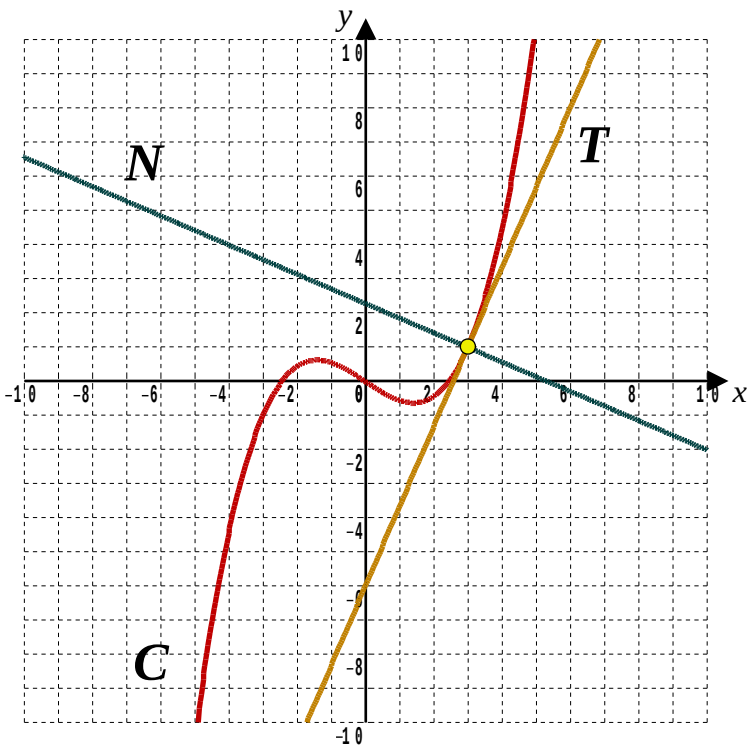
## 2.1 The Tangent and The Normal to a Curve

**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.

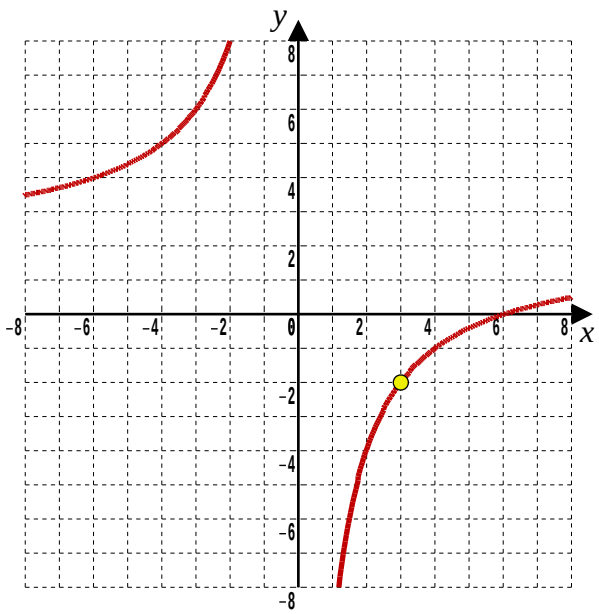
**[ 8 marks ]**

## 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 $(3, -2)$

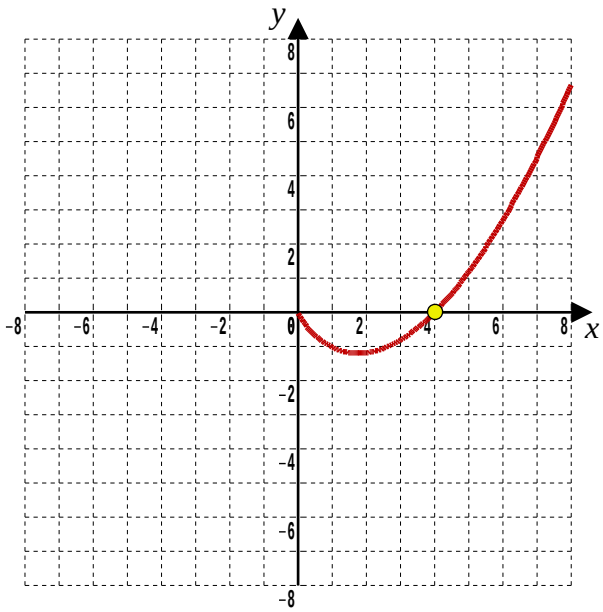
**[ 3 marks ]**

**( 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 $x \geqslant 0$




**( 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 $(4,\ 0)$

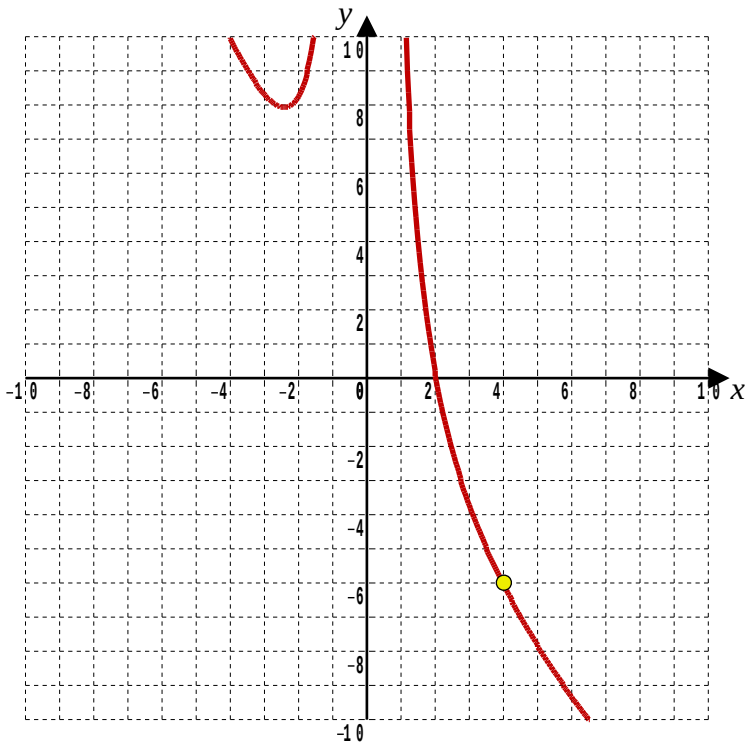
**[ 3 marks ]**

**( 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 $(4, -6)$

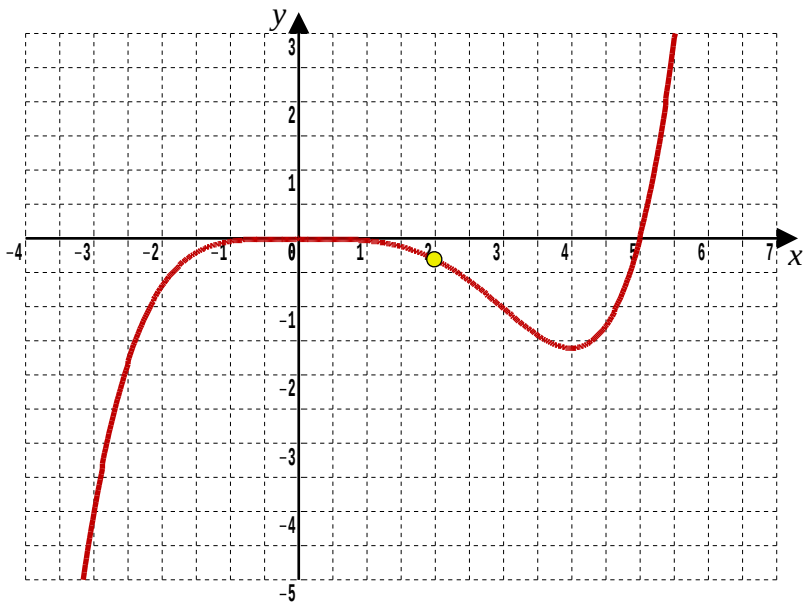
**[ 3 marks ]**

**( 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 $(2, a)$

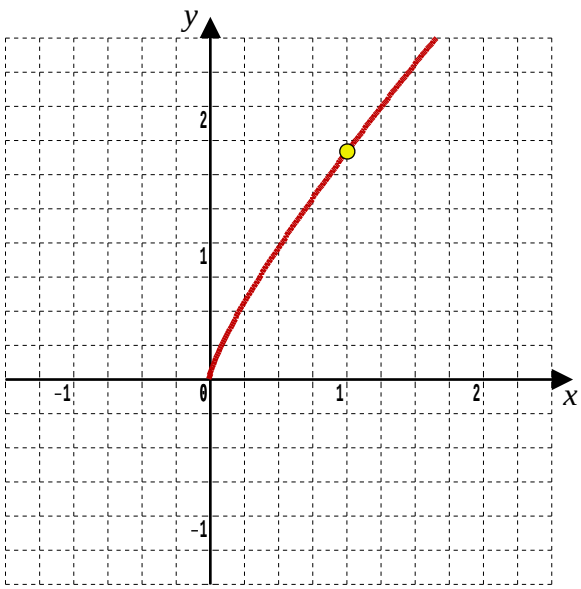
**[ 3 marks ]**

**( 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 $y = x^{\frac{2}{3}} + \frac{2x}{3}$ $\qquad x \geqslant 0$




**( 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 ]**