GCE Examinations

Advanced / Advanced Subsidiary

Core Mathematics C2

Paper D

Time: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** the questions.

- Give non-exact numerical answers correct to 3 significant figures, unless a different degree of accuracy is specified in the question or is clearly appropriate.

- You are permitted to use a graphic calculator in this paper.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.

- The total number of marks for this paper is 72.

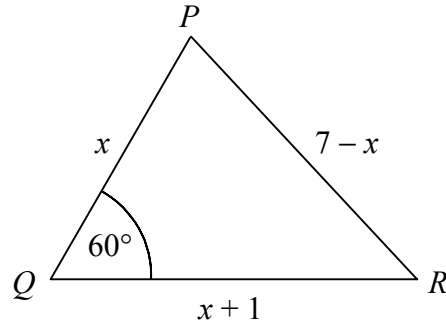- **You are reminded of the need for clear presentation in your answers.**

1. Find

$$\int (3x^2 + \frac{1}{2x^2})\ dx.$$ [4]

2.

The diagram shows triangle *PQR* in which *PQ* = *x*, *PR* = 7 − *x*, *QR* = *x* + 1 and ∠*PQR* = 60°.

Using the cosine rule, find the value of *x*. [4]

3.
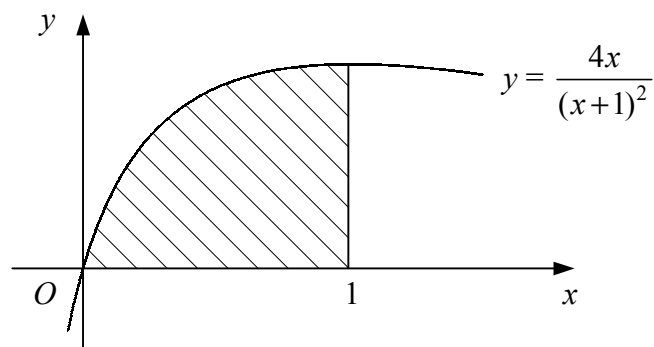
The diagram shows the curve with equation $y = \dfrac{4x}{(x+1)^2}$.

The shaded region is bounded by the curve, the *x*-axis and the line *x* = 1.

(i) Use the trapezium rule with four intervals, each of width 0.25, to find an estimate for the area of the shaded region. [5]

(ii) State, with a reason, whether your answer to part *(a)* is an under-estimate or an over-estimate of the true area. [2]

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4. The coefficient of x^2 in the binomial expansion of $(1 + kx)^7$, where k is a positive constant, is 525.

    (i)   Find the value of k. [3]

    Using this value of k,

    (ii)   show that the coefficient of x^3 in the expansion is 4375, [2]

    (iii) find the first three terms in the expansion in ascending powers of x of

    $$(2 - x)(1 + kx)^7.$$ [3]

5. *(i)*   Given that

    $$8 \tan x - 3 \cos x = 0,$$

    show that

    $$3 \sin^2 x + 8 \sin x - 3 = 0.$$ [3]

    (ii)   Find, to 2 decimal places, the values of x in the interval $0 \le x \le 2\pi$ such that

    $$8 \tan x - 3 \cos x = 0.$$ [5]

6. $$f(x) = 2x^3 + 3x^2 - 6x + 1.$$

    (a)   Find the remainder when f(x) is divided by $(2x - 1)$. [2]

    (b)   *(i)*   Find the remainder when f(x) is divided by $(x + 2)$. [1]

            (ii)   Hence, or otherwise, solve the equation

    $$2x^3 + 3x^2 - 6x - 8 = 0.$$ [6]

Turn over

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7. *(i)* Given that

$$\log_2 (y - 1) = 1 + \log_2 x,$$

show that

$$y = 2x + 1.$$ [3]

(ii) Solve the simultaneous equations

$$\log_2 (y - 1) = 1 + \log_2 x$$

$$2 \log_3 y = 2 + \log_3 x$$ [7]

8. The first two terms of an arithmetic progression are $(t - 1)$ and $(t^2 - 5)$ respectively, where t is a positive constant.

(a) Find and simplify expressions in terms of t for

    (i) the common difference, [2]

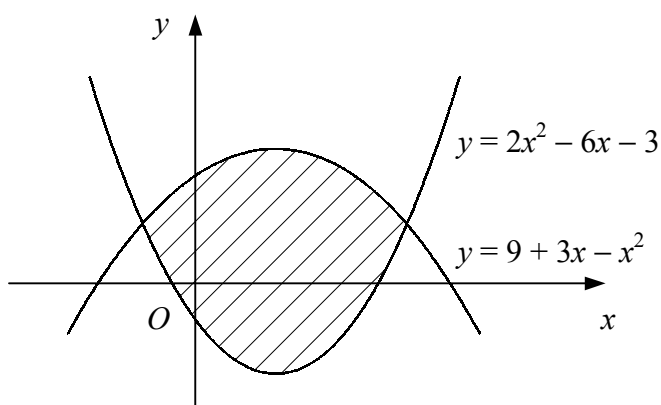   *(ii)* the third term. [2]

Given also that the third term is 19,

(b) find the value of t, [2]

(c) show that the 10th term is 75, [3]

(d) find the sum of the first 40 terms. [2]

9.

The diagram shows the curves $y = 2x^2 - 6x - 3$ and $y = 9 + 3x - x^2$.

(i) Find the coordinates of the points where the two curves intersect. [4]

(ii) Find the area of the shaded region bounded by the two curves. [7]