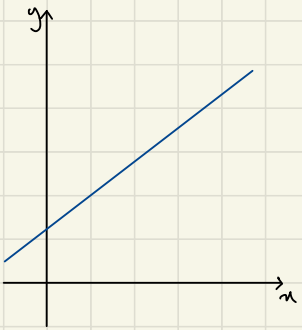
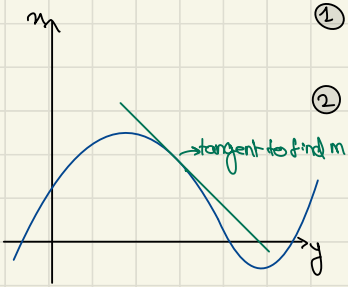
Differentiation



Constant slope

$m = \frac{y_2 - y_1}{x_2 - x_1}$



Find the Gradient of Tangent at $x = x_1$

① Find $\frac{dy}{dx}$ or $f'(x)$ by diff the equation of the curve

② Plug in $x = x_1$ in the gradient function

$y \rightarrow$ Equation of the curve

diff

$\frac{dy}{dx} \rightarrow$ gradient function.

Equation of the curve → $f(x)$ / y → $f'(x)$ / $\frac{dy}{dx}$ → Gradient function

Power Function

Rule	Rule2:
$y = ax^n$	$y = c$
$\frac{dy}{dx} = nax^{n-1}$	$\frac{dy}{dx} = 0$

① $y = x^2$

$y = 2x$

② $y = \sqrt{x}$

$y = x^{1/2}$

$y = \frac{1}{2}x^{\frac{1}{2}-1}$

$y = \frac{1}{2}x^{-\frac{1}{2}}$

$y = \frac{1}{2\sqrt{x}}$

③ $y = 3x^3 + 5x^2 - 7x + 9$

$\frac{dy}{dx} = 9x^2 + 10x - 7$

(4) $2x^3 - 5x + 4$

$\frac{dy}{dx} = 6x^2 - 5$

(5) $2x - \frac{1}{x} - \frac{1}{\sqrt{x}}$

$\frac{dy}{dx} = 2x - x^{-1} - x^{-1/2}$

$= 2 + x^{-2} + x^{-3/2}$

$= \boxed{2 + \frac{1}{x^2} + \frac{1}{x^{3/2}}}$

(6) $\frac{5x^2 - \sqrt{x}}{x}$

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

$y = 5x - x^{-1/2}$

$\frac{dy}{dx} = 5 + \frac{1}{2}x^{-3/2}$

$\boxed{\frac{dy}{dx} = 5 + \frac{1}{2x^{3/2}}}$

(7) $8x^5 - 3x^2 - 2$

$\boxed{40x^4 - 6x}$

(8) $\frac{x+5}{\sqrt{x}}$

$y = (x+5)x^{-1/2}$

$y = x^{1/2} + 5x^{-1/2}$

$\boxed{\frac{dy}{dx} = \frac{1}{2\sqrt{x}} - \frac{5}{2x^{3/2}}}$

(9) $\frac{x^2 - 3}{x}$

$y = (x^2 - 3)x^{-1}$

$= x - 3x^{-1}$

$= \boxed{1 + \frac{3}{x^2}}$

Find the value of $\frac{dy}{dx}$ at the given points.

(1) $y = 4 - 2x^2$ at the point $(-1, 2)$

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

$= -4(-1)$

$= \boxed{+4}$

(2) $y = 5x^3 - 2x^2 - 3$ at the point $(0, -3)$

$\frac{dy}{dx} = 15x^2 - 4x$

$= 15(0)^2 - 4(0)$

$= \boxed{0}$

(3) $y = 2 + \frac{8}{x}$ at the point $(-2, -2)$

$\frac{dy}{dx} = -\frac{8}{x^2} \rightarrow \frac{-8}{4} = \boxed{-2}$

Find the coordinates of the point on the curve $y = 2x^2 - x - 1$ at which the gradient is 7

$\frac{dy}{dx} = 7$

$y = 2x^2 - x - 1$

$\frac{dy}{dx} = 4x - 1$

$7 = 4x - 1$

$8 = 4x$

$x = 2$

$y = 2(2)^2 - (2) - 1$

$y = 8 - 2 - 1$

$y = 5$

$(2, 5)$

The curve $y = ax^2 + bx$ has a gradient 8 when $x = 2$ and has gradient -10 when $x = -1$
Find the value of a and the value of b

$y = ax^2 + bx$

$\frac{dy}{dx} = 2ax + b$

$-10 = -2a + b$

$-10 + 2a = b$

$-10 + 6 = b$

$-4 = b$

$8 = 4a + b$

$8 = 4a - 10 + 2a$

$8 = 6a - 10$

$18 = 6a$

$a = 3$

$\frac{dy}{dx} = x^2 - 5x + 6$

$2 = x^2 - 5x + 6$

$0 = x^2 - 5x + 4$

$0 = x^2 - 4x - x + 4$

$0 = x(x-4) - 1(x-4)$

$0 = (x-4)(x-1)$

$x = 4 \qquad x = 1$

$y = \frac{x^3}{3} - \frac{5x^2}{2} + 6x - 1$

$y = \frac{1}{3} - \frac{5}{2} + 6 - 1$

$y = \frac{16}{3} - \frac{5}{2}$

$= \frac{32}{6} - \frac{15}{6}$

$= \boxed{\frac{17}{6}}$

$y = \frac{64}{3} - \frac{80}{2} + 24 - 1$

$y = \boxed{-4\frac{1}{3}}$