Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	6	4	/	0	1R	Signature	

Paper Reference(s)

6664/01R

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Friday 24 May 2013 – 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	
Total	

Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

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.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

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 9 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. Using calculus, find the coordinates of the stationary point on the curve with equation

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

(6)

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

$\frac{dy}{dx} = 2 - 16x^{-3}$

Stationary point is where $\frac{dy}{dx} = 0$

$2 - 16x^{-3} = 0$

$2 - \frac{16}{x^3} = 0$

$2 = \frac{16}{x^3}$

$2x^3 = 16$

$x^3 = 8$

$x = 2$

when $x = 2$:

$y = 2(2) + 3 + \frac{8}{(2)^2}$

$= 9$

$\underline{\underline{(2, 9)}}$

Leave blank

2.

$$y = \frac{x}{\sqrt{(1+x)}}$$

(a) Complete the table below with the value of y corresponding to $x = 1.3$, giving your answer to 4 decimal places.

(1)

x	1	1.1	1.2	1.3	1.4	1.5
y	0.7071	0.7591	0.8090	0.8572	0.9037	0.9487

(b) Use the trapezium rule, with all the values of y in the completed table, to obtain an approximate value for

$$\int_1^{1.5} \frac{x}{\sqrt{(1+x)}}\,dx$$

giving your answer to 3 decimal places.

You must show clearly each stage of your working.

(4)

b/ $0.1\left(\frac{0.7071}{2} + 0.7591 + 0.8090 + 0.8572 + 0.9037 + \frac{0.9487}{2}\right)$

$= 0.41569$

$= 0.416$ units^2 (3dp)

Leave blank

3. Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(2 - \frac{1}{2}x\right)^8$$

giving each term in its simplest form.

(4)

1 8 28 56

$1(2)^8 + 8(2)^7\left(-\frac{1}{2}x\right) + 28(2)^6\left(-\frac{1}{2}x\right)^2 + 56(2)^5\left(-\frac{1}{2}x\right)^3$

$256 - 512x + 448x^2 - 224x^3$

Leave blank

4. $f(x) = ax^3 - 11x^2 + bx + 4$, where a and b are constants.

When $f(x)$ is divided by $(x - 3)$ the remainder is 55

When $f(x)$ is divided by $(x + 1)$ the remainder is -9

(a) Find the value of a and the value of b.

(5)

Given that $(3x + 2)$ is a factor of $f(x)$,

(b) factorise $f(x)$ completely.

(4)

a) $f(3) = 55$

$f(-1) = -9$

$a(3)^3 - 11(3)^2 + b(3) + 4 = 55$

$27a - 99 + 3b + 4 = 55$

$27a + 3b = 150$

$9a + b = 50$ 1

$a(-1)^3 - 11(-1)^2 + b(-1) + 4 = -9$

$-a - 11 - b + 4 = -9$

$-a - b = -2$

$a + b = 2$ 2

1 - 2 $8a = 48$

$a = 6$

$b = -4$

b)
$$
\begin{array}{r|l}
 & 2x^2 - 5x + 2 \\
3x+2 & 6x^3 - 11x^2 - 4x + 4 \\
 & 6x^3 + 4x^2 \\
 & -15x^2 - 4x \\
 & -15x^2 - 10x \\
 & 6x + 4 \\
 & 6x + 4 \\
 & 0
\end{array}
$$

Leave blank

Question 4 continued

$(3x+2)(2x^2 - 5x + 2)$

$(3x+2)(2x-1)(x-2)$

Leave blank

5. The first three terms of a geometric series are $4p$, $(3p + 15)$ and $(5p + 20)$ respectively, where p is a **positive** constant.

(a) Show that $11p^2 - 10p - 225 = 0$ **(4)**

(b) Hence show that $p = 5$ **(2)**

(c) Find the common ratio of this series. **(2)**

(d) Find the sum of the first ten terms of the series, giving your answer to the nearest integer. **(3)**

a) $\frac{3p+15}{4p} = \frac{5p+20}{3p+15}$

$(3p+15)(3p+15) = 4p(5p+20)$

$9p^2 + 90p + 225 = 20p^2 + 80p$

$0 = 11p^2 - 10p - 225$

b) $(11p + 45)(p - 5) = 0$

$p = \frac{-45}{11}$ $\quad p = 5$

p cannot be negative $\therefore p = 5$

c) $r = \frac{3p+15}{4p}$

$= \frac{3(5)+15}{4(5)} = \frac{3}{2}$

d) $S_n = \frac{a(1-r^n)}{1-r}$ $\quad a = 4p = 4(5) = 20$

$S_{10} = \frac{20(1-(\frac{3}{2})^{10})}{1-(\frac{3}{2})}$

$= 2267$ (nearest integer)

Leave blank

6. Given that $\log_3 x = a$, find in terms of a,

(a) $\log_3 (9x)$

(2)

(b) $\log_3\left(\dfrac{x^5}{81}\right)$

(3)

giving each answer in its simplest form.

(c) Solve, for x,

$$\log_3(9x) + \log_3\left(\frac{x^5}{81}\right) = 3$$

giving your answer to 4 significant figures.

(4)

a) $\log_3 9x = \log_3 9 + \log_3 x$

$= 2 + a$

b/ $\log_3\left(\frac{x^5}{81}\right) = \log_3 x^5 - \log_3 81$

$= 5\log_3 x - \log_3 81$

$= 5a - 4$

c/ $2 + a + 5a - 4 = 3$

$6a - 2 = 3$

$6a = 5$

$a = 5/6$

$\log_3 x = 5/6$

$x = 3^{5/6}$

$= 2.498 \ (4sf)$

7.

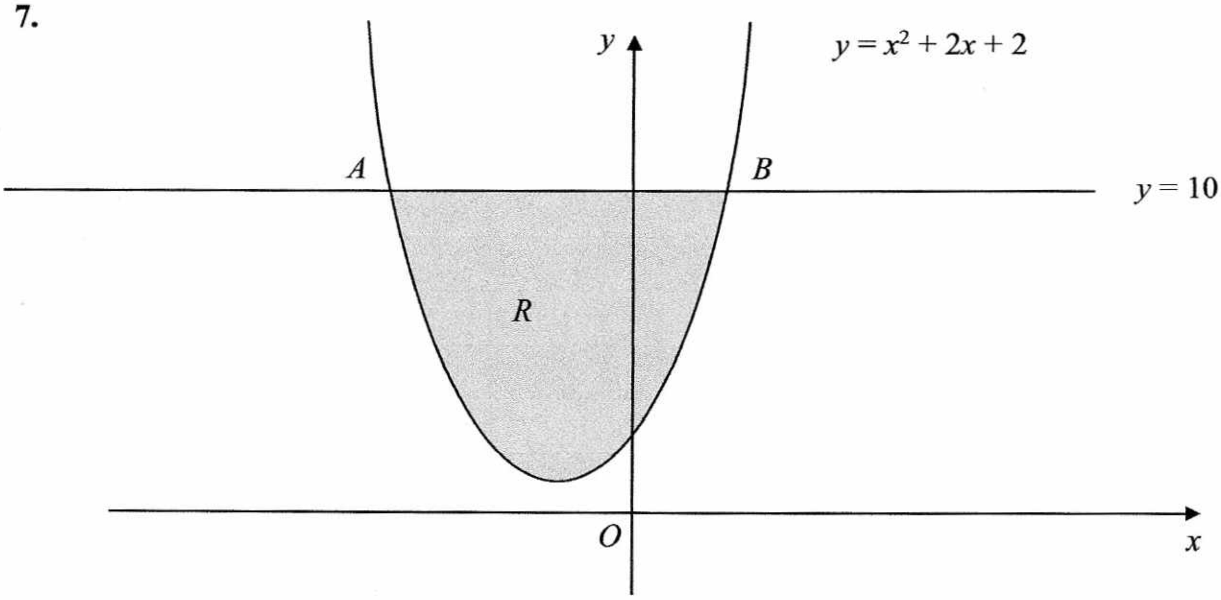


Figure 1

The line with equation $y = 10$ cuts the curve with equation $y = x^2 + 2x + 2$ at the points A and B as shown in Figure 1. The figure is not drawn to scale.

(a) Find by calculation the x-coordinate of A and the x-coordinate of B.

(2)

The shaded region R is bounded by the line with equation $y = 10$ and the curve as shown in Figure 1.

(b) Use calculus to find the exact area of R.

(7)

a) $10 = x^2 + 2x + 2$

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

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

$\underline{\underline{x = -4}}$ $\underline{\underline{x = 2}}$

A B

b) $\int_{-4}^{2} x^2 + 2x - 8 \; dx$

$\left[\frac{x^3}{3} + \frac{2x^2}{2} - 8x + C \right]_{-4}^{2}$

$\left[\frac{1}{3}x^3 + x^2 - 8x \right]_{-4}^{2}$

$\boxed{\text{or} \quad 60 - \int_{-4}^{2} x^2 + 2x + 2 \; dx}$

Leave blank

Question 7 continued

$$\left[\frac{1}{3}(2)^3 + (2)^2 - 8(2)\right] - \left[\frac{1}{3}(-4)^3 + (-4)^2 - 8(-4)\right]$$

$$\left[\frac{-28}{3}\right] - \left[\frac{80}{3}\right] = -36$$

$\underline{\underline{36 \text{ units}^2}}$

8.

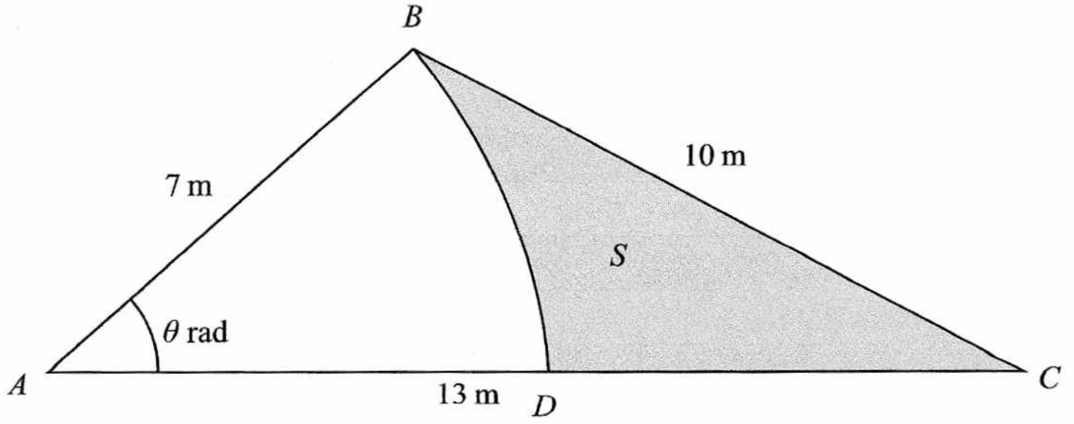


Figure 2

Figure 2 shows the design for a triangular garden ABC where $AB = 7$ m, $AC = 13$ m and $BC = 10$ m.

Given that angle $BAC = \theta$ radians,

(a) show that, to 3 decimal places, $\theta = 0.865$

(3)

The point D lies on AC such that BD is an arc of the circle centre A, radius 7 m.

The shaded region S is bounded by the arc BD and the lines BC and DC. The shaded region S will be sown with grass seed, to make a lawned area.

Given that 50 g of grass seed are needed for each square metre of lawn,

(b) find the amount of grass seed needed, giving your answer to the nearest 10 g.

(7)

a) $\cos\theta = \dfrac{b^2 + c^2 - a^2}{2bc}$

$= \dfrac{(7)^2 + (13)^2 - (10)^2}{2(7)(13)}$

$\cos\theta = 59/91$

$\theta = 0.8653789549^c$

$= 0.865$ (3dp)

b/ Area of S = Area of triangle − Area of sector

Area of triangle $= \frac{1}{2} ab \sin C$

$= \frac{1}{2}(7)(13)\sin(0.865)$

$= 34.6298345 \text{ m}^2$

Leave blank

Leave blank

Question 8 continued

Area of sector $= \frac{\theta}{2} r^2$

$= \frac{0.865}{2} (7)^2$

$= 21.1925 \ m^2$

Area of S $= 13.437... \ m^2$

Grass seed needed $= 13.437 \times 50$

$= 671.8667... \ g$

$= 670g$ (nearest 10g)

Turn over

Leave blank

9. (i) Solve, for $0 \leqslant \theta < 180°$

$$\sin(2\theta - 30°) + 1 = 0.4$$

giving your answers to 1 decimal place.

(5)

(ii) Find all the values of x, in the interval $0 \leqslant x < 360°$, for which

$$9\cos^2 x - 11\cos x + 3\sin^2 x = 0$$

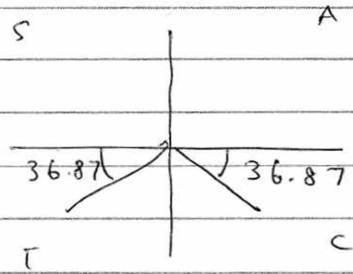
giving your answers to 1 decimal place.

(7)

You must show clearly how you obtained your answers.

i/ $\sin(2\theta - 30) = -0.6$

$2\theta - 30 = -36.87$



$2\theta - 30 = 216.87,\ 323.13$

$\theta = \underline{123.4°},\ \underline{176.6°}$

ii/ $\cos^2\theta + \sin^2\theta = 1 \quad [\sin^2\theta = 1 - \cos^2\theta]$

$9\cos^2 x - 11\cos x + 3(1 - \cos^2 x) = 0$

$9\cos^2 x - 11\cos x + 3 - 3\cos^2 x = 0$

$6\cos^2 x - 11\cos x + 3 = 0$

$(3\cos x - 1)(2\cos x - 3) = 0$

$\cos x = \frac{1}{3} \qquad \cos x = \frac{3}{2}$

no solutions

$x = \underline{70.5°},\ \underline{289.5°}$