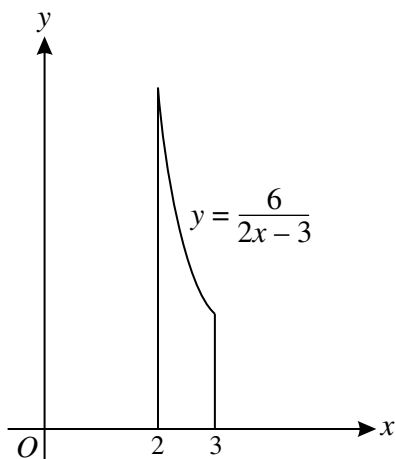


1



The diagram shows the region enclosed by the curve $y = \frac{6}{2x-3}$, the x -axis and the lines $x = 2$ and $x = 3$. Find, in terms of π , the volume obtained when this region is rotated through 360° about the x -axis. [4]

2 The equation of a curve is $y = 4\sqrt{x} + \frac{2}{\sqrt{x}}$.

(i) Obtain an expression for $\frac{dy}{dx}$. [3]

(ii) A point is moving along the curve in such a way that the x -coordinate is increasing at a constant rate of 0.12 units per second. Find the rate of change of the y -coordinate when $x = 4$. [2]

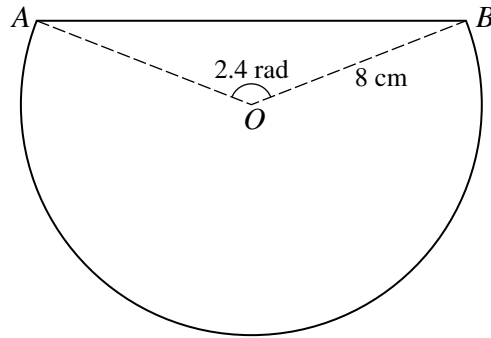
3 The coefficient of x^3 in the expansion of $(a+x)^5 + (2-x)^6$ is 90. Find the value of the positive constant a . [5]

4 The point A has coordinates $(-1, -5)$ and the point B has coordinates $(7, 1)$. The perpendicular bisector of AB meets the x -axis at C and the y -axis at D . Calculate the length of CD . [6]

5 (i) Prove the identity $\tan x + \frac{1}{\tan x} \equiv \frac{1}{\sin x \cos x}$. [2]

(ii) Solve the equation $\frac{2}{\sin x \cos x} = 1 + 3 \tan x$, for $0^\circ \leq x \leq 180^\circ$. [4]

6



The diagram shows a metal plate made by removing a segment from a circle with centre O and radius 8 cm. The line AB is a chord of the circle and angle $AOB = 2.4$ radians. Find

- (i) the length of AB , [2]
 (ii) the perimeter of the plate, [3]
 (iii) the area of the plate. [3]

- 7 (a) In an arithmetic progression, the sum of the first n terms, denoted by S_n , is given by

$$S_n = n^2 + 8n.$$

Find the first term and the common difference. [3]

- (b) In a geometric progression, the second term is 9 less than the first term. The sum of the second and third terms is 30. Given that all the terms of the progression are positive, find the first term. [5]

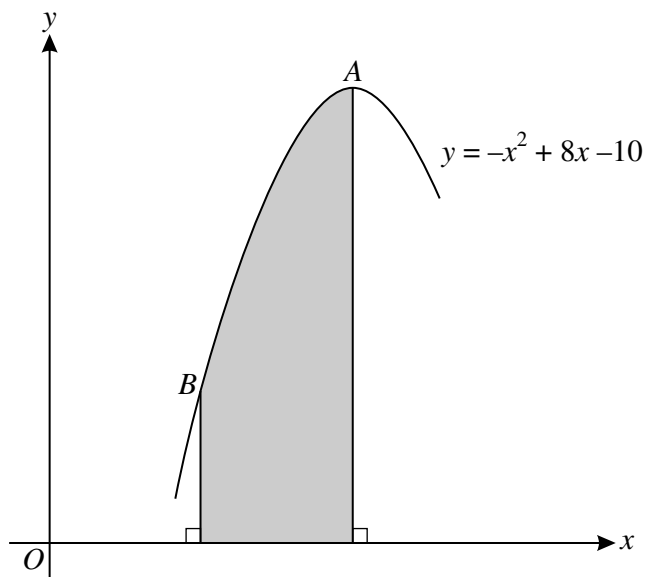
- 8 (i) Find the angle between the vectors $3\mathbf{i} - 4\mathbf{k}$ and $2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$. [4]

The vector \vec{OA} has a magnitude of 15 units and is in the same direction as the vector $3\mathbf{i} - 4\mathbf{k}$. The vector \vec{OB} has a magnitude of 14 units and is in the same direction as the vector $2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$.

- (ii) Express \vec{OA} and \vec{OB} in terms of \mathbf{i} , \mathbf{j} and \mathbf{k} . [3]
 (iii) Find the unit vector in the direction of \vec{AB} . [3]

[Questions 9 and 10 are printed on the next page.]

9



The diagram shows part of the curve $y = -x^2 + 8x - 10$ which passes through the points A and B . The curve has a maximum point at A and the gradient of the line BA is 2.

(i) Find the coordinates of A and B . [7]

(ii) Find $\int y \, dx$ and hence evaluate the area of the shaded region. [4]

10 Functions f and g are defined by

$$f : x \mapsto 2x + 5 \quad \text{for } x \in \mathbb{R},$$

$$g : x \mapsto \frac{8}{x-3} \quad \text{for } x \in \mathbb{R}, x \neq 3.$$

(i) Obtain expressions, in terms of x , for $f^{-1}(x)$ and $g^{-1}(x)$, stating the value of x for which $g^{-1}(x)$ is not defined. [4]

(ii) Sketch the graphs of $y = f(x)$ and $y = f^{-1}(x)$ on the same diagram, making clear the relationship between the two graphs. [3]

(iii) Given that the equation $fg(x) = 5 - kx$, where k is a constant, has no solutions, find the set of possible values of k . [5]

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