

8. (a) Given that

$$\frac{d}{dx}(\cos x) = -\sin x$$

show that $\frac{d}{dx}(\sec x) = \sec x \tan x$.

(3)

Given that

$$x = \sec 2y$$

(b) find $\frac{dx}{dy}$ in terms of y .

(2)

(c) Hence find $\frac{dy}{dx}$ in terms of x .

(4)

[illegible]

(a) $e^{3x} + \ln 2x$,

(3)

(b) $(5 + x^2)^{\frac{3}{2}}$.

(3)

(Total 6 marks)



4. (i) The curve C has equation

$$y = \frac{x}{9 + x^2}.$$

Use calculus to find the coordinates of the turning points of C .

(6)

- (ii) Given that

$$y = (1 + e^{2x})^{\frac{3}{2}},$$

find the value of $\frac{dy}{dx}$ at $x = \frac{1}{2} \ln 3$.

(5)



3. A curve C has equation

$$y = x^2 e^x.$$

(a) Find $\frac{dy}{dx}$, using the product rule for differentiation.

(3)

(b) Hence find the coordinates of the turning points of C .

(3)

(c) Find $\frac{d^2y}{dx^2}$.

(2)

(d) Determine the nature of each turning point of the curve C .

(2)



1. Differentiate with respect to x , giving your answer in its simplest form,

$$(a) \quad x^2 \ln(3x) \tag{4}$$

$$(b) \quad \frac{\sin 4x}{x^3} \tag{5}$$



2. A curve C has equation

$$y = e^{2x} \tan x, \quad x \neq (2n+1)\frac{\pi}{2}.$$

(a) Show that the turning points on C occur where $\tan x = -1$.

(6)

(b) Find an equation of the tangent to C at the point where $x = 0$.

(2)





7. $f(x) = \frac{4x-5}{(2x+1)(x-3)} - \frac{2x}{x^2-9}, \quad x \neq \pm 3, x \neq -\frac{1}{2}$

(a) Show that

$$f(x) = \frac{5}{(2x+1)(x+3)} \quad (5)$$

The curve C has equation $y=f(x)$. The point $P\left(-1, -\frac{5}{2}\right)$ lies on C .

(b) Find an equation of the normal to C at P . (8)



6. (a) Differentiate with respect to x ,

$$(i) \quad e^{3x}(\sin x + 2 \cos x), \quad (3)$$

$$(ii) \quad x^3 \ln (5x+2).$$

(3)

Given that $y = \frac{3x^2 + 6x - 7}{(x+1)^2}$, $x \neq -1$,

(b) show that $\frac{dy}{dx} = \frac{20}{(x+1)^3}$. (5)

(c) Hence find $\frac{d^2y}{dx^2}$ and the real values of x for which $\frac{d^2y}{dx^2} = -\frac{15}{4}$. (3)

3. The point P lies on the curve with equation $y = \ln\left(\frac{1}{3}x\right)$. The x -coordinate of P is 3.

Find an equation of the normal to the curve at the point P in the form $y = ax + b$, where a and b are constants.

(5)



4. (a) Differentiate with respect to x

$$(i) \quad x^2 e^{3x+2}, \quad (4)$$

$$(ii) \quad \frac{\cos(2x^3)}{3x}.$$

(4)

(b) Given that $x = 4 \sin(2y + 6)$, find $\frac{dy}{dx}$ in terms of x .

[illegible]

1. (a) Find the value of $\frac{dy}{dx}$ at the point where $x = 2$ on the curve with equation

$$y = x^2 \sqrt{5x - 1}.$$

(6)

- (b) Differentiate $\frac{\sin 2x}{x^2}$ with respect to x .

(4)



3. The curve C has equation

$$x = 2 \sin y.$$

(a) Show that the point $P\left(\sqrt{2}, \frac{\pi}{4}\right)$ lies on C . **(1)**

(b) Show that $\frac{dy}{dx} = \frac{1}{\sqrt{2}}$ at P . (4)

(c) Find an equation of the normal to C at P . Give your answer in the form $y = mx + c$, where m and c are exact constants.

(4)



1. Differentiate with respect to x

$$(a) \ln(x^2 + 3x + 5) \quad (2)$$

$$(b) \frac{\cos x}{x^2} \tag{3}$$



7. (a) Differentiate with respect to x ,

(i) $x^{\frac{1}{2}} \ln(3x)$

(ii) $\frac{1-10x}{(2x-1)^5}$, giving your answer in its simplest form. (6)

(b) Given that $x = 3 \tan 2y$ find $\frac{dy}{dx}$ in terms of x . (5)



4. The point P is the point on the curve $x = 2 \tan\left(y + \frac{\pi}{12}\right)$ with y -coordinate $\frac{\pi}{4}$.

Find an equation of the normal to the curve at P .

(7)



4. Find the equation of the tangent to the curve $x = \cos(2y + \pi)$ at $\left(0, \frac{\pi}{4}\right)$.

Give your answer in the form $y = ax + b$, where a and b are constants to be found.

(6)



5. Sketch the graph of $y = \ln|x|$, stating the coordinates of any points of intersection with the axes.

(3)



5. Given that

$$x = \sec^2 3y, \quad 0 < y < \frac{\pi}{6}$$

(a) find $\frac{dx}{dy}$ in terms of y . (2)

$$\frac{dy}{dx} = \frac{1}{6x(x-1)^{\frac{1}{2}}} \quad (4)$$


1. The point P lies on the curve with equation

$$y = 4e^{2x+1}.$$

The y -coordinate of P is 8.

- (a) Find, in terms of $\ln 2$, the x -coordinate of P .

(2)

- (b) Find the equation of the tangent to the curve at the point P in the form $y = ax + b$, where a and b are exact constants to be found.

(4)



5. (i) Differentiate with respect to x

(a) $y = x^3 \ln 2x$

(b) $y = (x + \sin 2x)^3$

(6)

Given that $x = \cot y$,

(ii) show that $\frac{dy}{dx} = \frac{-1}{1+x^2}$

(5)



2. A curve C has equation

$$y = \frac{3}{(5-3x)^2}, \quad x \neq \frac{5}{3}$$

The point P on C has x -coordinate 2. Find an equation of the normal to C at P in the form $ax + by + c = 0$, where a , b and c are integers.

(7)

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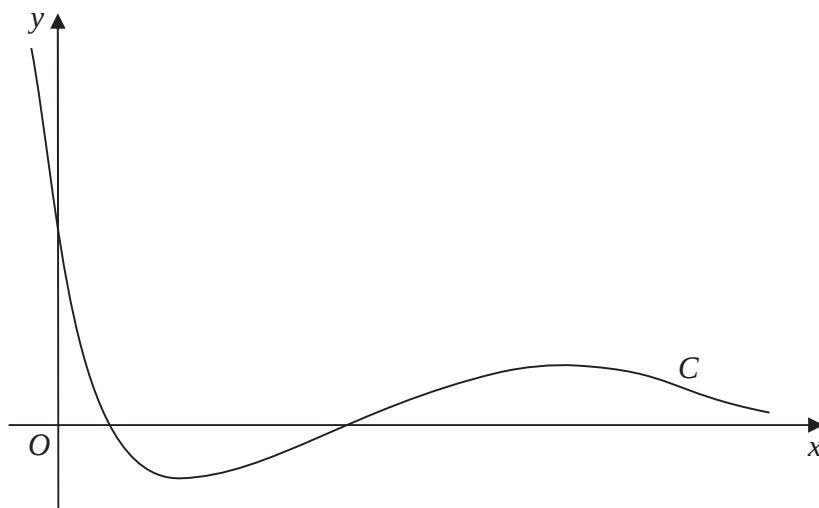


Figure 1

Figure 1 shows a sketch of the curve C with the equation $y = (2x^2 - 5x + 2)e^{-x}$.

- (a) Find the coordinates of the point where C crosses the y -axis. (1)
- (b) Show that C crosses the x -axis at $x = 2$ and find the x -coordinate of the other point where C crosses the x -axis. (3)
- (c) Find $\frac{dy}{dx}$. (3)
- (d) Hence find the exact coordinates of the turning points of C . (5)

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