Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						6 6 6 3 / 0 1	Signature	

Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Advanced Subsidiary

Monday 24 May 2010 – Afternoon

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

Materials required for examination
Mathematical Formulae (Pink)

Items included with question papers
Nil

Calculators may NOT be used in this examination.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer to each question in the space following the question.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 11 questions in this question paper. The total mark for this paper is 75.
There are 28 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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Turn over

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1. Write

$$\sqrt{(75)}-\sqrt{(27)}$$

in the form $k\sqrt{x}$, where k and x are integers.

(2)

$\sqrt{75} - \sqrt{27}$

$\sqrt{25}\sqrt{3} - \sqrt{9}\sqrt{3}$

$5\sqrt{3} - 3\sqrt{3}$

$\underline{\underline{2\sqrt{3}}}$

Q1

(Total 2 marks)

Leave blank

2. Find

$$\int (8x^3 + 6x^{\frac{1}{2}} - 5)\,\mathrm{d}x$$

giving each term in its simplest form.

(4)

$$\frac{8x^4}{4} + \frac{6x^{3/2}}{3/2} - 5x + C$$

$$\underline{2x^4 + 4x^{3/2} - 5x + C}$$

Q2

(Total 4 marks)

Leave blank

3. Find the set of values of x for which

(a) $3(x-2) < 8-2x$

(2)

(b) $(2x-7)(1+x) < 0$

(3)

(c) both $3(x-2) < 8-2x$ **and** $(2x-7)(1+x) < 0$

(1)

a) $3(x-2) < 8-2x$

$3x-6 < 8-2x$

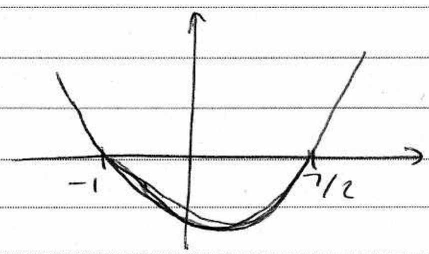
$5x-6 < 8$

$5x < 14$

$x < 14/5$

b) $(2x-7)(1+x) < 0$

$x = \frac{7}{2}$ $\quad x = -1$



$-1 < x < 7/2$

c) $-1 < x < 14/5$

Leave blank

4. (a) Show that $x^2 + 6x + 11$ can be written as

$$(x + p)^2 + q$$

where p and q are integers to be found.

(2)

(b) In the space at the top of page 7, sketch the curve with equation $y = x^2 + 6x + 11$, showing clearly any intersections with the coordinate axes.

(2)

(c) Find the value of the discriminant of $x^2 + 6x + 11$

(2)

a) $x^2 + 6x + 11$

$(x + 3)^2 - (3)^2 + 11$

$(x + 3)^2 - 9 + 11$

$\underline{(x+3)^2 + 2}$

b) Min point at $(-3, 2)$

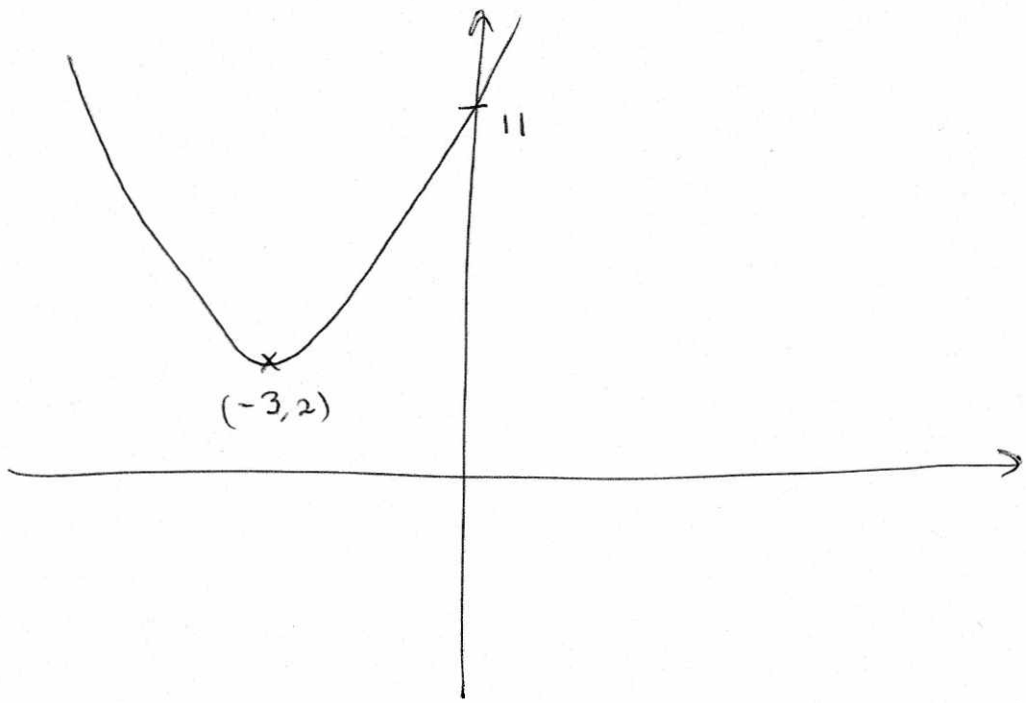
crosses y when $x = 0$

$y = (0)^2 + 6(0) + 11$

$= 11$

Leave blank

Question 4 continued



c) $b^2 - 4ac$

$a = 1 \quad b = 6 \quad c = 11$

$(6)^2 - 4(1)(11)$

$36 - 44$

$b^2 - 4ac = \underline{\underline{-8}}$

Q4

(Total 6 marks)

Leave blank

5. A sequence of positive numbers is defined by

$$a_{n+1} = \sqrt{(a_n^2 + 3)}, \qquad n \geqslant 1,$$
$$a_1 = 2$$

(a) Find a_2 and a_3, leaving your answers in surd form.

(2)

(b) Show that $a_5 = 4$

(2)

a) $a_2 = \sqrt{(a_1)^2 + 3}$

$= \sqrt{(2)^2 + 3}$

$= \sqrt{7}$

$a_3 = \sqrt{(a_2)^2 + 3}$

$= \sqrt{(\sqrt{7})^2 + 3}$

$= \sqrt{10}$

b) $a_4 = \sqrt{(a_3)^2 + 3}$

$= \sqrt{(\sqrt{10})^2 + 3}$

$= \sqrt{13}$

$a_5 = \sqrt{(a_4)^2 + 3}$

$= \sqrt{(\sqrt{13})^2 + 3}$

$= \sqrt{16}$

$= 4$

6.

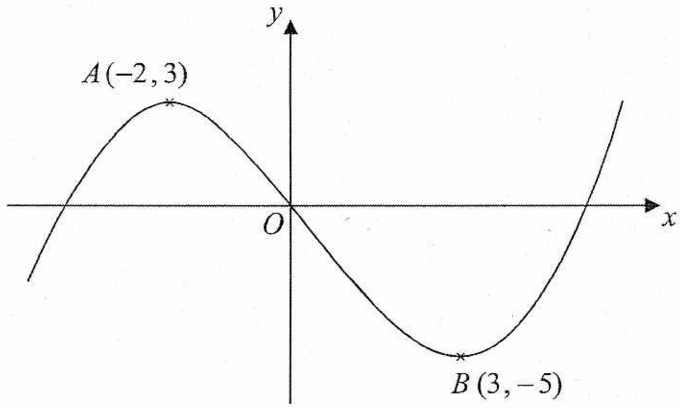


Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve has a maximum point A at (–2, 3) and a minimum point B at (3, –5).

On separate diagrams sketch the curve with equation

(a) $y = \mathrm{f}(x+3)$

(3)

(b) $y = 2\mathrm{f}(x)$

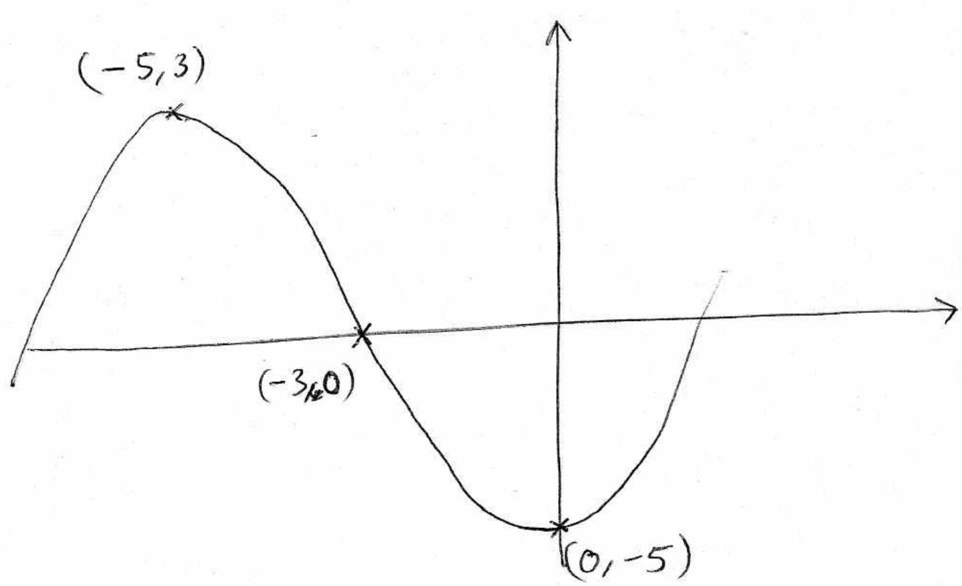
(3)

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of $y = \mathrm{f}(x) + a$ has a minimum at (3, 0), where a is a constant.

(c) Write down the value of a.

(1)



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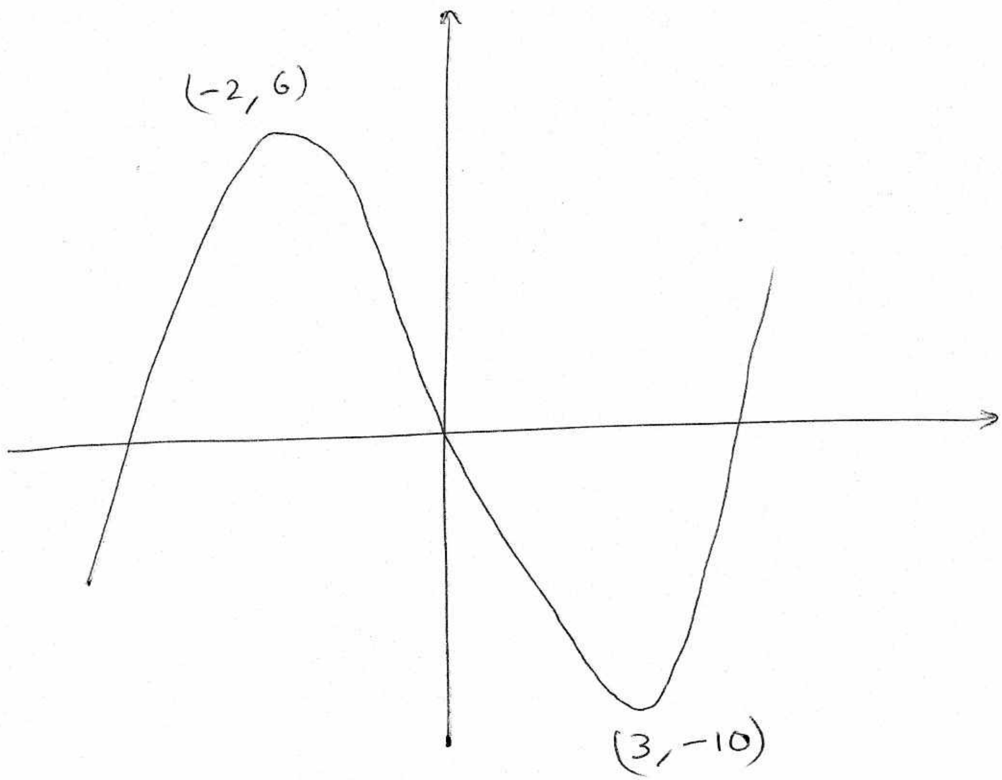
Question 6 continued



c/ $\underline{a = 5}$

(Total 7 marks)

Q6

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7. Given that

$$y = 8x^3 - 4\sqrt{x} + \frac{3x^2 + 2}{x}, \quad x > 0$$

find $\frac{dy}{dx}$.

(6)

$y = 8x^3 - 4x^{\frac{1}{2}} + 3x + 2x^{-1}$

$\frac{dy}{dx} = 24x^2 + 2x^{-\frac{1}{2}} + 3 - 2x^{-2}$

Leave blank

8. (a) Find an equation of the line joining $A(7, 4)$ and $B(2, 0)$, giving your answer in the form $ax+by+c=0$, where a, b and c are integers.

(3)

(b) Find the length of AB, leaving your answer in surd form.

(2)

The point C has coordinates $(2, t)$, where $t > 0$, and $AC = AB$.

(c) Find the value of t.

(1)

(d) Find the area of triangle ABC.

(2)

a) $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $\quad \overset{x_1\ y_1}{(2,0)} \quad \overset{x_2\ y_2}{(7,4)}$

$= \dfrac{4-0}{7-2} = \dfrac{4}{5}$

$y = \frac{4}{5}x + c \quad (2,0)$

$0 = \frac{4}{5}(2) + c$

$0 = \frac{8}{5} + c$

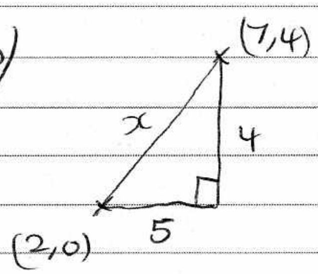
$c = -\frac{8}{5}$

$y = \frac{4}{5}x - \frac{8}{5}$

$5y = 4x - 8$

$\underline{\underline{0 = 4x - 5y - 8}}$

b)



$x^2 = 5^2 + 4^2$

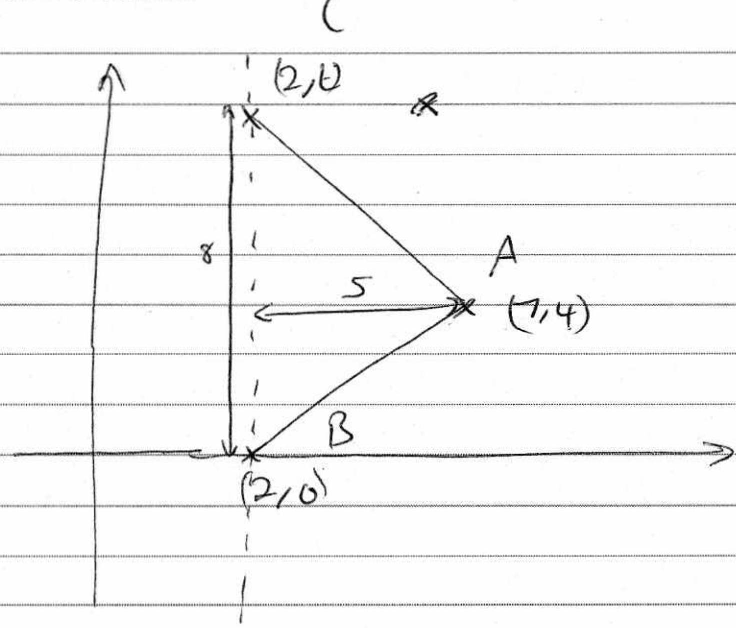
$x^2 = 25 + 16$

$x^2 = 41$

$\underline{\underline{x = \sqrt{41}}}$

Leave blank

Question 8 continued



$t = 8$

d/ Area = ½ base × height

$= \frac{1}{2} \times 8 \times 5$

$= 20 \text{ units}^2$

Leave blank

9. A farmer has a pay scheme to keep fruit pickers working throughout the 30 day season. He pays £a for their first day, £$(a+d)$ for their second day, £$(a+2d)$ for their third day, and so on, thus increasing the daily payment by £d for each extra day they work.

A picker who works for all 30 days will earn £40.75 on the final day.

(a) Use this information to form an equation in a and d.

(2)

A picker who works for all 30 days will earn a total of £1005

(b) Show that $15(a+40.75) = 1005$

(2)

(c) Hence find the value of a and the value of d.

(4)

a/ $U_{30} = 40.75$

$U_n = a + (n-1)d$

$40.75 = a + 29d$

b/ $S_n = \frac{n}{2}(2a + (n-1)d)$

$S_{30} = \frac{30}{2}(2a + 29d)$

$1005 = 15(2a + 29d)$

$1005 = 15(a + (a + 29d))$

$40.75 = a + 29d$

$\underline{1005 = 15(a + 40.75)}$

c/ $\frac{1005}{15} = a + 40.75$

$67 = a + 40.75$

$\underline{£26.25 = a}$

$40.75 = 26.25 + 29d$

$14.50 = 29d$

$\underline{d = 50p}$

Leave blank

10. (a) On the axes below sketch the graphs of

(i) $y = x(4-x)$

(ii) $y = x^2(7-x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes.

(5)

(b) Show that the x-coordinates of the points of intersection of

$$y = x(4-x) \quad \text{and} \quad y = x^2(7-x)$$

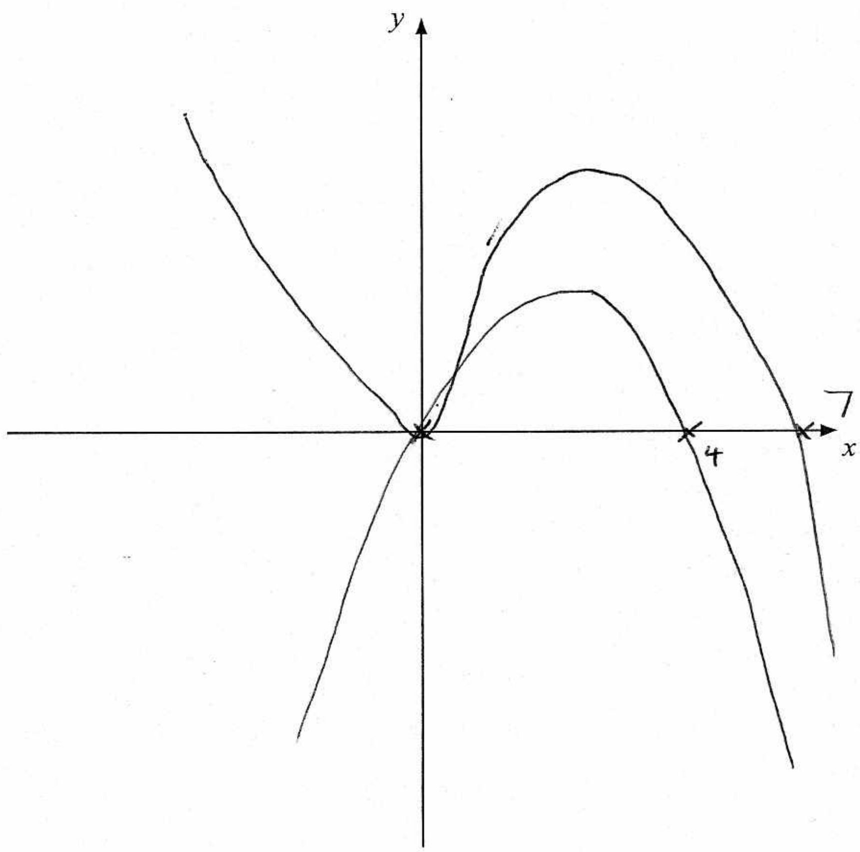
are given by the solutions to the equation $x(x^2 - 8x + 4) = 0$

(3)

The point A lies on both of the curves and the x and y coordinates of A are both positive.

(c) Find the exact coordinates of A, leaving your answer in the form $(p + q\sqrt{3},\ r + s\sqrt{3})$, where p, q, r and s are integers.

(7)



Question 10 continued

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$y = x(4-x) \qquad y = x^2(7-x)$

$x(4-x) = x^2(7-x)$

$4x - x^2 = 7x^2 - x^3$

$x^3 - x^2 + 4x = 7x^2$

$x^3 - 8x^2 + 4x = 0$

$\underline{x(x^2 - 8x + 4) = 0}$

c/ $x^2 - 8x + 4 = 0$

$(x-4)^2 - (4)^2 + 4 = 0$

$(x-4)^2 - 16 + 4 = 0$

$(x-4)^2 - 12 = 0$

$(x-4)^2 = 12$

$x - 4 = \pm\sqrt{12}$

$x = 4 \pm \sqrt{12}$

$= 4 \pm \sqrt{4}\sqrt{3}$

$= 4 \pm 2\sqrt{3}$

$y = x(4-x)$

$= (4-2\sqrt{3})(4-(4-2\sqrt{3}))$

$= (4-2\sqrt{3})(4-4+2\sqrt{3})$

$= (4-2\sqrt{3})(2\sqrt{3})$

$= 8\sqrt{3} - 12$

$\underline{(4-2\sqrt{3}, -12+8\sqrt{3})}$

Leave blank

11. The curve C has equation $y = \mathrm{f}(x)$, $x > 0$, where

$$\frac{\mathrm{d}y}{\mathrm{d}x} = 3x - \frac{5}{\sqrt{x}} - 2$$

Given that the point $P(4, 5)$ lies on C, find

(a) $\mathrm{f}(x)$,

(5)

(b) an equation of the tangent to C at the point P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

11a) $\frac{dy}{dx} = 3x - 5x^{-1/2} - 2$

$y = \frac{3x^2}{2} - \frac{5x^{1/2}}{1/2} - 2x + c$

x y
(4, 5) $y = \frac{3x^2}{2} - 10x^{1/2} - 2x + c$

$5 = \frac{3(4)^2}{2} - 10(4)^{1/2} - 2(4) + c$

$5 = \frac{48}{2} - 20 - 8 + c$

$5 = 24 - 20 - 8 + c$

$5 = -4 + c$

$9 = c$

$f(x) = \frac{3x^2}{2} - 10x^{1/2} - 2x + 9$

b) when $x = 4$ $\frac{dy}{dx} = 3(4) - \frac{5}{\sqrt{4}} - 2$

$= 12 - \frac{5}{2} - 2$

$= 10 - \frac{5}{2}$

$= \frac{15}{2}$

$m = \frac{15}{2}$

Leave blank

Question 11 continued

$y = \frac{15}{2}x + c$ $(4, 5)$

$5 = \frac{15}{2}(4) + c$

$5 = 30 + c$

$-25 = c$

$y = \frac{15}{2}x - 25$

$2y = 15x - 50$

$15x - 2y - 50 = 0$