Paper Reference (complete below)								
	6	6	6	6	/	0	1	

Centre No.					
Candidate No.					

Surname	Initial(s)
Signature	

Paper Reference(s)

6666

Edexcel GCE

Core Mathematics C4

Advanced Subsidiary

Set A: Practice Paper 5

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	
Total	

Materials required for examination
Mathematical Formulae

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature. You must write your answer for each question in the space following the question. If you need more space to complete your answer to any question, use additional answer sheets.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
This paper has seven questions.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the examiner.
Answers without working may gain no credit.

Turn over

1. $$f(x) = (1 + 3x)^{-1}, \quad |x| < \tfrac{1}{3}.$$

(*a*) Expand f(x) in ascending powers of x up to and including the term in x^3.

(3)

(*b*) Hence show that, for small x,

$$\frac{1+x}{1+3x} \approx 1 - 2x + 6x^2 - 18x^3.$$

(2)

(*c*) Taking a suitable value for x, which should be stated, use the series expansion in part (*b*) to find an approximate value for $\frac{101}{103}$, giving your answer to 5 decimal places.

(3)

---

2. (*a*) Express $\frac{13 - 2x}{(2x - 3)(x + 1)}$ in partial fractions.

(4)

(*b*) Given that $y = 4$ at $x = 2$, use your answer to part (*a*) to find the solution of the differential equation

$$\frac{dy}{dx} = \frac{y(13 - 2x)}{(2x - 3)(x + 1)}, \quad x > 1.5$$

Express your answer in the form $y = f(x)$.

(7)

---

3. **Figure 2**

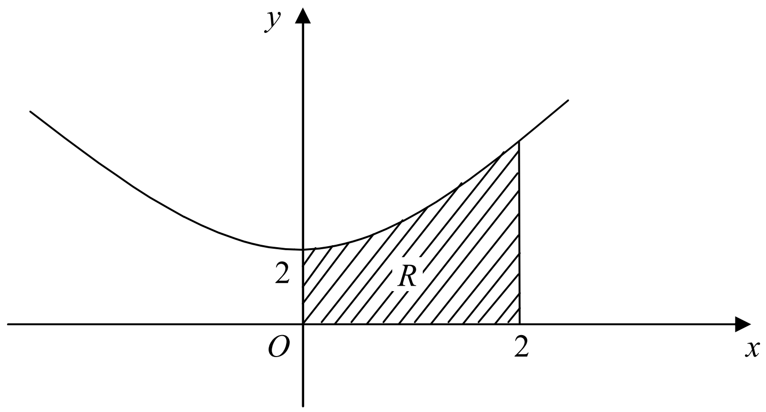


Figure 2 shows part of the curve with equation $y = x^2 + 2$.

The finite region R is bounded by the curve, the x-axis and the lines $x = 0$ and $x = 2$.

(a) Use the trapezium rule with 4 strips of equal width to estimate the area of R.

(5)

(b) State, with a reason, whether your answer in part (a) is an under-estimate or over-estimate of the area of R.

(1)

(c) Using integration, find the volume of the solid generated when R is rotated through 360° about the x-axis, giving your answer in terms of π.

(6)

---

4. A Pancho car has value £V at time t years. A model for V assumes that the rate of decrease of V at time t is proportional to V.

(a) By forming and solving an appropriate differential equation, show that $V = A\mathrm{e}^{-kt}$, where A and k are positive constants.

(3)

The value of a new Pancho car is £20 000, and when it is 3 years old its value is £11 000.

(b) Find, to the nearest £100, an estimate for the value of the Pancho when it is 10 years old.

(5)

A Pancho car is regarded as ‘scrap’ when its value falls below £500.

(c) Find the approximate age of the Pancho when it becomes ‘scrap’.

(3)

---

5. **Figure 1**

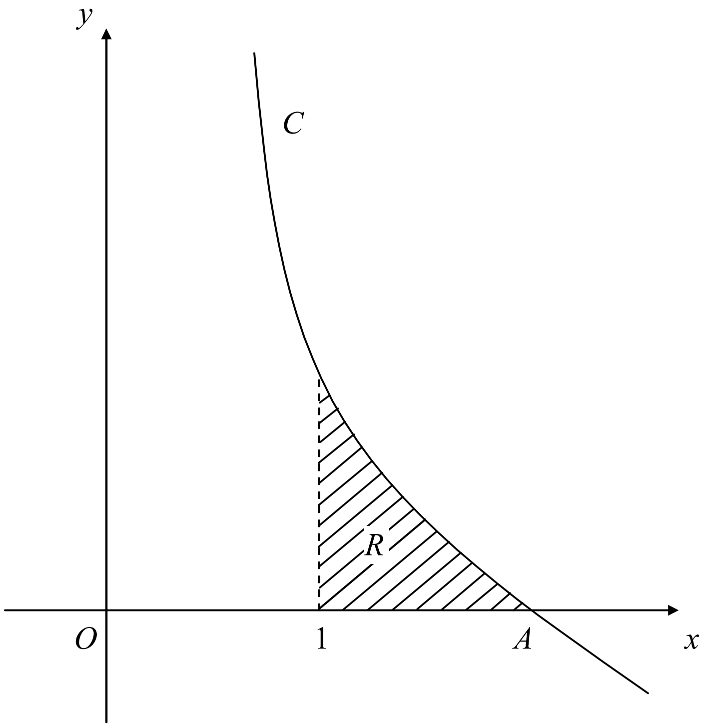


Figure 1 shows the curve C with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = \frac{8}{x} - x^2, \ \ x > 0.$$

Given that C crosses the x-axis at the point A,

(a) find the coordinates of A.

(2)

The finite region R, bounded by C, the x-axis and the line $x = 1$, is rotated through 2π radians about the x-axis.

(b) Use integration to find, in terms of π, the volume of the solid generated.

(7)

6. Referred to a fixed origin O, the points A and B have position vectors $(\mathbf{i} + 2\mathbf{j} - 3\mathbf{k})$ and $(5\mathbf{i} - 3\mathbf{j})$ respectively.

(*a*) Find, in vector form, an equation of the line l_1 which passes through A and B.

(2)

The line l_2 has equation $\mathbf{r} = (4\mathbf{i} - 4\mathbf{j} + 3\mathbf{k}) + \mu(\mathbf{i} - 2\mathbf{j} + 2\mathbf{k})$, where μ is a scalar parameter.

(*b*) Show that A lies on l_2.

(1)

(*c*) Find, in degrees, the acute angle between the lines l_1 and l_2.

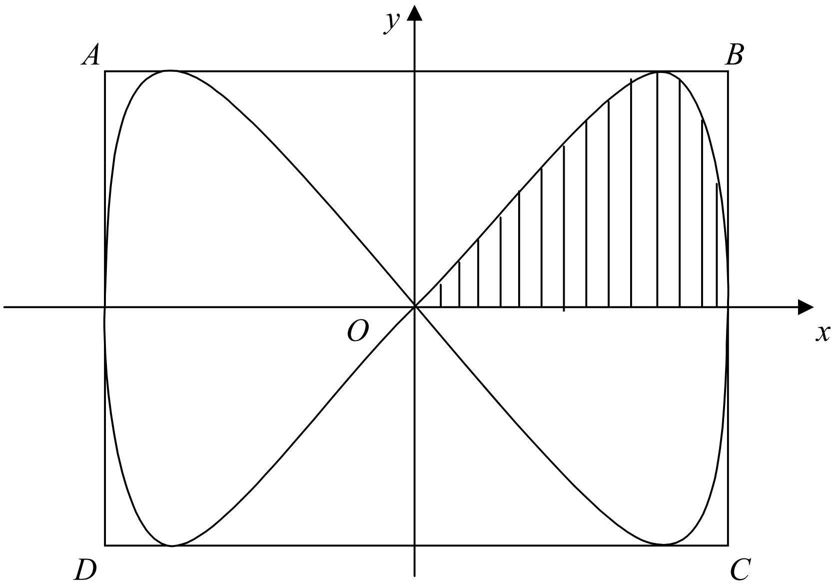
(4)

The point C with position vector $(2\mathbf{i} - \mathbf{k})$ lies on l_2.

(*d*) Find the shortest distance from C to the line l_1.

(4)

7. **Figure 2**



Part of the design of a stained glass window is shown in Fig. 2. The two loops enclose an area of blue glass. The remaining area within the rectangle $ABCD$ is red glass.

The loops are described by the curve with parametric equations

$$x = 3\cos t, \quad y = 9\sin 2t, \quad 0 \leq t < 2\pi.$$

(a) Find the cartesian equation of the curve in the form $y^2 = \mathrm{f}(x)$.

(4)

(b) Show that the shaded area in Fig. 2, enclosed by the curve and the x-axis, is given by

$\int_0^{\frac{\pi}{2}} A\sin 2t \sin t \, \mathrm{d}t$, stating the value of the constant A.

(3)

(c) Find the value of this integral.

(4)

The sides of the rectangle $ABCD$, in Fig. 2, are the tangents to the curve that are parallel to the coordinate axes. Given that 1 unit on each axis represents 1 cm,

(d) find the total area of the red glass.

(4)

END