

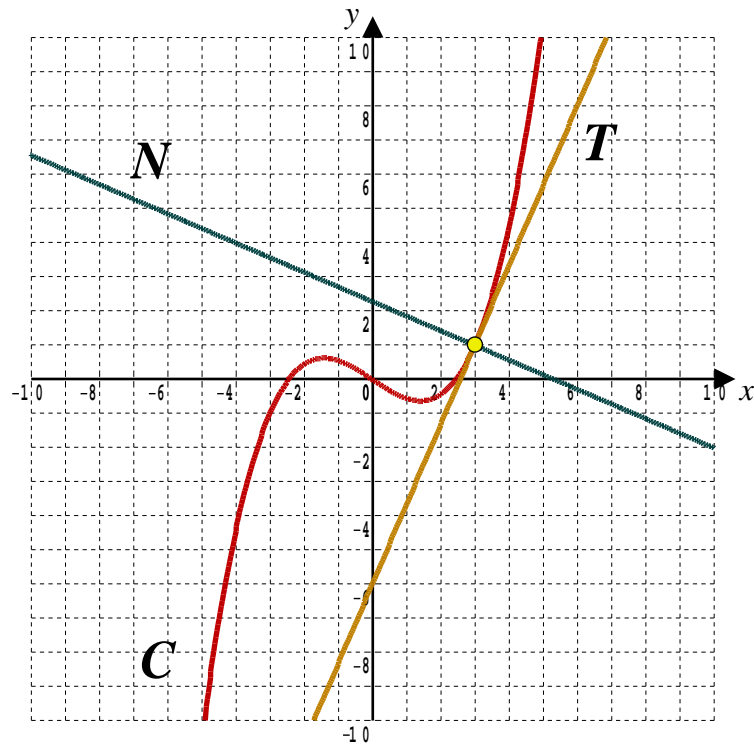
Lesson 2

A-Level Pure Mathematics : Year 1 Differentiation II

2.1 The Tangent and The Normal to a Curve

Example

The graph shows a curve C with equation $y = \frac{x^3}{9} - \frac{2x}{3}$



Also shown is the tangent T and Normal N to the curve at the point $(3, 1)$

Use calculus to determine the equation of the tangent and the equation of the normal.

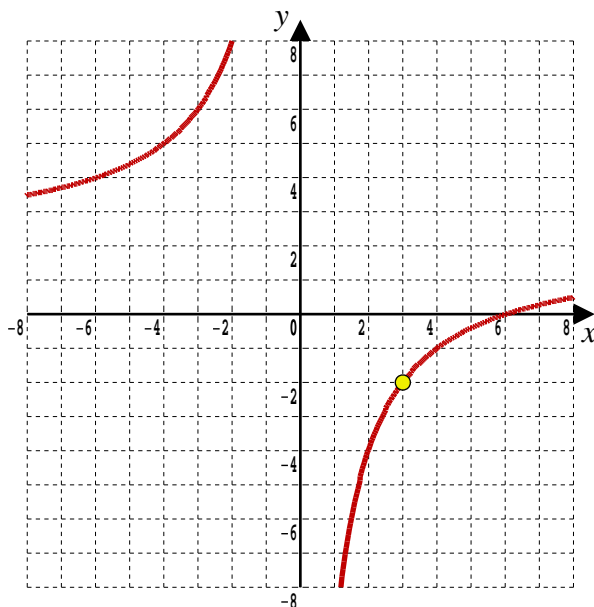
[8 marks]

2.2 Exercise

Marks Available : 52

Question 1

The graph is of the curve with equation $y = 2 - \frac{12}{x}$ with $x \neq 0$



- (i) Determine the gradient equation of the curve, $\frac{dy}{dx}$

[2 marks]

- (ii) Work out the equation of the tangent to the curve at the point $(3, -2)$

[3 marks]

- (iii) Work out the equation on the normal to the curve at the point $(3, -2)$

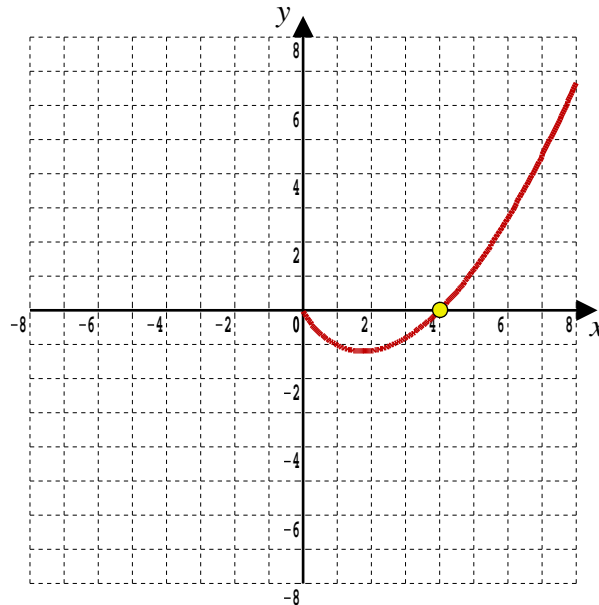
[3 marks]

- (iv) Draw your part (ii) and (iii) straight lines onto the graph above.

[2 marks]

Question 2

The graph is of the curve with equation $y = x^{\frac{3}{2}} - 2x$ with $x \geq 0$



- (i) Determine the gradient equation of the curve, $\frac{dy}{dx}$

[2 marks]

- (ii) Work out the equation of the tangent to the curve at the point (4, 0)

[3 marks]

- (iii) Work out the equation on the normal to the curve at the point (4, 0)

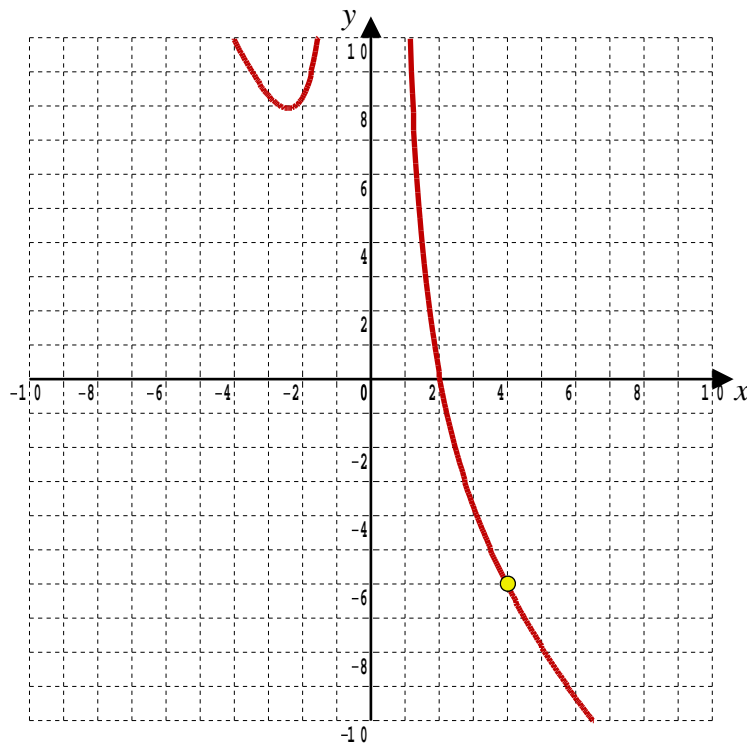
[3 marks]

- (iv) Draw your part (ii) and (iii) straight lines onto the graph above.

[2 marks]

Question 3

The graph is of the curve with equation $y = \frac{x^2}{16} + \frac{16}{x^2} - 2x$ with $x \neq 0$



- (i) Determine the gradient equation of the curve, $\frac{dy}{dx}$

[2 marks]

- (ii) Work out the equation of the tangent to the curve at the point $(4, -6)$

[3 marks]

- (iii) Work out the equation on the normal to the curve at the point $(4, -6)$

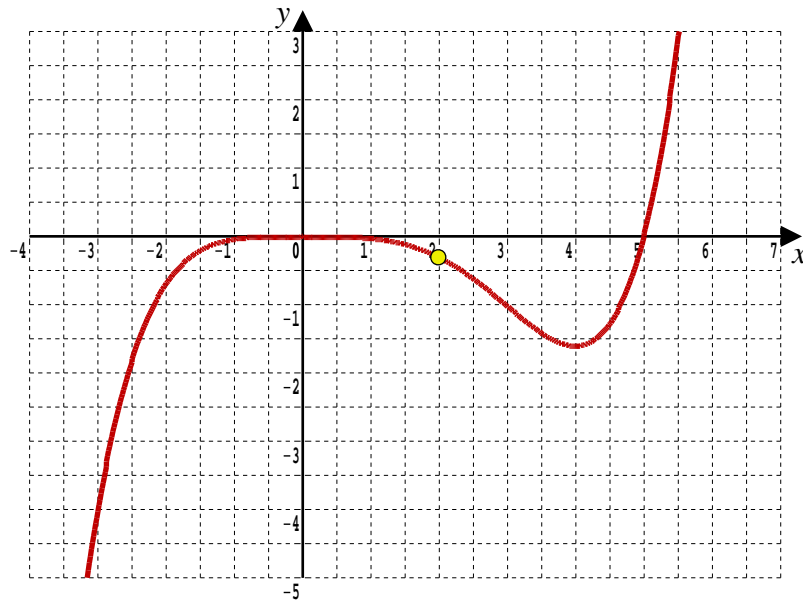
[3 marks]

- (iv) Draw your part (ii) and (iii) straight lines onto the graph above.

[2 marks]

Question 4

The graph is of the curve with equation $y = \frac{x^4}{32} \left(\frac{x-5}{5} \right)$



(i) Given that the point $(2, a)$ is on the curve, find the value of a

[2 marks]

(ii) Determine the gradient equation of the curve, $\frac{dy}{dx}$

[2 marks]

(iii) Work out the equation of the tangent to the curve at the point $(2, a)$

[3 marks]

(iv) Work out the equation on the normal to the curve at the point $(2, a)$

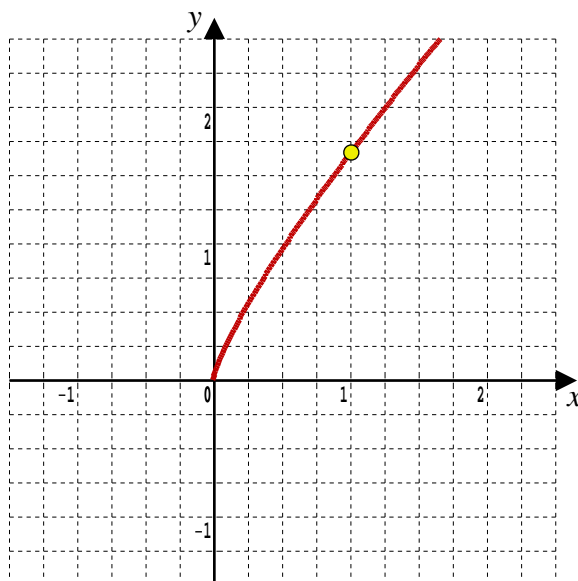
[3 marks]

(v) Draw your part (iii) and (iv) straight lines onto the graph above.

[2 marks]

Question 5

The graph is of the curve with equation $y = x^{\frac{2}{3}} + \frac{2x}{3}$ $x \geq 0$



- (i) Determine the gradient equation of the curve, $\frac{dy}{dx}$

[2 marks]

- (iii) Find the equation of the tangent to the curve at the point where $x = 1$

[3 marks]

- (iii) Find the equation of the normal to the curve at the point where $x = 1$

[3 marks]

- (iv) Draw your part (ii) and (iii) straight lines onto the graph above.

[2 marks]

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In October 2020, Shrewsbury School was voted "**Independent School of the Year 2020**"

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk