Surname	
Other Names	
Candidate Signature	

Centre Number						Candidate Number				

Examiner Comments		Total Marks

MATHEMATICS

CM

AS PAPER 1

Gold 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 12 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 0 3 3 3 2 1 1 8 0 0 0 4

1 Relative to a fixed origin O, the points A and C have position vectors $-4\mathbf{i} - 2\mathbf{j}$ and $\mathbf{i} + 8\mathbf{j}$ respectively.

The point B lies on the straight line segment AC such that the ratio $AB : BC = 2 : 3$.

(a) Find the position vector of B relative to O. **(3)**

The point D is such that $OBCD$ is a parallelogram.

(b) Find the distance of the point D from O. **(2)**

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Question 1 continued

TOTAL 5 MARKS

2 The curve C has the equation

$$y = \sqrt{x^3} + \frac{k}{\sqrt{x}}, \quad x > 0$$

where k is a constant.

The point P is a stationary point on C and has x coordinate 4.

(a) Find the y coordinate of P.
Show your working clearly. **(5)**

(b) Show that P is the only stationary point on C **and** determine its nature. **(4)**

Question 2 continued

TOTAL 9 MARKS

3 (a) Given that $\log_2 c = m$ and $\log_{16} d = n$, express $\dfrac{c^3}{\sqrt{d}}$ in the form 2^y, where y is an expression in terms of m and n. **(4)**

(b) Solve the equation

$$4^x \times 5^{2-x} = 7^{3-2x}$$

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

Question 3 continued

TOTAL 8 MARKS

4 (a) Show that the equation

$$(2\sqrt{2}-2)x^2+\sqrt{8}x+(1+\sqrt{2})=0$$

has two equal roots. **(3)**

(b) Hence, or otherwise, solve the equation

$$(2\sqrt{2}-2)x^2+\sqrt{8}x+(1+\sqrt{2})=0$$

Give your answer in the form $a+b\sqrt{2}$, where a and b are rational numbers to be found.
Show all of your working. **(3)**

Question 4 continued

TOTAL 6 MARKS

5 (a) Show that $5 - 3\sin^2 x > 0$ for all x. **(2)**

(b) For $0 \leq x < 360^\circ$, solve the equation

$$\log_4(5 - 3\sin^2 x) = 1$$

giving your answers to one decimal place. **(5)**

(c) Explain how you have used part (a) in your answer to part (b). **(1)**

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Question 5 continued

TOTAL 8 MARKS

6 A biologist is studying the population of fish in a lake.

He models the number of fish in the lake, N fish, to vary according to

$$N = \frac{A}{1 + B\mathrm{e}^{-Ct}}, \quad t \geq 0$$

where t is the time in years since the start of the study and A, B and C are positive constants.

At the start of the study, the population of fish in the lake is 50.

The population of fish in the lake tripled in the first year.

The limiting size of the population is 5000.

Find the values of A, B and C in the model. **(6)**

Question 6 continued

TOTAL 6 MARKS

7 (a) In ascending powers of x, find the first three terms in the binomial expansion of

$$\left(2+\frac{x}{3}\right)\left(3-\frac{x}{5}\right)^5$$

up to and including the term in x^2. **(4)**

(b) Given that n is a positive integer, use the definition

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

to prove that $^nC_2 = \frac{1}{2}n(n-1)$. **(2)**

In the expansion of $(5x + 1)^p$, where p is a positive integer, the coefficient of x^2 is 700.

(c) Find the value of p. **(2)**

Question 7 continued

Question 7 continued

Question 7 continued

TOTAL 8 MARKS

8 Use the limit definition of the derivative twice to prove that

$$\frac{d^2}{dx^2}(x^2 - 2x^3) = 2 - 12x$$

(5)

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Question 8 continued

TOTAL 5 MARKS

9

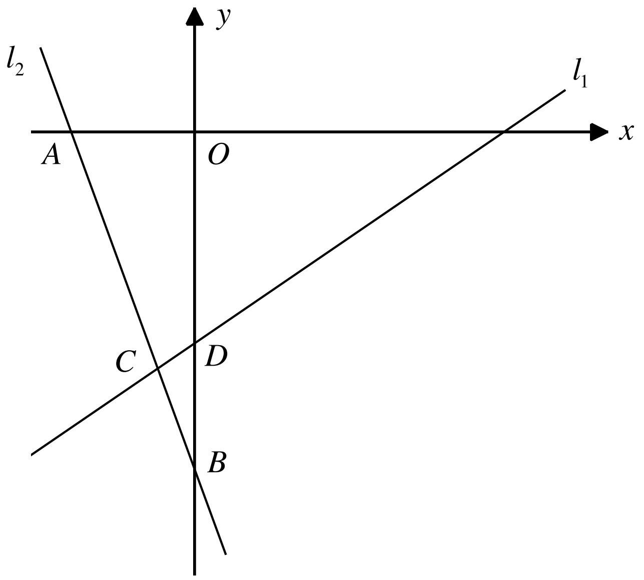

Figure 1

Figure 1 above shows two straight lines, l_1 and l_2.

The line l_1 has the equation $2x - 4y - 10 = 0$.

Given that l_1 and l_2 are perpendicular,

(a) find the gradient of l_2. **(2)**

The line l_2 crosses the x axis and the y axis at the points A and B respectively.

The area of the triangle OAB is 4 units^2, where O is the origin.

(b) Find the coordinates of A and B. **(4)**

(c) Hence, determine the equation of the line l_2.
Give your answer in the form $ax + by + c = 0$, where a, b and c are integers to be found. **(1)**

The lines l_1 and l_2 intersect at the point C. The point D is where l_1 meets the y axis.

(d) Calculate the area of the quadrilateral $OACD$. **(5)**

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Question 9 continued

Question 9 continued

Question 9 continued

TOTAL 12 MARKS

10

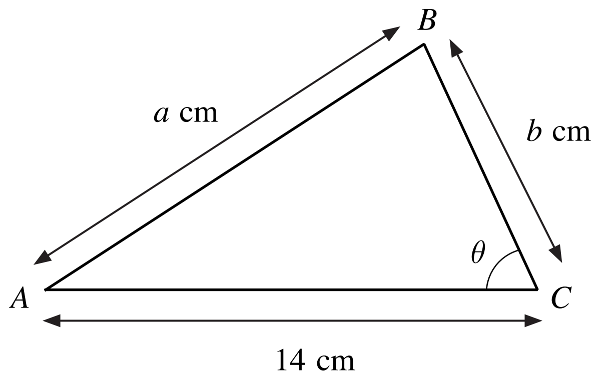

Figure 2

Figure 2 shows the triangle *ABC* which has $AB = a$ cm, $BC = b$ cm and $AC = 14$ cm. The perimeter of the triangle is 40 cm.

Given that the angle *ACB* is θ,

(a) show that $\cos\theta = \dfrac{13}{7} - \dfrac{120}{7b}$. **(4)**

(b) Hence, show that the area of the triangle, A cm^2, satisfies

$$A^2 = -120b^2 + 3120b - 14400$$ **(4)**

(c) (i) Find the maximum area of the triangle *ABC*. **(4)**

(ii) State what type of triangle *ABC* is when its area is a maximum. **(1)**

Question 10 continued

Question 10 continued

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Question 10 continued

TOTAL 13 MARKS

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11

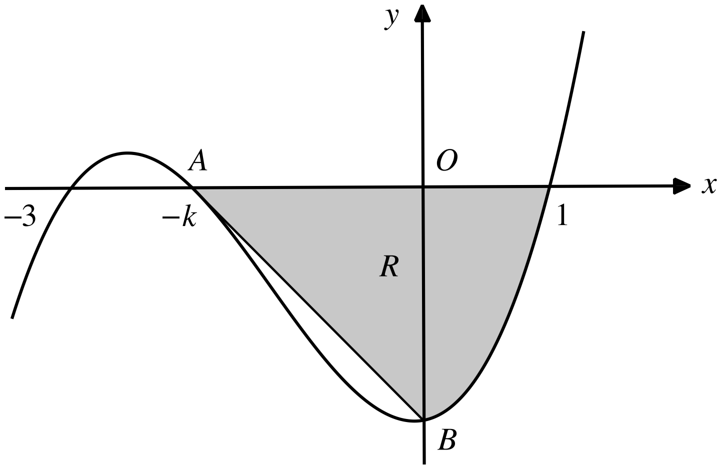

Figure 3

Figure 3 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = (x - 1)(x + 3)(x + k)$$

where k is a constant.

(a) Sketch the curve with equation $y = \mathrm{f}(x + 2)$.

On your sketch, show clearly the coordinates of any points where the curve crosses or meets the coordinate axes. **(3)**

The point A has coordinates $(-k, 0)$. The point B is where C intersects the y axis.

The finite region R, shown shaded in Figure 3, is bounded by the curve C, the x axis, the lines $x = -k$ and $x = 1$ and the line segment AB.

Given that the area of the shaded region R is $\dfrac{119}{12}$,

(b) show that $9k^2 + 10k - 56 = 0$. **(7)**

(c) Hence, find the value of k. **(1)**

Question 11 continued

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Question 11 continued

Question 11 continued

TOTAL 11 MARKS

12 Leigh models the interaction of an octopus and a fish.

The octopus is able to catch the fish if it swims within a 5 metre radius of its position.

Leigh models the octopus as a fixed particle located at the point $(-7, 5)$.

She models the fish as a particle that swims on a path defined by $y = kx + 6$.

The unit of distance for Leigh's coordinate system is metres.

(a) Find the set of values of k such that the octopus does not catch the fish. **(8)**

(b) State **one** limitation of the model. **(1)**

Question 12 continued

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Question 12 continued

Do not write outside the box

Question 12 continued

END OF PAPER **TOTAL 9 MARKS**

TOTAL FOR PAPER IS 100 MARKS

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