

**Solomon Press**  
**Core Mathematics C3**  
**Paper C**  
**(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 C3

Paper C

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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1. (a) Express

$$\frac{x+4}{2x^2+3x+1} - \frac{2}{2x+1}$$

as a single fraction in its simplest form. (3)

- (b) Hence, find the values of  $x$  such that

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

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2. (a) Prove, by counter-example, that the statement

“ $\operatorname{cosec} \theta - \sin \theta > 0$  for all values of  $\theta$  in the interval  $0 < \theta < \pi$ ”

is false. (2)

- (b) Find the values of  $\theta$  in the interval  $0 < \theta < \pi$  such that

$$\operatorname{cosec} \theta - \sin \theta = 2,$$

giving your answers to 2 decimal places. (5)

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3. Solve each equation, giving your answers in exact form.

(a)  $\ln(2x - 3) = 1$  (3)

(b)  $3e^y + 5e^{-y} = 16$  (5)

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4. Differentiate each of the following with respect to  $x$  and simplify your answers.

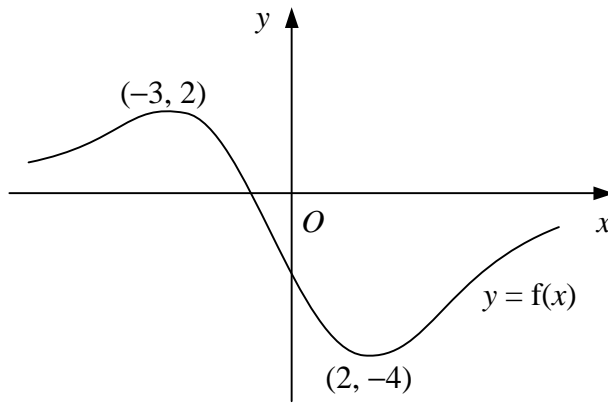
(a)  $\ln(3x - 2)$  (2)

(b)  $\frac{2x+1}{1-x}$  (3)

(c)  $x^{\frac{3}{2}} e^{2x}$  (3)

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5.



**Figure 1**

Figure 1 shows the curve  $y = f(x)$  which has a maximum point at  $(-3, 2)$  and a minimum point at  $(2, -4)$ .

(a) Showing the coordinates of any stationary points, sketch on separate diagrams the graphs of

(i)  $y = f(|x|)$ ,

(ii)  $y = 3f(2x)$ . (7)

(b) Write down the values of the constants  $a$  and  $b$  such that the curve with equation  $y = a + f(x + b)$  has a minimum point at the origin  $O$ . (2)

6. The function  $f$  is defined by

$$f(x) \equiv 4 - \ln 3x, \quad x \in \mathbb{R}, \quad x > 0.$$

(a) Solve the equation  $f(x) = 0$ . (2)

(b) Sketch the curve  $y = f(x)$ . (2)

(c) Find an expression for the inverse function,  $f^{-1}(x)$ . (3)

The function  $g$  is defined by

$$g(x) \equiv e^{2-x}, \quad x \in \mathbb{R}.$$

(d) Show that

$$fg(x) = x + a - \ln b,$$

where  $a$  and  $b$  are integers to be found. (3)

**Turn over**

7. (a) Express  $4 \sin x + 3 \cos x$  in the form  $R \sin(x + \alpha)$  where  $R > 0$  and  $0 < \alpha < \frac{\pi}{2}$ . (4)

(b) State the minimum value of  $4 \sin x + 3 \cos x$  and the smallest positive value of  $x$  for which this minimum value occurs. (3)

(c) Solve the equation

$$4 \sin 2\theta + 3 \cos 2\theta = 2,$$

for  $\theta$  in the interval  $0 \leq \theta \leq \pi$ , giving your answers to 2 decimal places. (6)

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8. The curve  $C$  has the equation  $y = \sqrt{x} + e^{1-4x}$ ,  $x \geq 0$ .

(a) Find an equation for the normal to the curve at the point  $(\frac{1}{4}, \frac{3}{2})$ . (4)

The curve  $C$  has a stationary point with  $x$ -coordinate  $\alpha$  where  $0.5 < \alpha < 1$ .

(b) Show that  $\alpha$  is a solution of the equation

$$x = \frac{1}{4} [1 + \ln(8\sqrt{x})]. \quad (3)$$

(c) Use the iteration formula

$$x_{n+1} = \frac{1}{4} [1 + \ln(8\sqrt{x_n})],$$

with  $x_0 = 1$  to find  $x_1, x_2, x_3$  and  $x_4$ , giving the value of  $x_4$  to 3 decimal places. (3)

(d) Show that your value for  $x_4$  is the value of  $\alpha$  correct to 3 decimal places. (2)

(e) Another attempt to find  $\alpha$  is made using the iteration formula

$$x_{n+1} = \frac{1}{64} e^{8x_n - 2},$$

with  $x_0 = 1$ . Describe the outcome of this attempt. (2)

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**END**