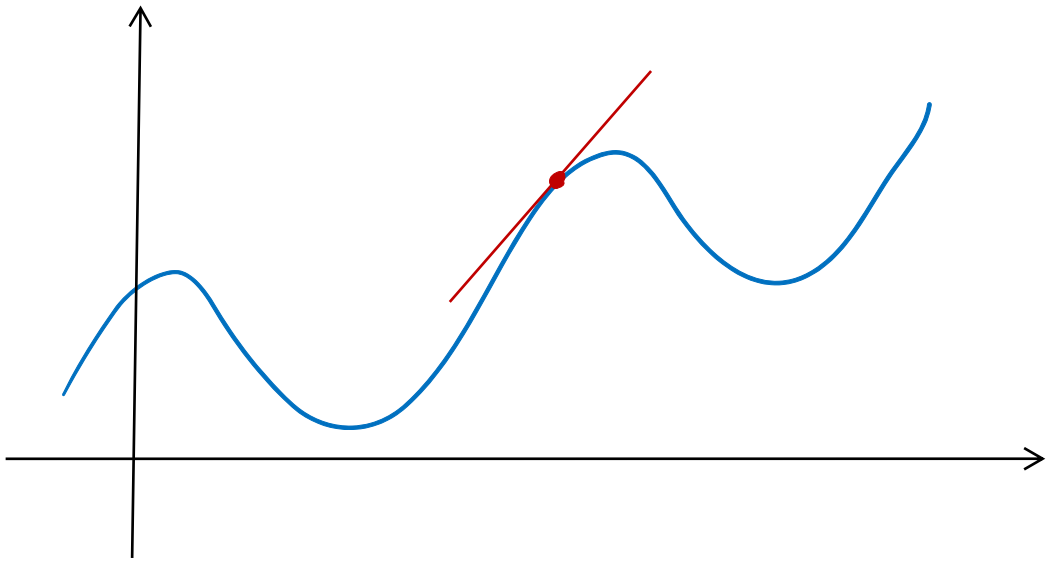
Notions & notations of derivatives



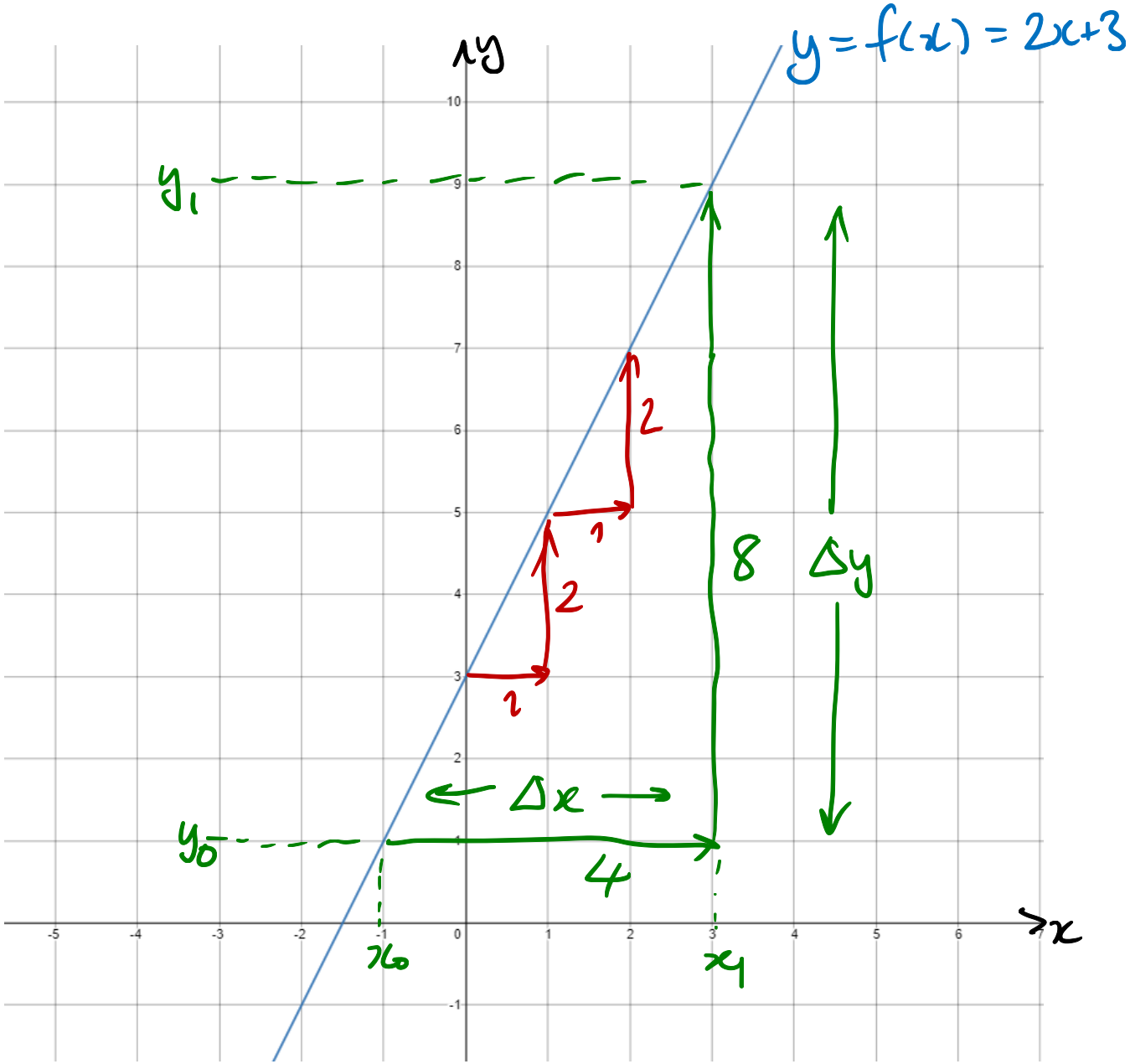
Notions of derivatives

slope / gradient

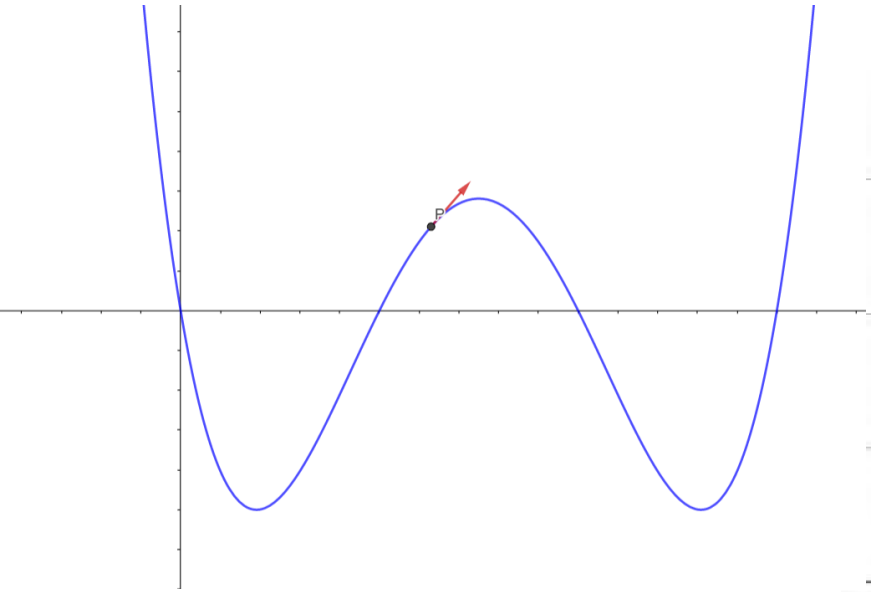
$$\frac{\Delta y}{\Delta x} = \frac{y_1 - y_0}{x_1 - x_0} = 2$$

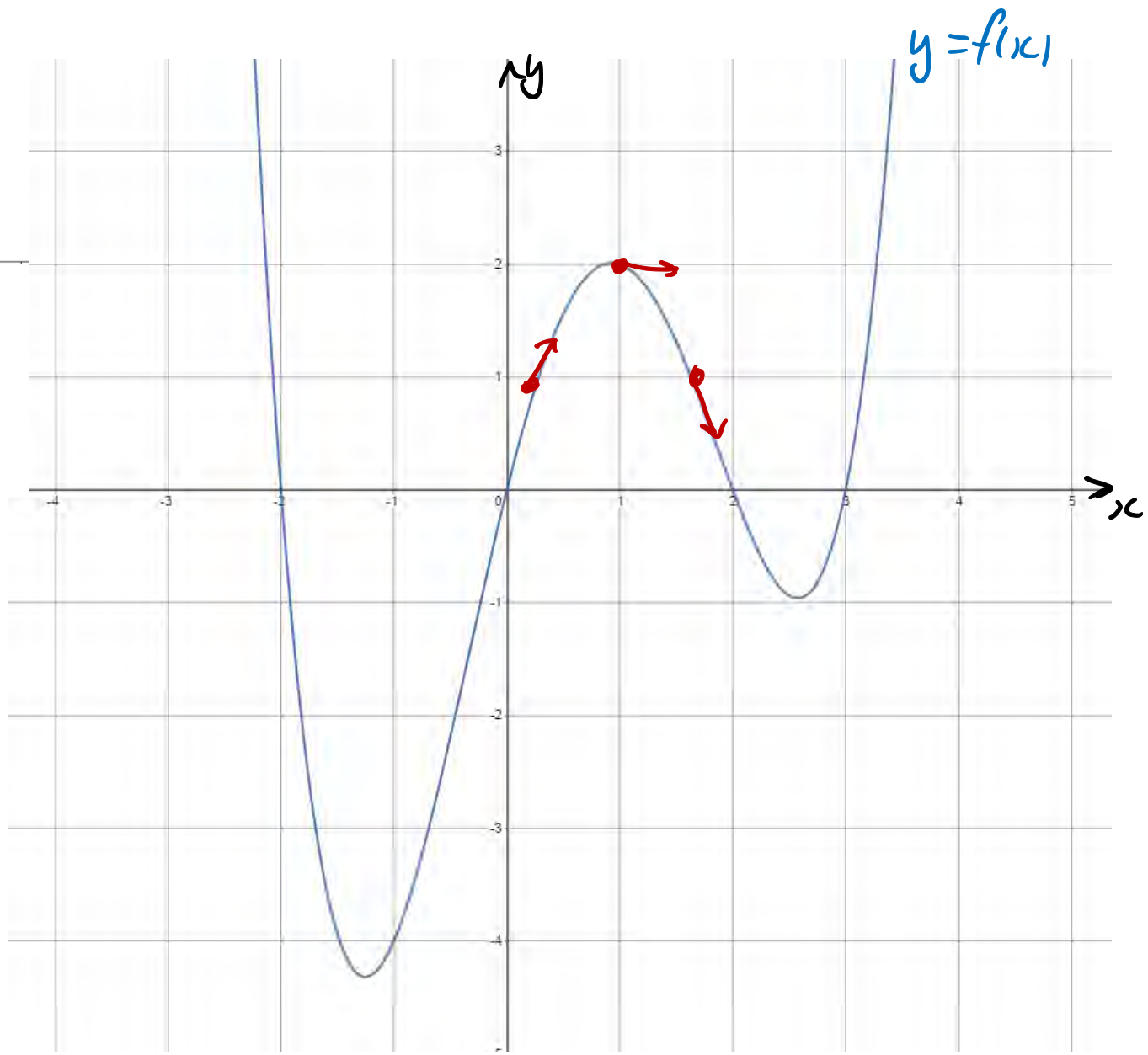
$$\frac{dy}{dx} = 2$$

$$y'(x) = 2$$

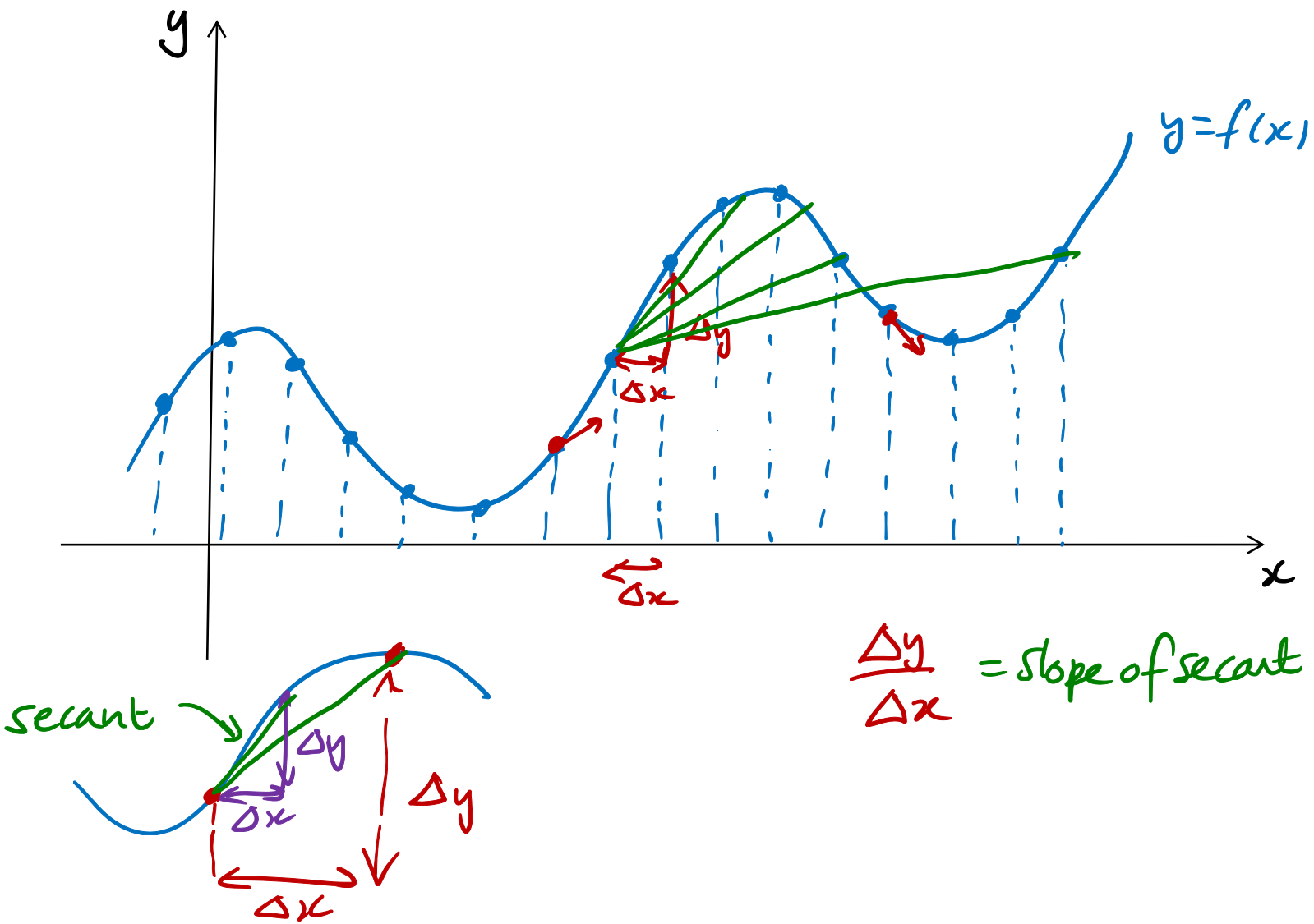


Notions of derivatives



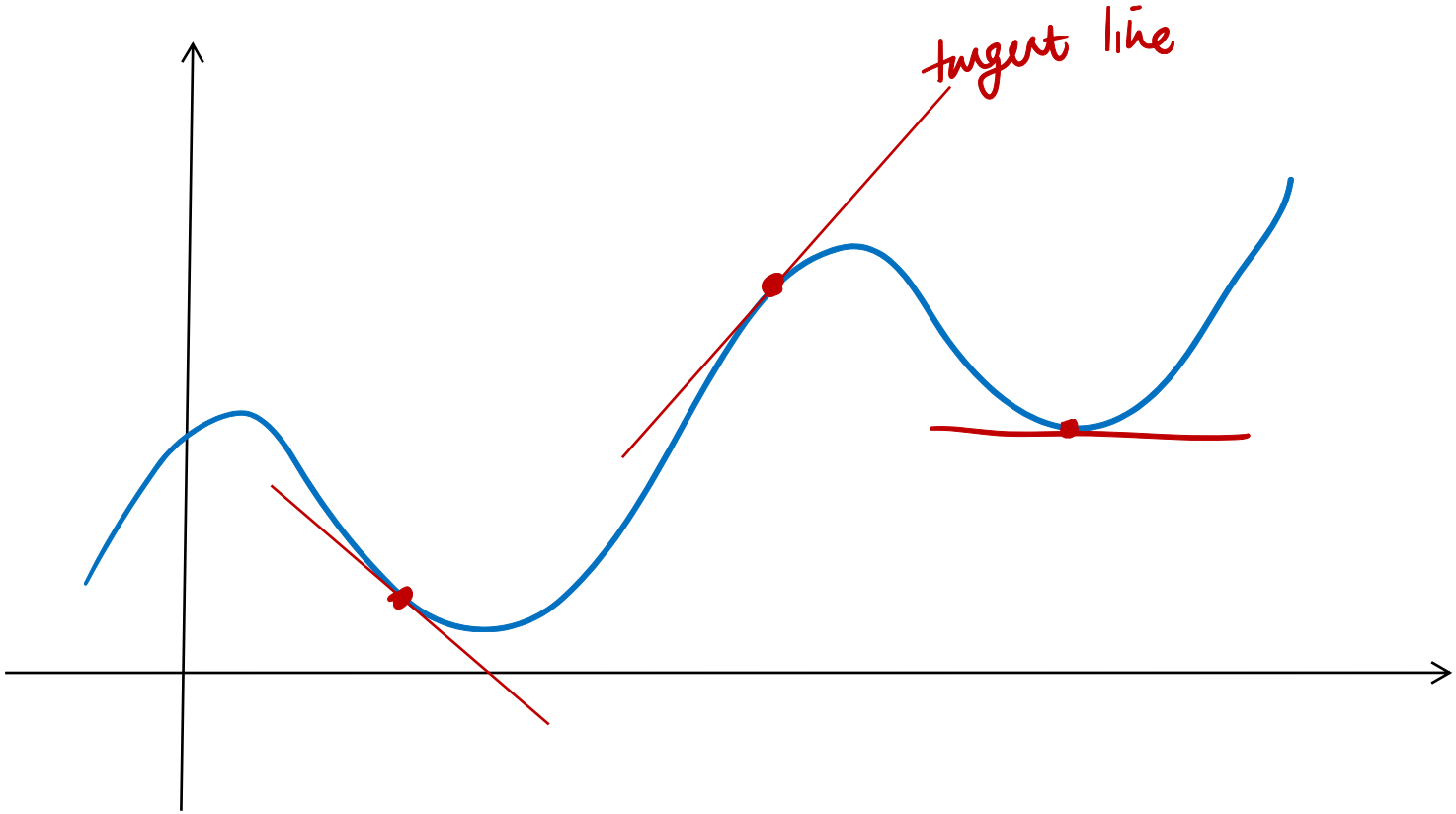


Notions of derivatives



$\frac{\Delta y}{\Delta x}$ = slope of secant line

Notions of derivatives



Notions of derivatives

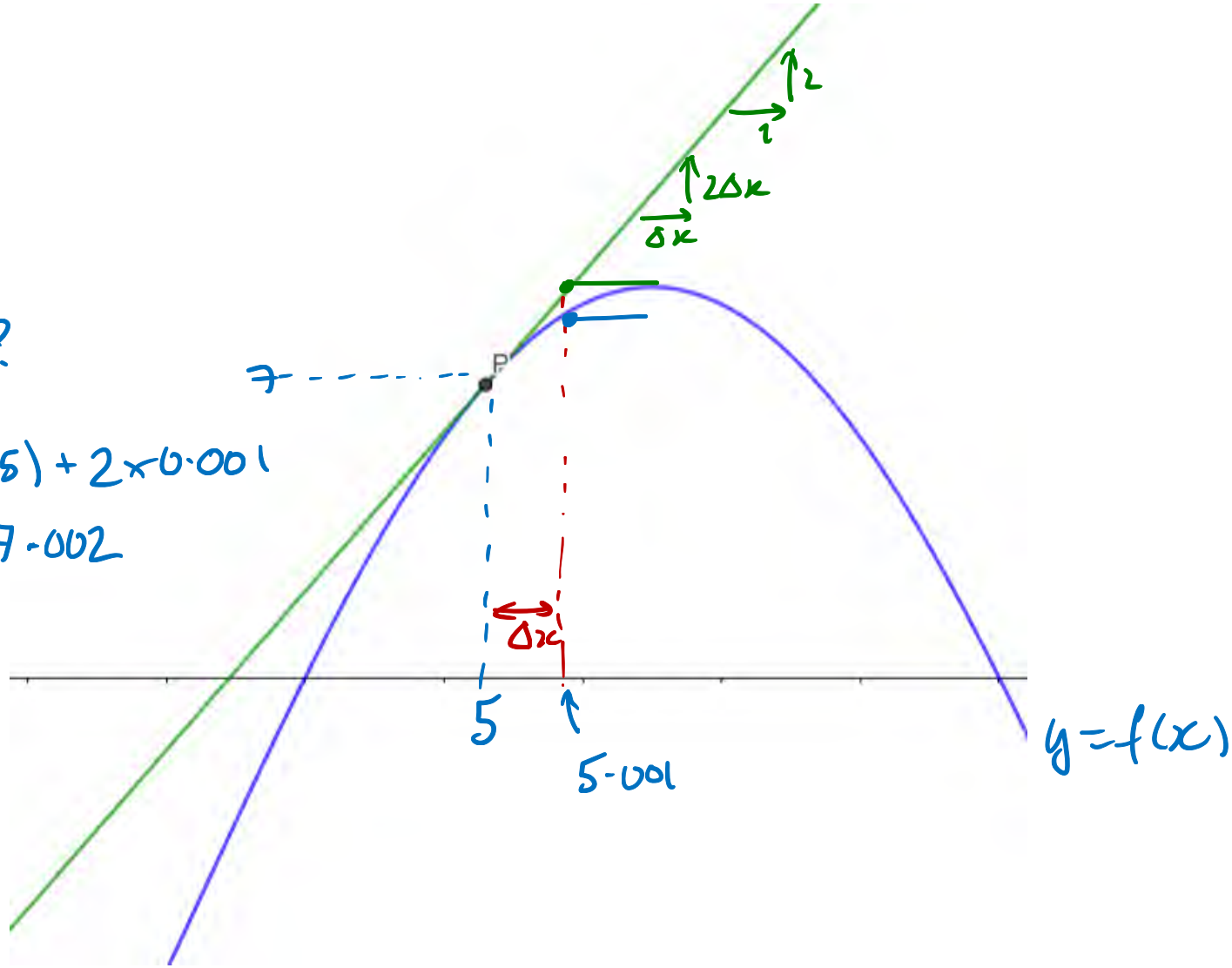
$f(5) = 7$

$f'(5) = 2$

$f(5.001) = ?$

$f(5 + \underbrace{0.001}_{\Delta x}) \approx f(5) + 2 \times 0.001$

$= 7.002$



$y = f(x) = 3x^2 + 5$

Notation for derivatives

$p(t) = 3t^2 + 5$ (t = time)

	Lagrange	Leibniz	Newton
1st order:	y', $f'(x)$ $y'(7)$, $f'(7)$ $f'(x)\big\|_{x=7}$ at $x=7$, $y'=42$	$\frac{dy}{dx}$, $\frac{d}{dx}(y)$, $\frac{df}{dx}(x)$, $\frac{d}{dx}(3x^2+5)$, $\frac{d(3x^2+5)}{dx}$ $\frac{dy}{dx}(7)$, $\frac{d}{dx}(f)\big\|_{x=7}$ $\frac{d}{dx}(3x^2+5)\big\|_{x=7}$	$\dot{p}$ $\quad \dot{p}(t)$ $\dot{p}(3)$ $\quad \dot{p}(t)\big\|_{t=7}$
2nd order	$(y')' = y''$ $f''(x)$ $f''(7)$, $f''(x)\big\|_{x=7}$	$\frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{d^2y}{dx^2}$ $\frac{d^2f}{dx^2}(x)$, $\left(\frac{d}{dx}\right)^2(f)$	$\ddot{p}$
3rd order	$(y'')' = y'''$	$\frac{d^3f}{dx^3}$	$\dddot{p}$
Higher order	$f^{(5)} = f'''''$	$\frac{d^7f}{dx^7}$	$p^{(4)}$

$\times$ $\frac{\partial f}{\partial x}$ - partial derivative

$\frac{\delta f}{\delta x}$, $\frac{\Delta f}{\Delta x}$ slopes