FOR EDEXCEL

GCE Examinations

Advanced Subsidiary

Core Mathematics C2

Paper K

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.

Mathematical formulae and statistical tables are available.

This paper has nine 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

1. Evaluate

$$\int_1^4 (x^2 - 5x + 4)\ \mathrm{d}x. \qquad \textbf{(4)}$$

2.

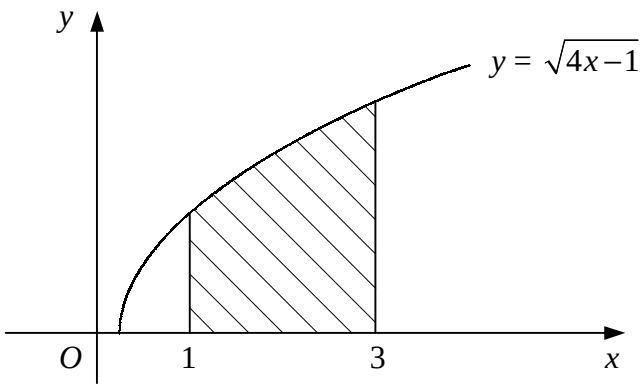

Figure 1

Figure 1 shows the curve with equation $y = \sqrt{4x-1}$.

Use the trapezium rule with five equally-spaced ordinates to estimate the area of the shaded region bounded by the curve, the x-axis and the lines $x = 1$ and $x = 3$. **(4)**

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3. *(a)* Given that $y = \log_2 x$, find expressions in terms of y for

(i) $\log_2 \left(\frac{x}{2}\right)$,

(ii) $\log_2 (\sqrt{x})$. **(4)**

(b) Hence, or otherwise, solve the equation

$$2 \log_2 \left(\frac{x}{2}\right) + \log_2 (\sqrt{x}) = 8. \qquad \textbf{(3)}$$

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4. $\mathrm{f}(x) = 2 - x - x^3$.

(a) Show that $\mathrm{f}(x)$ is decreasing for all values of x. **(4)**

(b) Verify that the point (1, 0) lies on the curve $y = \mathrm{f}(x)$. **(1)**

(c) Find the area of the region bounded by the curve $y = \mathrm{f}(x)$ and the coordinate axes. **(4)**

5.

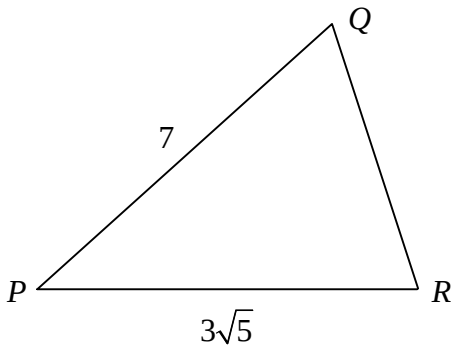

Figure 2

Figure 2 shows triangle PQR in which $PQ = 7$ and $PR = 3\sqrt{5}$.

Given that $\sin(\angle QPR) = \frac{2}{3}$ and that $\angle QPR$ is acute,

(a) find the exact value of $\cos(\angle QPR)$ in its simplest form, **(2)**

(b) show that $QR = 2\sqrt{6}$, **(4)**

(c) find $\angle PQR$ in degrees to 1 decimal place. **(3)**

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6. The polynomial $p(x)$ is defined by

$$p(x) = 2x^3 + x^2 + ax + b,$$

where a and b are constants.

Given that when $p(x)$ is divided by $(x + 2)$ there is a remainder of 20,

(a) find an expression for b in terms of a. **(2)**

Given also that $(x + 3)$ is a factor of $p(x)$,

(b) find the values of a and b, **(4)**

(c) fully factorise $p(x)$. **(4)**

Turn over

7. *(a)* Find, to 2 decimal places, the values of x in the interval $0 \leq x < 2\pi$ for which

$$\tan\left(x + \frac{\pi}{4}\right) = 3.$$ **(4)**

(b) Find, in terms of π, the values of y in the interval $0 \leq y < 2\pi$ for which

$$2 \sin y = \tan y.$$ **(6)**

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8. The point A has coordinates (4, 6).

Given that OA, where O is the origin, is a diameter of circle C,

(a) find an equation for C. **(4)**

Circle C crosses the x-axis at O and at the point B.

(b) Find the coordinates of B. **(2)**

(c) Find an equation for the tangent to C at B, giving your answer in the form $ax + by = c$, where a, b and c are integers. **(5)**

9.

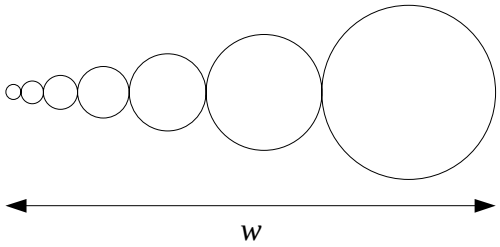

Figure 3

Figure 3 shows part of a design being produced by a computer program.

The program draws a series of circles with each one touching the previous one and such that their centres lie on a horizontal straight line.

The radii of the circles form a geometric sequence with first term 1 mm and second term 1.5 mm. The width of the design is w as shown.

(a) Find the radius of the fourth circle to be drawn. **(2)**

(b) Show that when eight circles have been drawn, $w = 98.5$ mm to 3 significant figures. **(4)**

(c) Find the total area of the design in square centimetres when ten circles have been drawn. **(5)**

END