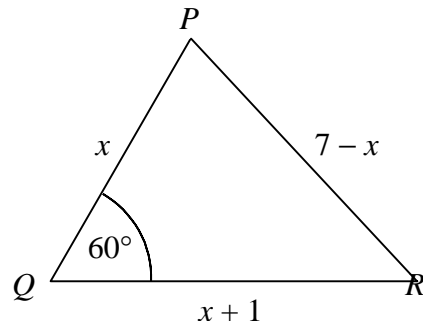


# Core Mathematics C2 Paper D

1. Find

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

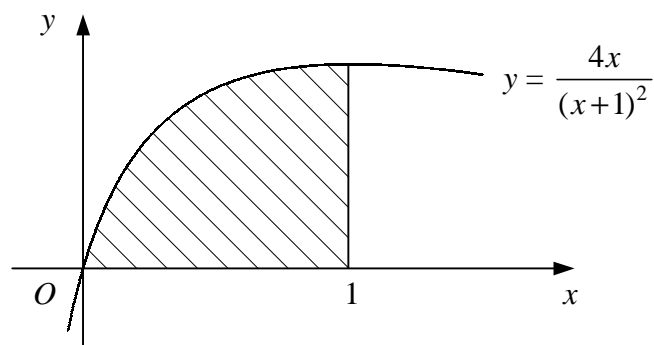
2.



The diagram shows triangle  $PQR$  in which  $PQ = x$ ,  $PR = 7 - x$ ,  $QR = x + 1$  and  $\angle PQR = 60^\circ$ .

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

3.



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

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]

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

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

5. (i) Given that

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

show that

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

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

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

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

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

**Turn over**

7. (i) Given that

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

show that

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

- (ii) Solve the simultaneous equations

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

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

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]

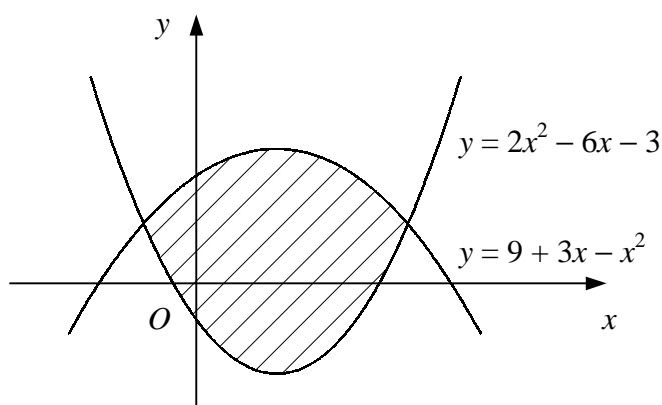
Given also that the third term is 19,

(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]