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

Wednesday 13 May 2015 – Morning

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	
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 10 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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P 4 3 1 4 5 A 0 1 3 2

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PEARSON

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1. Simplify

(a) $(2\sqrt{5})^2$

(1)

(b) $\dfrac{\sqrt{2}}{2\sqrt{5} - 3\sqrt{2}}$ giving your answer in the form $a + \sqrt{b}$, where a and b are integers.

(4)

1a)

$2\sqrt{5} \times 2\sqrt{5}$

$= 2 \times 2 \times \sqrt{5} \times \sqrt{5}$

$= 4 \times 5$

$= \underline{\underline{20}}$

b/ $\dfrac{\sqrt{2}\,(2\sqrt{5} + 3\sqrt{2})}{(2\sqrt{5} - 3\sqrt{2})(2\sqrt{5} + 3\sqrt{2})}$

$\dfrac{2\sqrt{10} + 6}{20 - 18}$

$\dfrac{2\sqrt{10} + 6}{2}$

$\underline{\underline{3 + \sqrt{10}}}$

P 4 3 1 4 5 A 0 2 3 2

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2. Solve the simultaneous equations

$$y - 2x - 4 = 0 \quad (1)$$
$$4x^2 + y^2 + 20x = 0 \quad (2)$$

(7)

(1) $y = 2x + 4$

sub (1) into (2)

$4x^2 + (2x+4)^2 + 20x = 0$
$4x^2 + (2x+4)(2x+4) + 20x = 0$
$4x^2 + 4x^2 + 8x + 8x + 16 + 20x = 0$
$8x^2 + 36x + 16 = 0$
$2x^2 + 9x + 4 = 0$
$(2x+1)(x+4) = 0$
$x = -\frac{1}{2}$ $\quad x = -4$

$y = 2(-\frac{1}{2}) + 4$
$= 3$

$y = 2(-4) + 4$
$= -4$

3. Given that $y = 4x^3 - \dfrac{5}{x^2}$, $x \neq 0$, find in their simplest form

(a) $\dfrac{dy}{dx}$

(3)

(b) $\int y\,dx$

(3)

a/ $y = 4x^3 - 5x^{-2}$

$\dfrac{dy}{dx} = 12x^2 + 10x^{-3}$

b/ $\int y\,dx = \dfrac{4x^4}{4} - \dfrac{5x^{-1}}{-1} + c$

$= x^4 + 5x^{-1} + c$

Leave blank

4. (i) A sequence $U_1, U_2, U_3, \ldots$ is defined by

$$U_{n+2} = 2U_{n+1} - U_n, \quad n \geqslant 1$$

$$U_1 = 4 \text{ and } U_2 = 4$$

Find the value of

(a) U_3

(1)

(b) $\sum_{n=1}^{20} U_n$

(2)

(ii) Another sequence $V_1, V_2, V_3, \ldots$ is defined by

$$V_{n+2} = 2V_{n+1} - V_n, \quad n \geqslant 1$$

$$V_1 = k \text{ and } V_2 = 2k, \text{ where } k \text{ is a constant}$$

(a) Find V_3 and V_4 in terms of k.

(2)

Given that $\sum_{n=1}^{5} V_n = 165$,

(b) find the value of k.

(3)

i/ a/ $U_3 = 2U_2 - U_1$

$= 2(4) - 4$

$= 4$

b/ $20 \times 4 = 80$

ii a/ $V_3 = 2V_2 - V_1$

$= 2(2k) - k$

$= 3k$

$V_4 = 2V_3 - V_2$

$= 2(3k) - 2k$

$= 4k$

Leave blank

Question 4 continued

$$V_5 = 2V_4 - V_3$$
$$= 2(4k) - 3k$$
$$= 5k$$

b) $k + 2k + 3k + 4k + 5k = 165$

$15k = 165$

$\underline{\underline{k = 11}}$

Q4

(Total 8 marks)

Leave blank

5. The equation

$$(p-1)x^2 + 4x + (p-5) = 0, \text{ where } p \text{ is a constant}$$

has no real roots.

(a) Show that p satisfies $p^2 - 6p + 1 > 0$

(3)

(b) Hence find the set of possible values of p.

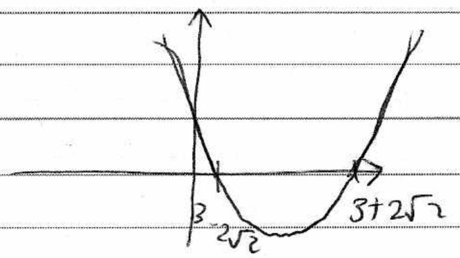
(4)

no real roots $\therefore$ $b^2 - 4ac < 0$

$a = p-1$
$b = 4$
$c = p-5$

$(4)^2 - 4(p-1)(p-5) < 0$
$16 - 4(p^2 - 5p - p + 5) < 0$
$16 - 4(p^2 - 6p + 5) < 0$
$16 - 4p^2 + 24p - 20 < 0$
$-4p^2 + 24p - 4 < 0$
$4p^2 - 24p + 4 > 0$
$p^2 - 6p + 1 > 0$

b/ $(p-3)^2 - 9 + 1 > 0$
$(p-3)^2 - 8 > 0$
$(p-3)^2 > 8$
$p - 3 > \pm\sqrt{8}$
~~$p > 3 \pm 2\sqrt{2}$~~
roots at $3 + 2\sqrt{2}$
$3 - 2\sqrt{2}$



$p < 3 - 2\sqrt{2}$
or $p > 3 + 2\sqrt{2}$

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6. The curve C has equation

$$y = \frac{(x^2+4)(x-3)}{2x}, \quad x \neq 0$$

(a) Find $\frac{dy}{dx}$ in its simplest form.

(5)

(b) Find an equation of the tangent to C at the point where $x = -1$

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

6/ $y = \frac{x^3 - 3x^2 + 4x - 12}{2x}$

$= \frac{1}{2}x^2 - \frac{3}{2}x + 2 - 6x^{-1}$

$\frac{dy}{dx} = x - \frac{3}{2} + 6x^{-2}$

b/

when $x = -1$

$\frac{dy}{dx} = (-1) - \frac{3}{2} + \frac{6}{(-1)^2}$

$= \frac{7}{2}$

$y = \frac{7}{2}x + c$

when $x = -1$ $y = \frac{(5)(-4)}{-2}$

$= \cancel{-8}\ 10$

$\overset{10}{\cancel{-8}} = \frac{7}{2}(-1) + c$

$c = \cancel{6}\frac{27}{2}$

$y = \frac{7}{2}x + \frac{27}{2}$

$2y = 7x + 27$

$7x - 2y + 27 = 0$

Leave blank

7. Given that $y = 2^x$,

(a) express 4^x in terms of y.

(1)

(b) Hence, or otherwise, solve

$$8(4^x) - 9(2^x) + 1 = 0$$

(4)

7a/

$$4^x = 2^{2x}$$
$$= 2^x \times 2^x$$
$$= y^2$$

b/ $8y^2 - 9y + 1 = 0$

$(8y - 1)(y - 1) = 0$

$y = 1/8 \quad y = 1$

$2^x = 1/8 \quad 2^x = 1$

$\underline{\underline{x = -3}} \quad \underline{\underline{x = 0}}$

Leave blank

8. (a) Factorise completely $9x - 4x^3$ **(3)**

(b) Sketch the curve C with equation

$$y = 9x - 4x^3$$

Show on your sketch the coordinates at which the curve meets the x-axis. **(3)**

The points A and B lie on C and have x coordinates of -2 and 1 respectively.

(c) Show that the length of AB is $k\sqrt{10}$ where k is a constant to be found. **(4)**

a) $x(9 - 4x^2)$

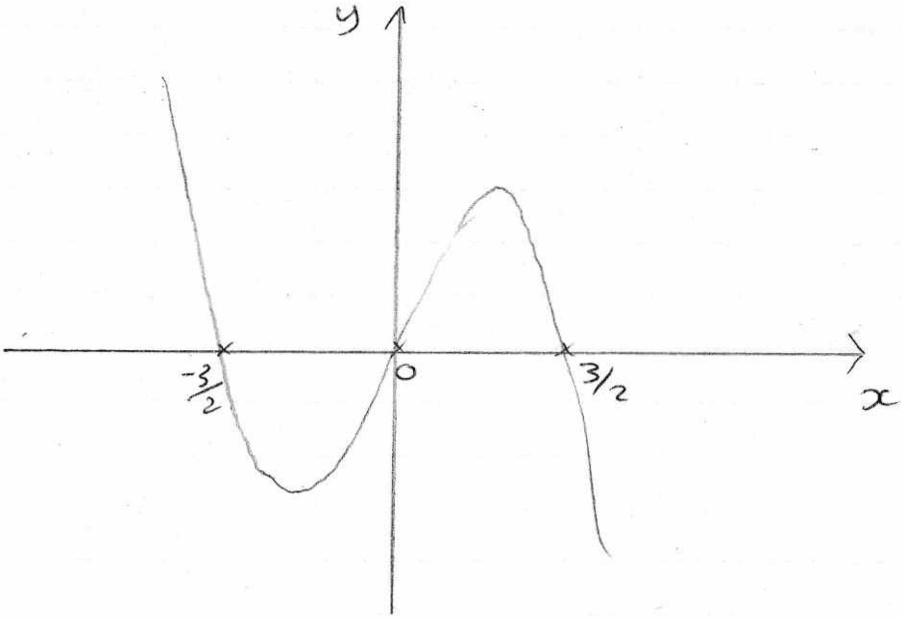
$x(3 + 2x)(3 - 2x)$

$x = 0 \quad x = -3/2 \quad x = 3/2$

Leave blank

Question 8 continued

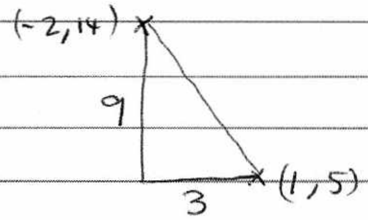
b/



c/ A: $x = -2$ B: $x = 1$

$y = 9(-2) - 4(-2)^3$ $y = 9(1) - 4(1)^3$

$= 14$ $= 5$



Distance $= \sqrt{3^2 + 9^2}$

$= \sqrt{90}$

$= \underline{\underline{3\sqrt{10}}}$

Leave blank

9. Jess started work 20 years ago. In year 1 her annual salary was £17000. Her annual salary increased by £1500 each year, so that her annual salary in year 2 was £18500, in year 3 it was £20000 and so on, forming an arithmetic sequence. This continued until she reached her maximum annual salary of £32000 in year k. Her annual salary then remained at £32000.

(a) Find the value of the constant k.

(2)

(b) Calculate the total amount that Jess has earned in the 20 years.

(5)

a/ $a = 17000$
$d = 1500$

$U_k = 32000$

$32000 = 17000 + (k-1)(1500)$
$15000 = (k-1)(1500)$
$10 = k - 1$
$\underline{k = 11}$

b/ $S_{11} = \frac{n}{2}(a + l)$

$= \frac{11}{2}(17000 + 32000)$

$= \frac{11}{2}(49000)$
$= 11(24500)$
$= \underline{269500}$

$10 \times 24500 = 245000$
$1 \times 24500 = +24500$
269500

9×32000
$= 288000$

$10 \times 32000 = 320000$
$1 \times 32000 \quad 32000$
288000

269500
$+ 288000$
557500

£557500

Leave blank

10. A curve with equation $y = f(x)$ passes through the point (4, 9).

Given that

$$f'(x) = \frac{3\sqrt{x}}{2} - \frac{9}{4\sqrt{x}} + 2, \quad x > 0$$

(a) find $f(x)$, giving each term in its simplest form.

(5)

Point P lies on the curve.

The normal to the curve at P is parallel to the line $2y + x = 0$

(b) Find the x coordinate of P.

(5)

a/ $f'(x) = \frac{3}{2}\sqrt{x} - \frac{9}{34}$

$= \frac{3}{2}x^{1/2} - \frac{9}{4}x^{-1/2} + 2$

$f(x) = \frac{\frac{3}{2}x^{3/2}}{3/2} - \frac{\frac{9}{4}x^{1/2}}{1/2} + 2x + c$

$= x^{3/2} - \frac{9}{2}x^{1/2} + 2x + c$

$x \; y$
$(4, 9)$ $\quad 9 = (4)^{3/2} - \frac{9}{2}(4)^{1/2} + 2(4) + c$

$9 = 8 - 9 + 8 + c$

$c = 2$

$y = x^{3/2} - \frac{9}{2}x^{1/2} + 2x + 2$

b) $2y = -x$

$y = -1/2 x$

$\underline{\underline{m = -1/2}}$ $\therefore$ normal $\underline{\underline{m = 2}}$

Question 10 continued

Leave blank

$$2 = \frac{3\sqrt{x}}{2} - \frac{9}{4\sqrt{x}} + 2$$

$$2\sqrt{x} = \frac{3}{2}x - \frac{9}{4} + 2\sqrt{x}$$

$$0 = \frac{3}{2}x - \frac{9}{4}$$

$$\frac{9}{4} = \frac{3}{2}x$$

$$\frac{18}{12} = x$$

$$x = \frac{3}{2}$$