

2.1 Nuts & Bolts Differentiation

To begin with, without worrying about why it works, we are going to look at a technique that allows us to take the equation of a simple curve, and straight away, without any working, write down a gradient equation for that curve.

The Power Rule

$$\text{If } y = x^n \text{ then } \frac{dy}{dx} = n x^{n-1} \text{ for any constant, } n$$

2.2 Examples

Teaching Video : <http://www.NumberWonder.co.uk/v9036/2.mp4>



The teaching video will walk you through the following examples.

$$\text{(i) } y = 7x^4 + 3x^2 \qquad \frac{dy}{dx} =$$

$$\text{(ii) } y = \frac{1}{2}x^8 - \frac{3}{4}x^6 \qquad \frac{dy}{dx} =$$

$$\text{(iii) } y = 5 \qquad \frac{dy}{dx} =$$

$$\text{(iv) } y = 7x \qquad \frac{dy}{dx} =$$

$$\text{(v) } y = \frac{2}{3}x + \frac{1}{3} \qquad \frac{dy}{dx} =$$

$$\text{(vi) } y = 3x^7 - x^5 + 0.2x + 3 \qquad \frac{dy}{dx} =$$

[6 marks]

2.3 Exercise

Marks Available : 56

Question 1

For each of these equations, write down the corresponding gradient equation.

(i) $y = 6x$ $\frac{dy}{dx} =$

(ii) $y = 4x + 5$ $\frac{dy}{dx} =$

(iii) $y = -3x + 17$ $\frac{dy}{dx} =$

(iv) $y = 3 - 17x$ $\frac{dy}{dx} =$

(v) $y = 4x^2$ $\frac{dy}{dx} =$

(vi) $y = 3x^2 - 7x$ $\frac{dy}{dx} =$

(vii) $y = 6x^2 + 2x - 5$ $\frac{dy}{dx} =$

(viii) $y = 10 - 5x - 3x^2$ $\frac{dy}{dx} =$

[16 marks]

Question 2

Find $f'(x)$ given that $f(x) = \frac{3}{2}x^2 - \frac{5}{2}x^4$

[2 marks]

Question 3

Find $g'(x)$ given that $g(x) = \frac{4}{3}x^6 + \frac{2}{3}x^2 - \frac{5}{6}$

[2 marks]

Question 4

Find $h'(x)$ given that $h(x) = \frac{3}{4}x^2 + \frac{1}{4}x + 2$

[2 marks]

Question 5

For each of the following equations, determine $\frac{dy}{dx}$

(i) $y = 2x^3$ $\frac{dy}{dx} =$

(ii) $y = 4x^3 + x + 1$ $\frac{dy}{dx} =$

(iii) $y = 7x - 5x^3$ $\frac{dy}{dx} =$

(iv) $y = 4x^2 - 9x^4$ $\frac{dy}{dx} =$

(v) $y = 10x^6 - 12x^5$ $\frac{dy}{dx} =$

(vi) $y = x^2(10 - 7x)$ $\frac{dy}{dx} =$

HINT : First, expand the brackets, then differentiate

(vii) $y = (x + 4)(2x - 7)$ $\frac{dy}{dx} =$

(viii) $y = (x^2 - 3)(2x - 1)$ $\frac{dy}{dx} =$

[16 marks]

Question 6

$$p(x) = \frac{4}{x}$$

By first rewriting this as $p(x) = 4x^{-1}$ find $p'(x)$

[2 marks]

Question 7

$$q(x) = \frac{10}{x^2}$$

Find $q'(x)$

[2 marks]

Question 8

$$v(x) = 4x - \frac{5}{x}$$

Find $v'(x)$

[2 marks]

Question 9

$$w(x) = 3x^3 + \frac{2}{x^3}$$

Find $w'(x)$

[3 marks]

Question 10

$$e(x) = \frac{1}{4x}$$

Find $e'(x)$

[3 marks]

Question 11

$$k(x) = \frac{3}{4x^2} + 5$$

Find $k'(x)$

[3 marks]

Question 12

$$m(x) = \frac{5}{2x} - \frac{3}{2x^2}$$

Find $m'(x)$

[3 marks]