GCE Examinations

Advanced Subsidiary

# Core Mathematics C1

Paper K

Time: 1 hour 30 minutes

## *Instructions and Information*

Candidates may NOT use a calculator in this paper

Full marks may be obtained for answers to ALL questions.

Mathematical formulae and statistical tables are available.

This paper has ten 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*

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**1.** Find the value of $y$ such that

$$4^{y+3} = 8.$$ **(3)**

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**2.** Find

$$\int (3x^2 + \frac{1}{2x^2})\ \mathrm{d}x.$$ **(4)**

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**3.**



**Figure 1**

Figure 1 shows the rectangles *ABCD* and *EFGH* which are similar.

Given that $AB = (3 - \sqrt{5})$ cm, $AD = \sqrt{5}$ cm and $EF = (1 + \sqrt{5})$ cm, find the length *EH* in cm, giving your answer in the form $a + b\sqrt{5}$ where $a$ and $b$ are integers. **(6)**

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**4.** *(a)* Sketch on the same diagram the curves $y = x^2 - 4x$ and $y = -\frac{1}{x}$. **(4)**

*(b)* State, with a reason, the number of real solutions to the equation

$$x^2 - 4x + \frac{1}{x} = 0.$$ **(2)**

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**5.** *(a)* By completing the square, find in terms of the constant $k$ the roots of the equation

$$x^2 + 2kx + 4 = 0.$$ **(4)**

*(b)* Hence find the exact roots of the equation

$$x^2 + 6x + 4 = 0.$$ **(2)**

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**6.** *(a)* Evaluate

$$\sum_{r=1}^{50} (80 - 3r).$$ **(3)**

*(b)* Show that

$$\sum_{r=1}^{n} \frac{r+3}{2} = kn(n+7),$$

where $k$ is a rational constant to be found. **(4)**

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**7.** Solve the simultaneous equations

$$x - 3y + 7 = 0$$

$$x^2 + 2xy - y^2 = 7$$ **(7)**

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**8.** Given that

$$\frac{dy}{dx} = \frac{x^3 - 4}{x^3}, \quad x \neq 0,$$

*(a)* find $\dfrac{d^2 y}{dx^2}$ . **(3)**

Given also that $y = 0$ when $x = -1$,

*(b)* find the value of $y$ when $x = 2$. **(6)**

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***Turn over***

**9.** A curve has the equation $y = (\sqrt{x} - 3)^2$, $x \geq 0$.

(a) Show that $\dfrac{dy}{dx} = 1 - \dfrac{3}{\sqrt{x}}$. **(4)**

The point $P$ on the curve has $x$-coordinate 4.

(b) Find an equation for the normal to the curve at $P$ in the form $y = mx + c$. **(5)**

(c) Show that the normal to the curve at $P$ does not intersect the curve again. **(4)**

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**10.** The straight line $l$ has gradient 3 and passes through the point $A$ (−6, 4).

(a) Find an equation for $l$ in the form $y = mx + c$. **(2)**

The straight line $m$ has the equation $x - 7y + 14 = 0$.

Given that $m$ crosses the $y$-axis at the point $B$ and intersects $l$ at the point $C$,

(b) find the coordinates of $B$ and $C$, **(4)**

(c) show that $\angle BAC = 90°$, **(4)**

(d) find the area of triangle $ABC$. **(4)**

**END**