Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments		Total Marks

MATHEMATICS

AS PAPER 1

CM

March Mock Exam (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 14 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.

1 2 3 3 2 2 1 2 8 M 1 8 4

1 Express $4x^2 + 4x + 3$ in the form $a(x+b)^2 + c$, where a, b and c are constants to be found. **(4)**

TOTAL 4 MARKS

2 Show that

$$\int_1^3 \frac{1}{\sqrt{x^3}}\,dx = k\left(3-\sqrt{3}\right)$$

where k is a rational number to be found. **(5)**

TOTAL 5 MARKS

3 The point A has position vector $3\mathbf{i} - 4\mathbf{j}$ and the point B has position vector $a\mathbf{i} + 7\mathbf{j}$, where a is a constant.

Given that $|\overrightarrow{AB}| = 5\sqrt{5}$, find the largest possible value of the constant a. **(4)**

Do not write outside the box

Question 3 continued

TOTAL 4 MARKS

4 The curve C has the equation $y = f(x)$, where

$$f(x) = \tan(x - 40^\circ), \quad 0 \leq x \leq 360^\circ$$

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

(b) Find the coordinates where the curve C crosses the y axis. **(1)**

(c) Write down the equations of any asymptotes to the curve C. **(2)**

(d) Sketch the curve C. **(2)**

On your sketch, you should show clearly the coordinates of any points where the curve crosses or meets the coordinate axes and the equations of any asymptotes.

Question 4 continued

TOTAL 7 MARKS

5 The function f is defined such that

$$f(x) = 2x^3 - x^2 - 25x - 12$$

(a) Find the remainder when $f(x)$ is divided by $(x - 2)$. **(2)**

(b) Show that $(x + 3)$ is a factor of $f(x)$. **(2)**

(c) Solve the equation $f(x) = 0$. **(3)**

Question 5 continued

TOTAL 7 MARKS

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6 Using differentiation from first principles, prove that

(a) the gradient of the line $y = mx + c$ is m **(2)**

(b) the derivative of $6x^3$ is $18x^2$ **(3)**

Question 6 continued

TOTAL 5 MARKS

7

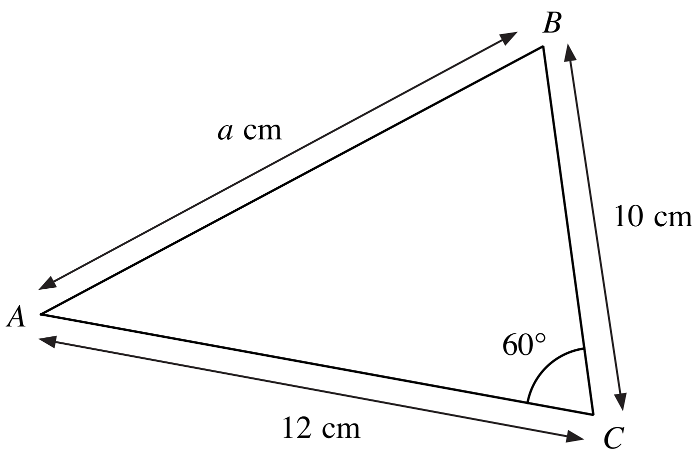

Figure 1

Figure 1 shows a triangle.

Angle $ACB = 60^{\circ}$, $AC = 12$ cm, $BC = 10$ cm and $AB = a$ cm, where a is a constant.

(a) Find the area of the triangle ABC. Give your answer to one decimal place. **(2)**

(b) Calculate the value of a. **(2)**

Given that the angle $BAC = x^{\circ}$,

(c) show that $\sin x = \dfrac{5\sqrt{93}}{62}$. **(1)**

Edward says,

"there are two possible values of x: either $x = \sin^{-1}\left(\dfrac{5\sqrt{93}}{62}\right)$ or $x = 180° - \sin^{-1}\left(\dfrac{5\sqrt{93}}{62}\right)$."

Edward's teacher says he is wrong and only one of these values is correct in this case.

(d) (i) Identify the correct value of x. **(1)**

(ii) Show that Edward's incorrect angle does not work. **(1)**

Question 7 continued

Question 7 continued

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Question 7 continued

TOTAL 7 MARKS

8 The curves C_1 and C_2 have the equations $y = 5^{x^2}$ and $y = 4^{k-6x}$ respectively, where k is a constant.

(a) Show that x coordinates of the points of intersection between C_1 and C_2 satisfy

$$(\log 5)x^2 + (6\log 4)x - k\log 4 = 0$$

(4)

(b) Given that the curves C_1 and C_2 do not intersect, show further that

$$k < \frac{9\log 0.25}{\log 5}$$

(3)

Do not write outside the box

Question 8 continued

Question 8 continued

Do not write outside the box

Question 8 continued

TOTAL 7 MARKS

9 **Figure 2** shows the circle C which passes through the points $A(-3, -2)$ and $B(0, -1)$.

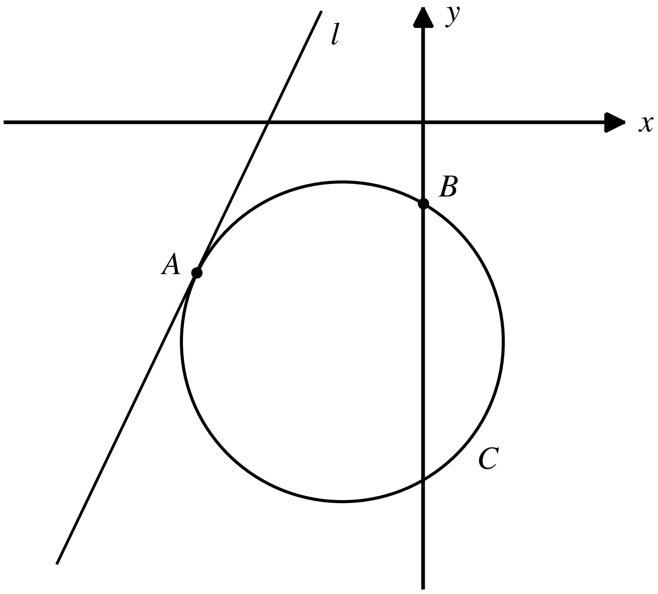

Figure 2

The straight line l has the equation $2x - y + 4 = 0$ and is a tangent to C at A.

(a) Find

(i) the gradient of the perpendicular bisector of the line segment AB **(3)**

(ii) the equation of the perpendicular bisector of the line segment AB **(3)**

(b) Show that the coordinates of the centre of C are $(-1, -3)$. **(5)**

(c) Calculate the radius of C. **(2)**

(d) Express the equation of the circle C in the form

$$(x-a)^2 + (y-b)^2 = k$$

where a, b and k are constants to be found. **(2)**

Question 9 continued

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Question 9 continued

Question 9 continued

TOTAL 15 MARKS

10 **Figure 3** shows a sketch of the curve with equation $y = f(x)$.

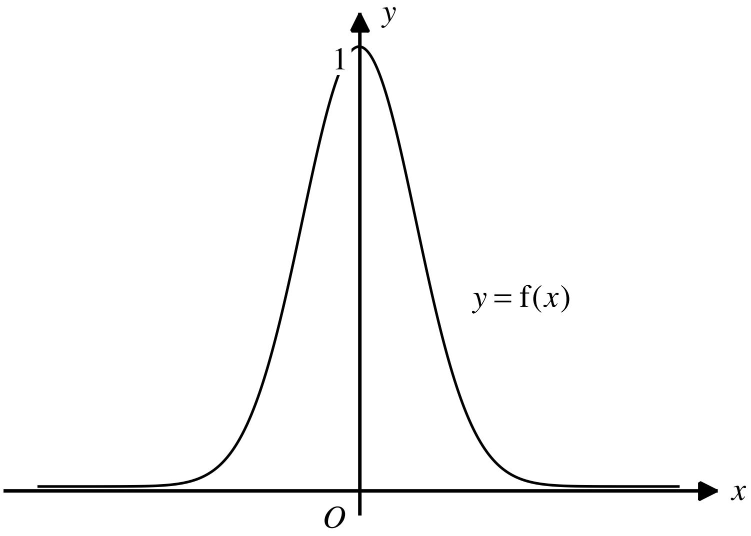

Figure 3

The curve crosses the y-axis at the point $(0, 1)$.

On separate axes, sketch the curves with equation

(a) $y = 2f(x)$ **(2)**

(b) $y = f'(x)$ **(3)**

On each sketch, you should show clearly the coordinates of any points where the curves cross or meet the coordinate axes.

Question 10 continued

TOTAL 5 MARKS

11 The binomial coefficient ${}^{n}C_{r}$ is defined such that

$${}^{n}C_{r} = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

where n and r are non-negative integers.

(a) Using the definition above directly, **show that** ${}^{10}C_{3} = 120$. **(2)**

(b) By starting with the right-hand side, or otherwise, prove that

$$\binom{n}{r}\binom{r}{m} = \binom{n}{m}\binom{n-m}{r-m}$$

(3)

(c) Hence, deduce that

$$\binom{n}{r} = \frac{n}{r}\binom{n-1}{r-1}$$

(2)

Question 11 continued

Question 11 continued

Question 11 continued

TOTAL 7 MARKS

12 (i) Given that

$$\frac{dy}{dx} = \frac{x^3 - \sqrt{x}}{x^2}, \quad x > 0$$

and that when $x = 1$, $y = 4$, express y in terms of x. **(6)**

(ii) Jessie proposes that given any two functions f and g, $\int_0^1 \mathrm{f}(x)\mathrm{g}(x)\,dx = \int_0^1 \mathrm{f}(x)\,dx \int_0^1 \mathrm{g}(x)\,dx$.

By choosing suitable functions for f and g, show that Jessie's claim is false. **(3)**

Question 12 continued

Question 12 continued

Question 12 continued

TOTAL 9 MARKS

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13 The curve C_1 has the equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = x^2 - 3\sqrt{x^3} + 4, \quad x > 0$$

The line l is a normal to the curve C_1 when $x = 4$.

(a) Find the equation of the line l. Give your answer in the form $y = mx + c$. **(5)**

The curve C_2 has the equation $y = \mathrm{g}(x)$ where

$$\mathrm{g}(x) = 4x^3 + qx^2 - 2x + 10$$

and q is a constant.

Given that l is a tangent to C_2 at $x = -1$,

(b) find the value of q. **(3)**

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Question 13 continued

Do not write outside the box

Question 13 continued

Question 13 continued

TOTAL 8 MARKS

14

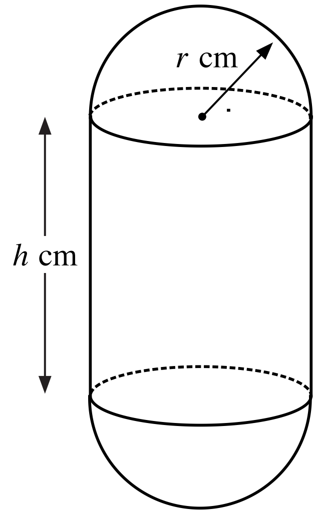

Figure 4

Figure 4 shows a solid. The solid is formed by attaching a hemisphere with radius r cm to each end of a cylinder, which has radius r cm and height h cm. The centres of cylinder and the hemispheres lie on the same line. The solid has a volume of 120 cm^3.

(a) (i) Show that

$$h = \frac{120}{\pi r^2} - \frac{4r}{3}$$

(2)

(ii) Hence, obtain an expression for the surface area, A cm^2, of the solid in terms of r. **(1)**

(b) Show that the surface area of the solid is minimised when $r = \left(\frac{90}{\pi}\right)^{\frac{1}{3}}$. **(4)**

(c) Justify, by further calculus, that A is a minimum for the value of r in part (b). **(3)**

Question 14 continued

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Question 14 continued

Question 14 continued

END OF PAPER

TOTAL 10 MARKS

TOTAL FOR PAPER IS 100 MARKS