



DIFFERENTIATION

GRADIENT AND TURNING POINTS

Ref: G989. **7R2**

A1 Differentiate	A2 Differentiate	A3 Differentiate	A4 Differentiate
$x^3 + 3x^2 - 5$	$x^4 + 5x^2 + 4x$	$2x^3+6x-3$	$5x^3 + \sqrt{x} - \frac{4}{x^2}$
B1 For the curve $y = x^3 - 6x + 3$	B2 For the curve $y = 100 - 4x^2$	B3 For the curve $y = 2x^3 - 12x^2 + 7x$	B4 For the curve $y = x^3 - \frac{3}{2}x^2 + 5$
Find the gradient when $x = 2$	Find the gradient when $x = 3$	Find the gradient at point $(4, -36)$	Find the gradient when $x = -2$
C1 For the curve $y = 2x^2 - 3x$ Find the coordinates when the gradient is 9	C2 For the curve $y = 4x^2 + 9x$ Find the coordinates when the gradient is -7	C3 For the curve $y = 4x^3 - 2x^2 + 1$ Find the coordinates of the two points where the gradient is 1	C4 For the curve $y = 15 + 6x - x^{2}$ Find the coordinates when the gradient is 4
D1 Find the turning points of the curve $y = x^3 - 12x + 17$	D2 Find the turning points of the curve $y = x^3 + 6x^2 + 5$	D3 Find the turning points of the curve $y = x^3 + 3x^2 - 24x$	D4 Find the turning point of the curve $y = x^2 + \frac{16}{x}$





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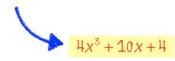
A1 Differentiate

$$x^3 + 3x^2 - 5$$



A2 Differentiate

$$x^4 + 5x^2 + 4x$$



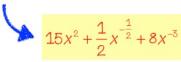
A3 Differentiate

$$2x^3 + 6x - 3$$



A4 Differentiate

$$5x^3 + x^{\frac{1}{2}} - 4x^{-2}$$



B1 For the curve

$$y = x^3 - 6x + 3$$

$$\frac{dy}{dx} = 3x^2 - 6$$

$$= 3(2)^2 - 6 = 6$$

B2 For the curve

$$y = 100 - 4x^2$$

$$\frac{dy}{dx} = -8x$$
$$= -8 \times (3) = -24$$

B3 For the curve

$$y = 2x^3 - 12x^2 + 7x$$

$$\frac{dy}{dx} = 6x^2 - 12x + 7$$
$$= 6(4)^2 - 12(4) + 7 = 55$$

B4 For the curve

$$y = x^3 - \frac{3}{2}x^2 + 5$$

$$\frac{dy}{dx} = 3x^2 - 3x$$
$$= 3(-2)^2 - 3(-2) = 18$$

C1 For the curve

$$y = 2x^2 - 3x$$

$$\frac{dy}{dx} = 4x - 3$$

$$4x - 3 = 9$$

$$x = 3$$
(3,9)

C2 For the curve

$$y = 4x^2 + 9x$$

$$\frac{dy}{dx} = 8x + 9$$

$$8x + 9 = -7$$

$$x = -2$$
(-2,-2)

C3 For the curve

$$y = 4x^3 - 2x^2 + 1$$

$$\frac{\mathrm{d}y}{\mathrm{d}x} = 12x^2 - 4x$$

 $\left(\frac{1}{2},1\right)$

$$-\frac{1}{6},\frac{25}{27}$$

C4 For the curve

$$y = 15 + 6x - x^2$$

$$\frac{\mathrm{d}y}{\mathrm{d}x} = 6 - 2x$$
$$6 - 2x = 4$$
$$x = 1$$

(1,20)

D1 Find the turning points of the curve

$$y = x^3 - 12x + 17$$
$$3x^2 - 12 = 0$$

(-2,33) and (2,1)

D2 Find the turning points of the curve

$$y = x^3 + 6x^2 + 5$$
$$3x^2 + 12x = 0$$

(-4,37) and (0,5)

D3 Find the turning points of the curve

$$y = x^3 + 3x^2 - 24x$$
$$3x^2 + 6x - 24 = 0$$

(-4,80) and (2,-28)

D4 Find the turning point of the curve

$$y = x^{2} + \frac{16}{x}$$
$$2x - \frac{16}{x^{2}} = 0$$

(2, 12)