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

Paper Reference(s)

6663/01R

Edexcel GCE

Core Mathematics C1

Advanced Subsidiary

Monday 13 May 2013 – 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	Items included with question papers
Mathematical Formulae (Pink)	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 for 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 32 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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1. Given $y = x^3 + 4x + 1$, find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 3$

(4)

$$\frac{dy}{dx} = 3x^2 + 4$$

when $x = 3$

$$\frac{dy}{dx} = 3(3)^2 + 4$$

$$= 3(9) + 4$$

$$= 27 + 4$$

$$= \underline{\underline{31}}$$

Q1

(Total 4 marks)

Leave blank

2. Express $\dfrac{15}{\sqrt{3}} - \sqrt{27}$ in the form $k\sqrt{3}$, where k is an integer.

(4)

$$\frac{15\sqrt{3}}{\sqrt{3}\sqrt{3}} - \sqrt{9}\sqrt{3}$$

$$\frac{15\sqrt{3}}{3} - 3\sqrt{3}$$

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

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

Q2

(Total 4 marks)

Leave blank

3. Find

$$\int \left(3x^2 - \frac{4}{x^2}\right) \mathrm{d}x$$

giving each term in its simplest form.

(4)

$$\int 3x^2 - 4x^{-2} \; dx$$

$$\frac{3x^3}{3} - \frac{4x^{-1}}{-1} + C$$

$$x^3 + 4x^{-1} + C$$

Leave blank

4. The line L_1 has equation $4x + 2y - 3 = 0$

(a) Find the gradient of L_1.

(2)

The line L_2 is perpendicular to L_1 and passes through the point (2, 5).

(b) Find the equation of L_2 in the form $y = mx + c$, where m and c are constants.

(3)

a) $4x + 2y - 3 = 0$

$2y = -4x + 3$

$y = -2x + 3/2$

$m = -2$

b) perpendicular gradient $= \frac{1}{2}$

$y = \frac{1}{2}x + c$ (2,5)

$5 = \frac{1}{2}(2) + c$

$5 = 1 + c$

$c = 4$

$y = \frac{1}{2}x + 4$

5. Solve

(a) $2^y = 8$

(1)

(b) $2^x \times 4^{x+1} = 8$

(4)

a) $y = 3$

b) $2^x \times 2^{2(x+1)} = 8$

2^{x+2x+2}

$2^{3x+2} = 8$

$2^{(3x+2)} = 2^{(3)}$

$3x + 2 = 3$

$3x = 1$

$x = 1/3$

Leave blank

Leave blank

6. A sequence $x_1, x_2, x_3 \ldots$ is defined by

$$x_1 = 1$$

$$x_{n+1} = (x_n)^2 - kx_n, \quad n \geqslant 1$$

where k is a constant, $k \neq 0$

(a) Find an expression for x_2 in terms of k.

(1)

(b) Show that $x_3 = 1 - 3k + 2k^2$

(2)

Given also that $x_3 = 1$,

(c) calculate the value of k.

(3)

(d) Hence find the value of $\sum_{n=1}^{100} x_n$

(3)

a) $x_2 = (x_1)^2 - k(x_1)$

$x_2 = (1)^2 - k(1)$

$= 1 - k$

b) $x_3 = (x_2)^2 - k(x_2)$

$= (1-k)^2 - k(1-k)$

$= (1-k)((1-k) - k(1-k)$

$= 1 - k - k + k^2 - k + k^2$

$= 2k^2 - 3k + 1$

$= \underline{1 - 3k + 2k^2}$

c) $2k^2 - 3k + 1 = 1$

$2k^2 - 3k = 0$

$k(2k - 3) = 0$

$k = 0 \quad k = 3/2$

k is non zero $\therefore$ $\underline{k = 3/2}$

d) $\underbrace{1, -\frac{1}{2}}_{0.5}, \underbrace{1, -\frac{1}{2}}_{0.5}$, etc.

~~Σ 100 × 0.5 = 50~~

Leave blank

Question 6 continued

50 pairs of numbers that add to 0.5

$50 \times 0.5 = \underline{25}$

Leave blank

7. Each year, Abbie pays into a savings scheme. In the first year she pays in £500. Her payments then increase by £200 each year so that she pays £700 in the second year, £900 in the third year and so on.

(a) Find out how much Abbie pays into the savings scheme in the tenth year.
(2)

Abbie pays into the scheme for n years until she has paid in a total of £67200.

(b) Show that $n^2 + 4n - 24 \times 28 = 0$
(5)

(c) Hence find the number of years that Abbie pays into the savings scheme.
(2)

a) $a = 500 \quad d = 200$

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

$u_{10} = 500 + 9(200)$

$= 500 + 1800$

$= £2300$

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

$67200 = \frac{n}{2}\left(2(500) + (n-1)(200)\right)$

$= \frac{n}{2}(1000 + 200n - 200)$

$= \frac{n}{2}(800 + 200n$

$67200 = 400n + 100n^2$

$672 = 4n + n^2$

$0 = n^2 + 4n - 672$

$= n^2 + 4n - 24 \times 28$

c/ $(n + 28)(n - 24)$

$n = -28 \quad n = 24$

$n = 24$ (cannot be negative)

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8. A rectangular room has a width of x m.

The length of the room is 4 m longer than its width.

Given that the perimeter of the room is greater than 19.2 m,

(a) show that $x > 2.8$

(3)

Given also that the area of the room is less than 21 m^2,

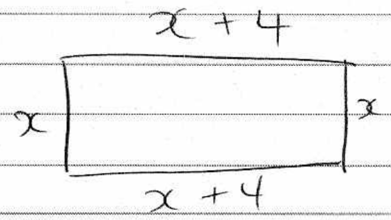
(b) (i) write down an inequality, in terms of x, for the area of the room.

(ii) Solve this inequality.

(4)

(c) Hence find the range of possible values for x.

(1)



a) $4x + 8 > 19.2$

$4x > 11.2$

$x > 2.8$

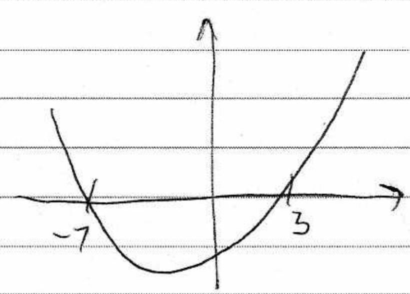
b) $x(x+4) < 21$

ii) $x^2 + 4x < 21$

$x^2 + 4x - 21 < 0$

$(x+7)(x-3) < 0$

$x = -7 \quad x = 3$



$-7 < x < 3$

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Question 8 continued

c/ $2.8 < x < 3$

Leave blank

9.

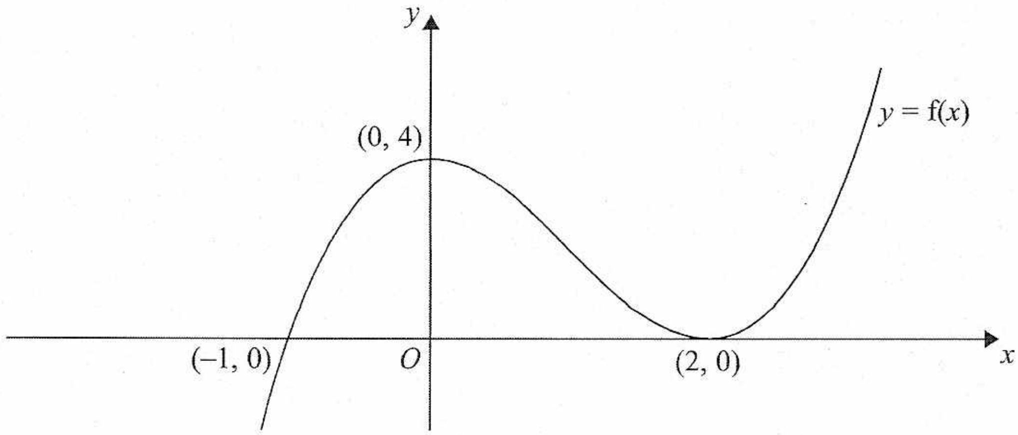

Figure 1

Figure 1 shows a sketch of the curve C with equation $y = f(x)$.

The curve C passes through the point $(-1, 0)$ and touches the x-axis at the point $(2, 0)$.

The curve C has a maximum at the point $(0, 4)$.

(a) The equation of the curve C can be written in the form

$$y = x^3 + ax^2 + bx + c$$

where a, b and c are integers.

Calculate the values of a, b and c.

(5)

(b) Sketch the curve with equation $y = f(\frac{1}{2}x)$ in the space provided on page 24

Show clearly the coordinates of all the points where the curve crosses or meets the coordinate axes.

(3)

a) $y = (x+1)(x-2)(x-2)$

$= (x+1)(x^2 - 4x + 4)$

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

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

$a = -3 \quad b = 0 \quad c = 4$

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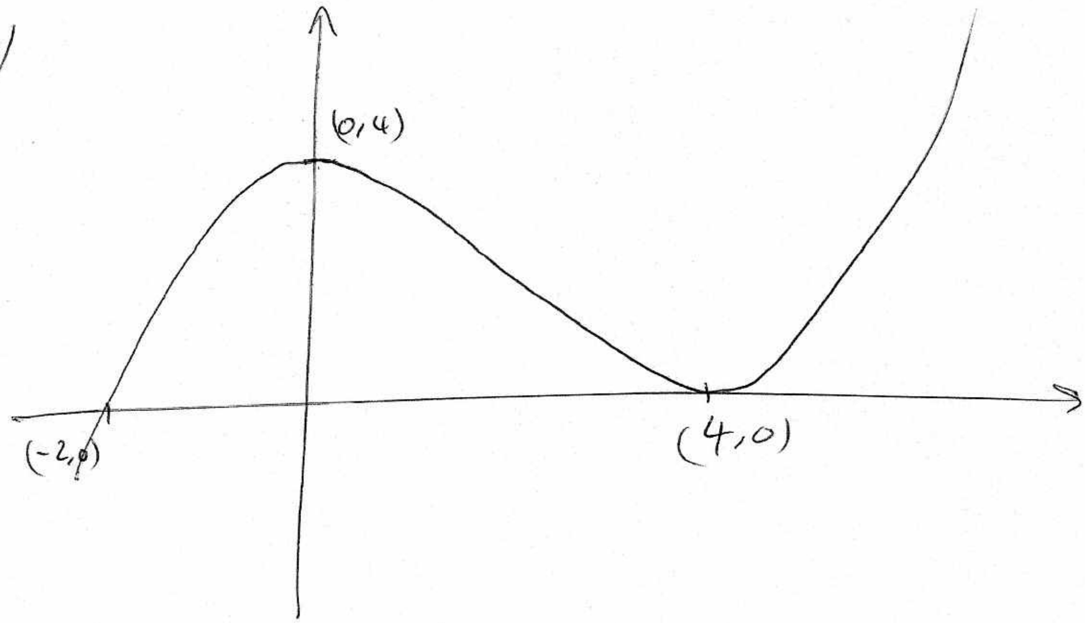
Question 9 continued

b/



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10. A curve has equation $y = \mathrm{f}(x)$. The point P with coordinates $(9, 0)$ lies on the curve.

Given that

$$\mathrm{f}'(x) = \frac{x+9}{\sqrt{x}}, \qquad x > 0$$

(a) find $\mathrm{f}(x)$.

(6)

(b) Find the x-coordinates of the two points on $y = \mathrm{f}(x)$ where the gradient of the curve is equal to 10

(4)

a/ $f'(x) = \frac{x}{\sqrt{x}} + \frac{9}{\sqrt{x}}$

$= x^{1/2} + 9x^{-1/2}$

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

$= \frac{2}{3}x^{3/2} + 18x^{1/2} + C$

9, 0 $\quad 0 = \frac{2}{3}(9)^{3/2} + 18(9)^{1/2} + C$

$0 = \frac{2}{3}(27) + 18(3) + C$

$0 = 18 + 54 + C$

$0 = 72 + C$

$C = -72$

$f(x) = \frac{2}{3}x^{3/2} + 18x^{1/2} - 72$

b) $10 = \frac{x+9}{\sqrt{x}}$

$10\sqrt{x} = x + 9$

$0 = x - 10\sqrt{x} + 9$

$0 = (x^{1/2} - 9)(x^{1/2} - 1)$

$x^{1/2} = 9 \qquad x^{1/2} = 1$

$(x > 0) \qquad x = \cancel{3}\,81 \qquad x = 1$

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11.

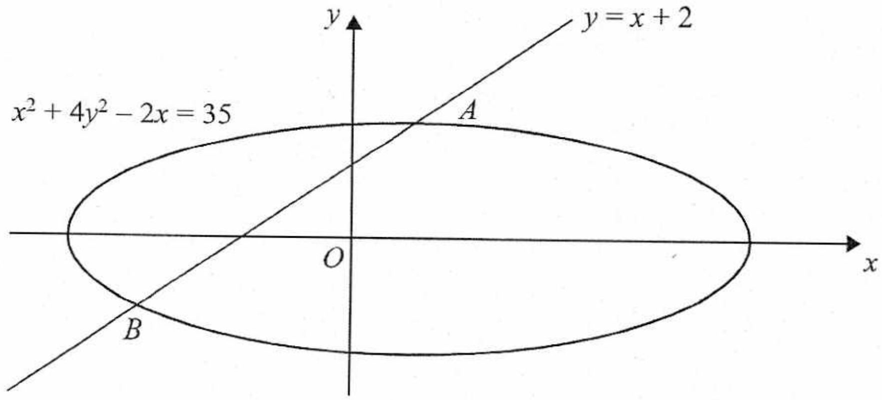

Figure 2

The line $y = x + 2$ meets the curve $x^2 + 4y^2 - 2x = 35$ at the points A and B as shown in Figure 2.

(a) Find the coordinates of A and the coordinates of B.

(6)

(b) Find the distance AB in the form $r\sqrt{2}$ where r is a rational number.

(3)

a/ $x^2 + 4y^2 - 2x = 35$

$y = (x+2)$

$x^2 + 4(x+2)^2 - 2x = 35$

$x^2 + 4(x^2 + 4x + 4) - 2x = 35$

$x^2 + 4x^2 + 16x + 16 - 2x = 35$

$5x^2 + 14x + 16 = 35$

$5x^2 + 14x - 19 = 0$

$(5x + 19)(x - 1) = 0$

$x = -\frac{19}{5}$ $\quad x = 1$

$y = -\frac{19}{5} + 2$ $\quad y = 1 + 2$

$= -\frac{9}{5}$ $\quad = 3$

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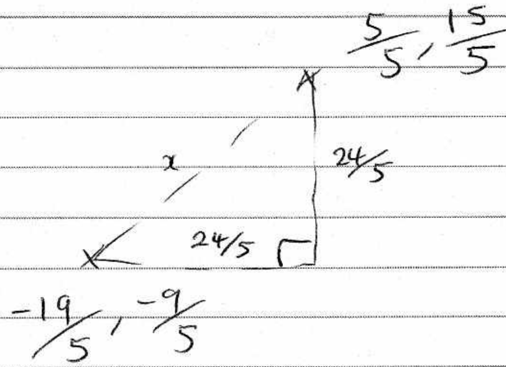
Question 11 continued

b) $\left(\frac{-19}{5}, \frac{-9}{5}\right) \quad (1, 3)$



$$x^2 = \left(\frac{24}{5}\right)^2 + \left(\frac{24}{5}\right)^2$$

$$x^2 = \frac{24^2}{25} + \frac{24^2}{25}$$

$$x^2 = \frac{2(24^2)}{25}$$

$$x = \sqrt{\frac{2(24)^2}{25}}$$

$$= \frac{\sqrt{2}(24)}{5}$$

$$= \frac{24}{5}\sqrt{2}$$