

**Solomon Press**  
**Core Mathematics C4**  
**Paper B**  
**(Question Paper)**

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**Mr.S.V.Swarnaraja (Marking Examiner, Team Leader & Author)**  
**www.swanash.com, Mobile: +94777304755 , email: swa@swanash.com**

GCE Examinations  
Advanced Subsidiary

## Core Mathematics C4

Paper B

Time: 1 hour 30 minutes

### *Instructions and Information*

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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 eight questions.

### *Advice to Candidates*

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



*Written by Shaun Armstrong*

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4. (a) Expand  $(1 + ax)^{-3}$ ,  $|ax| < 1$ , in ascending powers of  $x$  up to and including the term in  $x^3$ . Give each coefficient as simply as possible in terms of the constant  $a$ . (3)

Given that the coefficient of  $x^2$  in the expansion of  $\frac{6-x}{(1+ax)^3}$ ,  $|ax| < 1$ , is 3,

- (b) find the two possible values of  $a$ . (4)

Given also that  $a < 0$ ,

- (c) show that the coefficient of  $x^3$  in the expansion of  $\frac{6-x}{(1+ax)^3}$  is  $\frac{14}{9}$ . (2)

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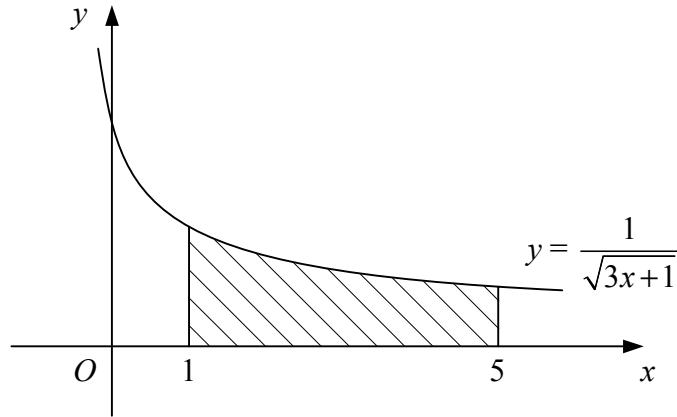
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5.



**Figure 1**

Figure 1 shows the curve with equation  $y = \frac{1}{\sqrt{3x+1}}$ .

The shaded region is bounded by the curve, the  $x$ -axis and the lines  $x = 1$  and  $x = 5$ .

(a) Find the area of the shaded region. (4)

The shaded region is rotated completely about the  $x$ -axis.

(b) Find the volume of the solid formed, giving your answer in the form  $k\pi \ln 2$ , where  $k$  is a simplified fraction. (5)

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6.  $f(x) = \frac{15-17x}{(2+x)(1-3x)^2}, \quad x \neq -2, \quad x \neq \frac{1}{3}.$

(a) Find the values of the constants  $A, B$  and  $C$  such that

$$f(x) = \frac{A}{2+x} + \frac{B}{1-3x} + \frac{C}{(1-3x)^2}. \quad (4)$$

(b) Find the value of

$$\int_{-1}^0 f(x) \, dx,$$

giving your answer in the form  $p + \ln q$ , where  $p$  and  $q$  are integers. (7)

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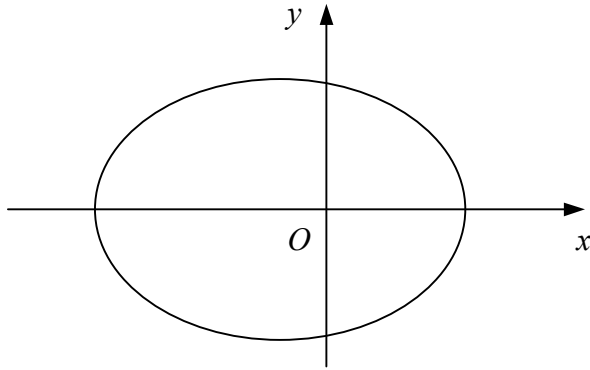
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7.



**Figure 2**

Figure 2 shows the curve with parametric equations

$$x = -1 + 4 \cos \theta, \quad y = 2\sqrt{2} \sin \theta, \quad 0 \leq \theta < 2\pi.$$

The point  $P$  on the curve has coordinates  $(1, \sqrt{6})$ .

- (a) Find the value of  $\theta$  at  $P$ . (2)
- (b) Show that the normal to the curve at  $P$  passes through the origin. (7)
- (c) Find a cartesian equation for the curve. (3)

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8. The line  $l_1$  passes through the points  $A$  and  $B$  with position vectors  $(-3\mathbf{i} + 3\mathbf{j} + 2\mathbf{k})$  and  $(7\mathbf{i} - \mathbf{j} + 12\mathbf{k})$  respectively, relative to a fixed origin.

(a) Find a vector equation for  $l_1$ . **(2)**

The line  $l_2$  has the equation

$$\mathbf{r} = (5\mathbf{j} - 7\mathbf{k}) + \mu(\mathbf{i} - 2\mathbf{j} + 7\mathbf{k}).$$

The point  $C$  lies on  $l_2$  and is such that  $AC$  is perpendicular to  $BC$ .

(b) Show that one possible position vector for  $C$  is  $(\mathbf{i} + 3\mathbf{j})$  and find the other. **(8)**

Assuming that  $C$  has position vector  $(\mathbf{i} + 3\mathbf{j})$ ,

(c) find the area of triangle  $ABC$ , giving your answer in the form  $k\sqrt{5}$ . **(3)**

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