

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

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GCE Examinations  
Advanced Subsidiary

## Core Mathematics C4

Paper E

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. The line  $l_1$  passes through the points  $P$  and  $Q$  with position vectors  $(-\mathbf{i} - 8\mathbf{j} + 3\mathbf{k})$  and  $(2\mathbf{i} - 9\mathbf{j} + \mathbf{k})$  respectively, relative to a fixed origin.

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

The line  $l_2$  has the equation

$$\mathbf{r} = (6\mathbf{i} + a\mathbf{j} + b\mathbf{k}) + \mu(\mathbf{i} + 4\mathbf{j} - \mathbf{k})$$

and also passes through the point  $Q$ .

(b) Find the values of the constants  $a$  and  $b$ . (3)

(c) Find, in degrees to 1 decimal place, the acute angle between lines  $l_1$  and  $l_2$ . (4)

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5. At time  $t = 0$ , a tank of height 2 metres is completely filled with water. Water then leaks from a hole in the side of the tank such that the depth of water in the tank,  $y$  metres, after  $t$  hours satisfies the differential equation

$$\frac{dy}{dt} = -ke^{-0.2t},$$

where  $k$  is a positive constant,

- (a) Find an expression for  $y$  in terms of  $k$  and  $t$ . (4)

Given that two hours after being filled the depth of water in the tank is 1.6 metres,

- (b) find the value of  $k$  to 4 significant figures. (3)

Given also that the hole in the tank is  $h$  cm above the base of the tank,

- (c) show that  $h = 79$  to 2 significant figures. (3)

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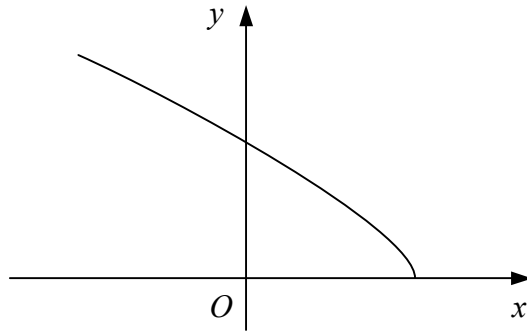


Figure 1

Figure 1 shows the curve with parametric equations

$$x = 2 - t^2, \quad y = t(t + 1), \quad t \geq 0.$$

- (a) Find the coordinates of the points where the curve meets the coordinate axes. **(4)**
- (b) Find the exact area of the region bounded by the curve and the coordinate axes. **(6)**

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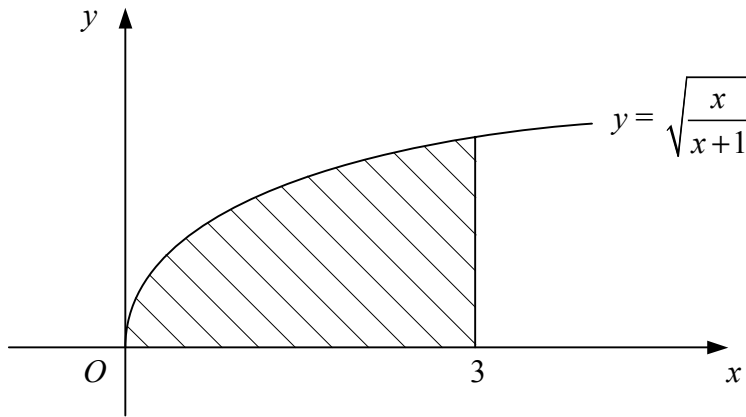
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8.



**Figure 2**

Figure 2 shows the curve with equation  $y = \sqrt{\frac{x}{x+1}}$ .

The shaded region is bounded by the curve, the  $x$ -axis and the line  $x = 3$ .

- (a) (i) Use the trapezium rule with three strips to find an estimate for the area of the shaded region.
- (ii) Use the trapezium rule with six strips to find an improved estimate for the area of the shaded region. (7)

The shaded region is rotated through  $2\pi$  radians about the  $x$ -axis.

- (b) Show that the volume of the solid formed is  $\pi(3 - \ln 4)$ . (6)

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