Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments	Total Marks

MATHEMATICS

A LEVEL PAPER 1

CM

Bronze Set A (Edexcel Version)

Time allowed: 2 hours

Instructions to candidates:

- In the boxes above, write your centre number, candidate number, your surname, other names and signature.
- Answer ALL of the questions.
- You must write your answer for each question in the spaces provided.
- You may use a calculator.

Information to candidates:

- Full marks may only be obtained for answers to ALL of the questions.
- The marks for individual questions and parts of the questions are shown in round brackets.
- There are 13 questions in this question paper. The total mark for this paper is 100.

Advice to candidates:

- You should ensure your answers to parts of the question are clearly labelled.
- You should show sufficient working to make your workings clear to the Examiner.
- Answers without working may not gain full credit.

A2/M/P1

1 0 3 3 1 2 1 1 8 0 0 0 4

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1 $$f(x) = x^3 - 3x + 2$$

(a) Show that $(x + 2)$ is a factor of $f(x)$. **(2)**

(b) Express $f(x)$ as a product of linear factors. **(3)**

(c) Hence, or otherwise, simplify $\dfrac{3x^2 + 2x - 8}{x^3 - 3x + 2}$. **(3)**

Question 1 continued

TOTAL 8 MARKS

2 (a) Given that $|2x-1|<1$, find the range of possible values of x. **(2)**

(b) Solve the equation

$$3|2^x-1|=2^x$$

giving your answers to three significant figures. **(4)**

Question 2 continued

TOTAL 6 MARKS

3 The circle C has the equation

$$x^2 + 4y^2 + 8x = 12y - 3x^2 + k$$

where k is a constant.

(a) Find the coordinates of the centre of C. **(3)**

(b) Find the range of possible values of k. **(2)**

(c) Explain why the equation

$$x^2 + 2y^2 = 4$$

is not the equation of a circle. **(1)**

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Question 3 continued

TOTAL 6 MARKS

4

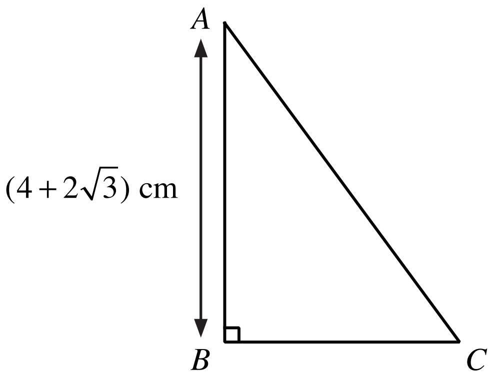

Figure 1

Figure 1 above shows a right-angled triangle *ABC*.

$AB = (4+2\sqrt{3})$ cm and the area of the triangle *ABC* is $(8+5\sqrt{3})$ cm^2.

Showing all of your working clearly, find the exact length of the hypotenuse of the triangle.

Give your answer in the form $(a+b\sqrt{3})^{\frac{1}{2}}$, where *a* and *b* are constants. **(6)**

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Question 4 continued

TOTAL 6 MARKS

5

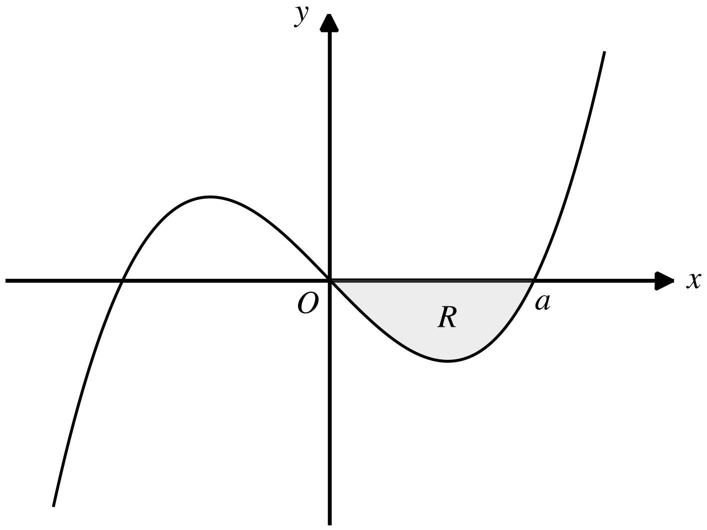

Figure 2

Figure 2 above shows a sketch of the curve C with equation $y = x^3 - 2x$.

(a) Differentiate $x^3 - 2x$ with respect to x from first principles. **(3)**

(b) Hence, find the coordinates of the stationary points on the curve C. **(3)**

The region R, shown shaded in Figure 2, is bounded by the curve C, the x-axis and the lines $x = 0$ and $x = a$, where a is a positive constant. The curve C crosses the x-axis at the point $(a, 0)$.

(c) Find the area of the shaded region R. **(5)**

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Question 5 continued

Question 5 continued

Question 5 continued

TOTAL 11 MARKS

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6

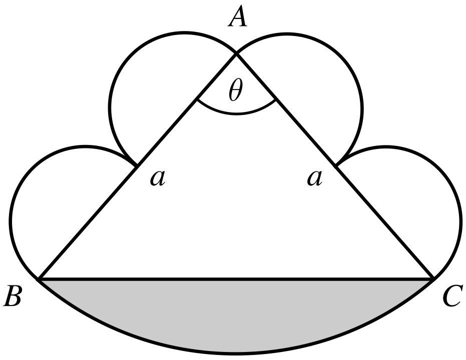

Figure 3

Figure 3 above shows a triangle *ABC* where $AB = AC = a$ and the angle $BAC = \theta$. Four identical semi-circles are drawn outside of the triangle *ABC*. A circular arc with centre *A* joins *B* to *C*. The area of the shaded segment is equal to the sum of the areas of the semicircles.

(a) Show that $\theta = \frac{1}{4}\pi + \sin\theta$. **(3)**

(b) Verify by calculation that θ lies between 1 and 2. **(2)**

(c) Use an iterative formula based on the equation in part (a) a suitable number of times to determine θ correct to two decimal places. Give the result of each iteration to four decimal places. **(3)**

Question 6 continued

TOTAL 8 MARKS

7 Let n be any positive integer that is not a square number.

Prove, by contradiction, that the square root of n is irrational. **(4)**

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Question 7 continued

TOTAL 4 MARKS

8 (i) Find, in terms of e, the equation of the normal to the curve $y = x^3e^x$ at the point $x = 1$. **(5)**

(ii) Given that $y = \dfrac{2}{\sqrt{1+(1-x)^2}}$, find $\dfrac{dy}{dx}$. **(4)**

Question 8 continued

TOTAL 9 MARKS

9 A mass, m kg, of a substance decreases with time t years.

The mass of the substance can be modelled by the equation $m = ab^t$, where a and b are constants.

(a) Show that the graph of $\ln(m)$ against t is a straight line. **(2)**

The graph of $\ln(m)$ against t passes through the point $(0, 3.91)$. It takes 5 years for the mass of the substance to decrease by half.

(b) Show that a is approximately 50. **(1)**

(c) Find, to three significant figures, the value of b. **(2)**

After 8 years, the substance is modified to increase its mass by 20 kg. The mass of the substance then decreases according to the model

$$m = P + 40e^{-0.32t}$$

where P is a constant.

(d) Find the value of P. **(3)**

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Question 9 continued

TOTAL 8 MARKS

10 $$f(x) = 12\cos(x) - 4\sin(x), \qquad 0 \le x \le 2\pi$$

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

Give the value of R as an exact value and the value of α to two decimal places. **(3)**

(b) Solve the equation $f(2x) = 4$. **(4)**

(c) Using your answer to part (a), find the maximum value of the function f and the value(s) of x at which this maximum occurs. **(3)**

Question 10 continued

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Question 10 continued

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Question 10 continued

TOTAL 10 MARKS

11 A liquid flows in a right-angled corner.

The velocity of the liquid flow, $\mathbf{v}$ m s^{-1}, at a point (x, y) is given by

$$\mathbf{v} = x\mathbf{i} - y\mathbf{j}, \qquad x, y > 0$$

(a) Find the magnitude of the velocity of the liquid flow at the point $(1, 2)$. **(2)**

Streamlines are lines that are parallel to the liquid flow.

For this flow, the streamlines are the solutions to the differential equation

$$\frac{dy}{dx} = -\frac{y}{x}$$

(b) Find the general solution to this differential equation, giving y in terms of x.
Simplify your answer. **(4)**

(c) Hence, sketch the family of streamlines for this flow. **(2)**

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Question 11 continued

TOTAL 8 MARKS

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12 The function f is defined such that

$$f(x) = \frac{-x}{2x^2 - 5x + 3}$$

(a) Express f(x) in the form $\frac{A}{x-1} + \frac{B}{2x-3}$, where A and B are constants to be found. **(3)**

(b) Hence, obtain the binomial expansion of f(x) in ascending powers of x, up to and including the term in x^3. **(4)**

Question 12 continued

TOTAL 7 MARKS

13 (i) An arithmetic series has first term a and common difference $(2a + 1)$.

(a) Prove that the sum of the first n terms of this series, S_n, can be given by

$$S_n = \frac{n}{2}\left[2a + (n-1)(2a+1)\right]$$

(4)

(b) Given that $a = 4$, find the value of n such that $S_n = 11225$. **(3)**

(ii) Evaluate

$$\sum_{n=1}^{\infty}\left(\tfrac{1}{2}\sin x\right)^n$$

and justify the validity of your answer. **(2)**

Question 13 continued

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Question 13 continued

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Question 13 continued

END OF PAPER **TOTAL 9 MARKS**

TOTAL FOR PAPER IS 100 MARKS