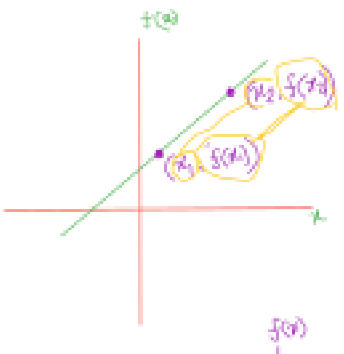
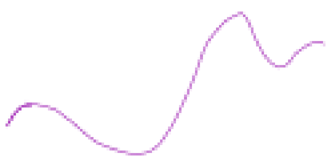
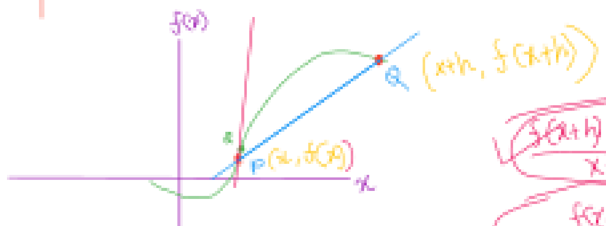
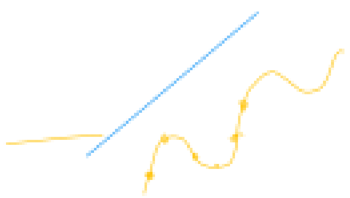
$$\boxed{\frac{f(x_2)-f(x_1)}{x_2-x_1}}$$









$$\frac{f(x+h)-f(x)}{x+h-x}$$

$$= \frac{f(x+h)-f(x)}{h}$$

What is the rate of change of the function with respect to 'x' at the point P?

$$\boxed{f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}}$$

Derivative: rate of change of the function w. r. t its independent variable.

Differentiation: It's a process to find the derivative.

$\frac{d}{d(\,)}$

$\boxed{y = f(x)}$

Derivative of "y" w.r.t "x" (rate of change of "y" w.r.t. "x")

$+$
$-$
$\times$
$\div$

$\frac{d}{dx} \rightarrow$ Differential Operator

$$\frac{d}{dx}y = \frac{d}{dx}(f(x))$$

$$\Rightarrow \boxed{\frac{dy}{dx}} = f'(x)$$

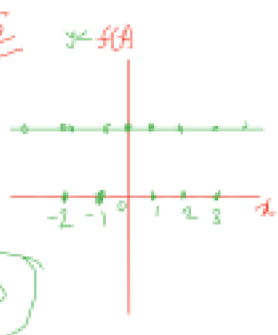
Derivative of the function "f" with respect to "x".

Derivative of "y" w.r.t. "x"

$f(x+h) = 5$

$f(x) = 5$

$y = \underline{f(x) = 5}$



$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$= \lim_{h\to 0}\frac{5-5}{h}$$
$$= 0$$

$$\frac{d}{dx}[c] = 0$$

$$f(x) = 2x$$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$= \lim_{h\to 0}\frac{2(x+h)-2x}{h}$$
$$= \lim_{h\to 0}\frac{2h}{h} = \lim_{h\to 0} 2$$
$$= 2$$

$f(x) = 2x \rightarrow f'(x) = 2$

$$f(x) = x^n$$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$$
$$= \lim_{h\to 0}\frac{(x+h)^n - x^n}{h}$$
$$= \lim_{h\to 0}\frac{x^n + nhx^{n-1} + \frac{n(n-1)}{2!}h^2x^{n-2} + \dots + h^n - x^n}{h}$$
$$= \lim_{h\to 0}\left(nx^{n-1} + \frac{n(n-1)}{2!}hx^{n-2} + \dots + h^{n-1}\right)$$
$$= nx^{n-1} + 0 + \dots + 0$$
$$= nx^{n-1} \rightarrow \boxed{\frac{d}{dx}(x^n) = nx^{n-1}}$$ Power rule.

$$\frac{d}{dx}(x^5) = 5x^4$$

$$f(x) = 7x^{-3}$$
$$\frac{d}{dx}[f(x)] = \frac{d}{dx}[7x^{-3}]$$
$$\Rightarrow f'(x) = 7\frac{d}{dx}(x^{-3})$$
$$\Rightarrow f'(x) = 7(-3)x^{-3-1}$$
$$\Rightarrow f'(x) = -21x^{-4}$$

$$f(x) = x^e + \frac{1}{x^{\sqrt{10}}}$$
$$\frac{d}{dx}[f(x)] = \frac{d}{dx}\left[x^e + \frac{1}{x^{\sqrt{10}}}\right] = \frac{d}{dx}\left[x^e + x^{-\sqrt{10}}\right]$$
$$= \frac{d}{dx}[x^e] + \frac{d}{dx}[x^{-\sqrt{10}}]$$
$$\Rightarrow f'(x) = e x^{e-1} + (-\sqrt{10})x^{-\sqrt{10}-1}$$
$$= \boxed{e x^{e-1} - \sqrt{10}\, x^{-\sqrt{10}-1}}$$

Find $y'(1)$ if $y = 5x^2+3x+1$

$$y = 5x^2+3x+1$$
$$\Rightarrow \frac{dy}{dx} = \frac{d}{dx}(5x^2+3x+1)$$
$$\Rightarrow y' = (5)2x^{2-1} + (3)(1)x^{1-1} + 0$$
$$\Rightarrow y' = 10x+3$$
$$\Rightarrow y'(1) = 10(1)+3 = \boxed{13}$$

$f(x)$
$f'(x)$
$f'(2)$

$f(x) = 3x^2-5$

$y' = 2x^2-5$

$f(2) =$

$y'(1) =$

Find $\left.\frac{dy}{dt}\right|_{t=2}$ $\quad y = 2t^{-5} + 10t + \sqrt{t}$

$$\Rightarrow \frac{dy}{dt} = \frac{d}{dt}\left(2t^{-5} + 10t + \sqrt{t}\right)$$
$$\Rightarrow \frac{dy}{dt} = 2(-5)t^{-5-1} + 10(1)t^{1-1} + \frac{1}{2}t^{\frac{1}{2}-1}$$
$$\Rightarrow \frac{dy}{dt} = -10t^{-6} + 10 + \frac{1}{2}t^{-\frac{1}{2}}$$

$\sqrt{t} = t^{\frac{1}{2}}$

$$\Rightarrow \left.\frac{dy}{dt}\right|_{t=2} = -10\cdot 2^{-6} + 10 + \frac{1}{2}2^{-1/2}$$
$$= \frac{-10}{2^6} + 10 + \frac{1}{2\cdot 2^{1/2}}$$
$$= \frac{-10}{64} + 10 + \frac{1}{2\sqrt{2}}$$