# Core Mathematics C3 For Edexcel Advanced Level

## Paper G
## 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.

The booklet 'Mathematical Formulae and Statistical Tables', available from Edexcel, may be used.

When a calculator is used, the answer should be given to an appropriate degree of accuracy.

*Advice to Candidates*

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

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**1.** The third and fifth terms of an arithmetic progression are $\ln 18$ and $\ln 162$ respectively.

Find (*a*) the exact value of the common difference, **(4)**

(*b*) the first term. **(2)**

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**2.** Express

$$\frac{2x+5}{4x^2-9} \times \frac{2x^2-x-3}{2(x+1)}$$

as a single fraction in its simplest form. **(6)**

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**3.** The function f is defined by $\quad \text{f}: x \mapsto \cos x, \quad 0 \leq x \leq \pi,$

and the function g is defined by $\quad \text{g}: x \mapsto x + \frac{\pi}{2}, \quad x \geq 0.$

(*a*) What is the range of $\text{f}(x)$? **(2)**

(*b*) What is the domain of $\text{fg}(x)$? **(3)**

(*c*) What is the range of $\text{fg}(x)$? **(2)**

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**4.** (*a*) Given that $\sin x = \frac{7}{25}$ and that the angle $x$ is obtuse,

find the exact value $\sin 2x$. **(5)**

(*b*) Prove that $\tan\left(\frac{\pi}{4} - \theta\right) = \frac{1-\tan\theta}{1+\tan\theta}$. **(3)**

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**5.** The function f is even and has a domain $\mathbb{R}$.

$$\text{f}(x) = a - x, \quad \text{for} \quad 0 \leq x \leq a$$

$$\text{and} \quad \text{f}(x) = 2x - 2a, \quad \text{for} \quad x > a,$$

where $a$ is a positive constant

(*a*) Sketch the curve with equation $y = \text{f}(x)$ showing the coordinates of all the points at which the curve meets the axes. **(4)**

(*b*) Find, in terms of $a$, the values of $\text{f}(2a)$ and $\text{f}(-2a)$. **(2)**

(*c*) Find the values of $x$ for which $\text{f}(x) = \frac{1}{2}a$. **(3)**

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**6.** Show that

$$y = e^{2x}(\cos 3x + \sin 3x)$$

satisfies the equation $\dfrac{d^2y}{dx^2} - 4\dfrac{dy}{dx} + 13y = 0.$ **(11)**

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**7.** The curve $C$ has the equation $y = f(x)$, where

$$f(x) = 4x - \ln x, \qquad x > 0.$$

The point $A$ is a stationary point on $C$.

($a$) Calculate the coordinates of $A$ and determine the nature of the stationary point. **(5)**

$B$ is the point on the curve $C$ whose $x$ coordinate is 1.

($b$) Find the equations of both the tangent and normal to the curve at the point $B$. **(6)**

The tangent at $B$ meets the $x$-axis at $P$, and the normal at $B$ meets the $x$-axis at $Q$.

($c$) Find the area of the $\Delta PBQ$. **(3)**

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**8.** ($a$) Given $f(x) = 5\sin x + 12\cos x$,

find $f(x)$ in the form $R\sin(x + \alpha)$ where $R$ and $\alpha$ are positive constants to be found. $(0 < \alpha < 90°)$ **(4)**

Hence or otherwise find,

($b$) the minimum value of $f(x) + 4$, **(2)**

($c$) the smallest positive value of $x$ for which this minimum value occurs, **(3)**

($d$) the values of $x$, $0 < x < 360°$, which satisfy the equation

$$5\sin x + 12\cos x = 6.$$ **(5)**

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**END** **TOTAL 75 MARKS**