)

3. continued

4. continued

5. A bath is filled with hot water which is allowed to cool. The temperature of the water is $\theta^{\circ}\text{C}$ after cooling for t minutes and the temperature of the room is assumed to remain constant at 20°C .

Given that the rate at which the temperature of the water decreases is proportional to the difference in temperature between the water and the room,

- (a) write down a differential equation connecting θ and t . (2)

Given also that the temperature of the water is initially 37°C and that it is 36°C after cooling for four minutes,

- (b) find, to 3 significant figures, the temperature of the water after ten minutes. (8)

Advice suggests that the temperature of the water should be allowed to cool to 33°C before a child gets in.

- (c) Find, to the nearest second, how long a child should wait before getting into the bath. (3)

5. continued

6. continued

7.

- (a) Express $f(x)$ in partial fractions. (3)

- (b) Show that

$$\int_0^{\frac{1}{2}} f(x) \, dx = \ln k,$$

where k is an integer to be found. (5)

- (c) Find the series expansion of $f(x)$ in ascending powers of x up to and including the term in x^3 , simplifying each coefficient. (6)

7. continued

7. continued

END