

Core Mathematics C2 Paper H

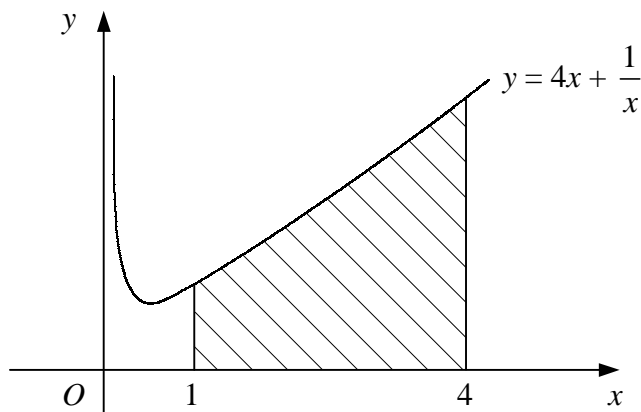
1. $f(x) = 3x^3 - 2x^2 + kx + 9.$

Given that when $f(x)$ is divided by $(x + 2)$ there is a remainder of -35 ,

(i) find the value of the constant k , [2]

(ii) find the remainder when $f(x)$ is divided by $(3x - 2)$. [2]

2.



The diagram shows the curve with equation $y = 4x + \frac{1}{x}$, $x > 0$.

Use the trapezium rule with three intervals, each of width 1, to estimate the area of the shaded region bounded by the curve, the x -axis and the lines $x = 1$ and $x = 4$. [4]

3. The sides of a triangle have lengths of 7 cm, 8 cm and 10 cm.

Find the area of the triangle correct to 3 significant figures. [5]

4. Find all values of x in the interval $0 \leq x < 360^\circ$ for which

$$2 \sin^2 x - 2 \cos x - \cos^2 x = 1,$$

giving non-exact answers to 1 decimal place. [8]

5. (i) Describe fully a single transformation that maps the graph of $y = 3^x$ onto the graph of $y = (\frac{1}{3})^x$. [1]
- (ii) Sketch on the same diagram the curves $y = (\frac{1}{3})^x$ and $y = 2(3^x)$, showing the coordinates of any points where each curve crosses the coordinate axes. [3]

The curves $y = (\frac{1}{3})^x$ and $y = 2(3^x)$ intersect at the point P .

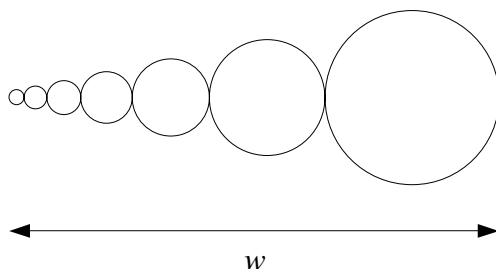
- (iii) Find the x -coordinate of P to 2 decimal places and show that the y -coordinate of P is $\sqrt{2}$. [5]

6. Evaluate

(i) $\int_1^4 (x^2 - 5x + 4) \, dx$, [5]

(ii) $\int_{-\infty}^{-1} \frac{1}{x^4} \, dx$. [5]

7.



The diagram shows part of a design being produced by a computer program.

The program draws a series of circles with each one touching the previous one and such that their centres lie on a horizontal straight line.

The radii of the circles form a geometric sequence with first term 1 mm and second term 1.5 mm. The width of the design is w as shown.

- (i) Find the radius of the fourth circle to be drawn. [2]
- (ii) Show that when eight circles have been drawn, $w = 98.5$ mm to 3 significant figures. [3]
- (iii) Find the total area of the design in square centimetres when ten circles have been drawn. [5]

Turn over

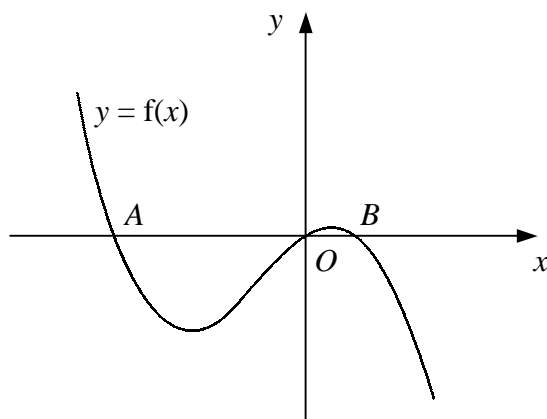
8. Given that for small values of x

$$(1 + ax)^n \approx 1 - 24x + 270x^2,$$

where n is an integer and $n > 1$,

- (i) show that $n = 16$ and find the value of a , [7]
- (ii) use your value of a and a suitable value of x to estimate the value of $(0.9985)^{16}$, giving your answer to 5 decimal places. [3]

- 9.



The diagram shows the curve with equation $y = f(x)$ which crosses the x -axis at the origin and at the points A and B .

Given that

$$f'(x) = 4 - 6x - 3x^2,$$

- (i) find an expression for y in terms of x , [5]
- (ii) show that A has coordinates $(-4, 0)$ and find the coordinates of B , [2]
- (iii) find the total area of the two regions bounded by the curve and the x -axis. [5]