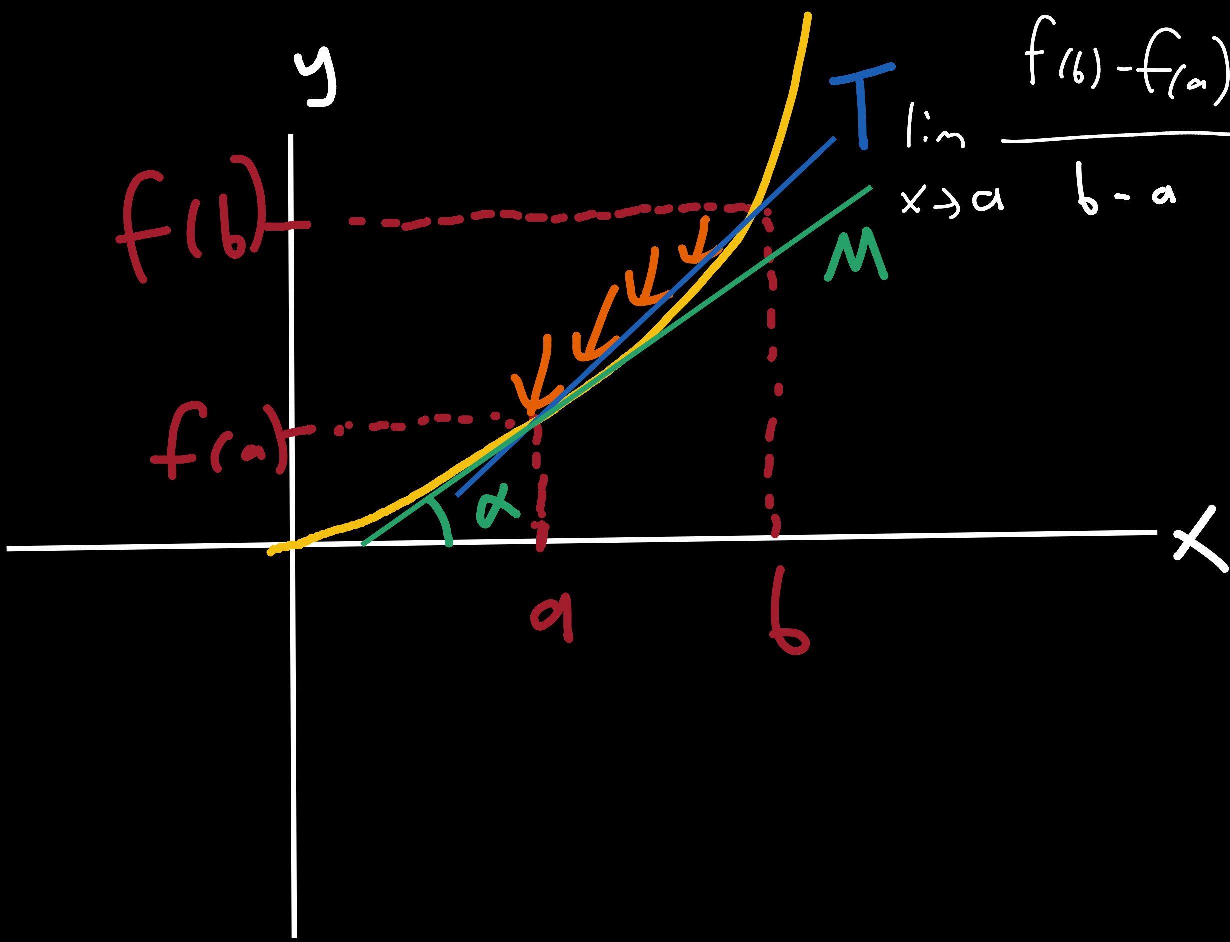
In T line when we're getting closer to point (a, f(a)) from point (b, f(b)), we realise that we're becoming similar to tangent of point (a, f(a)). That's why derivative of f(a) is =

Derivative

$$\lim_{x\to a}\frac{f(b)-f(a)}{b-a} = f'(a) = \tan\alpha = \frac{\sin\alpha}{\cos\alpha} = M$$



$$b = a+h \qquad \lim_{a+h\to a}\frac{f(a+h)-f(a)}{a+h-a} = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$

Why h goes to 0 ? Because h is the difference between a and a+h, if a+h goes to a this means that h is going to 0

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

$$f(x) = x^2 \quad f'(3) = \frac{f(x)-f(3)}{x-3} = \frac{x^2-9}{x-3} = \frac{\cancel{(x-3)}(x+3)}{\cancel{x-3}} = 6$$

$f(x) = x \rightarrow f'(x) = 1$

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

$f(x) = 2x^4 \rightarrow f'(x) = 8x^3$

$f(x) = \sqrt{x} \rightarrow f'(x) = \frac{1}{2} x^{-\frac{1}{2}}$

$f(x) = e^x \rightarrow f'(x) = e^x$

$f(x) = e^{x^2+5} \rightarrow f'(x) = 2x\, e^{x^2+5}$

$f(x) = 3^{x^2+5} \rightarrow f'(x) = 2x \ln(3) . 3^{x^2+5}$

$f(x) = 3x^{x^2+5} \rightarrow f'(x) = \left(2x \ln(3x) + \frac{x^2+5}{x}\right) 3x^{\frac{x^2+5}{x}}$

$f(x) = \ln(5x) \rightarrow f'(x) = 5/x$

$f(x) = \ln(x^2+3) \rightarrow f'(x) = 2x/x^2+3$

$f(x) = \log_5(x) \rightarrow f'(x) = 1/x\ln(5)$

$f(x) = \sin(3x^2) \rightarrow f'(x) = 6x\cos(3x^2)$

$f(x) = \arcsin(x) \to f'(x) = 1/\sqrt{1-x2}$

$f(x) = \arcsin(x^2+5) \to f'(x) = 2x/\sqrt{1-(x^2+5)^2}$

$f(x) = \arccos(x^2+5) \to f'(x) = -2x/\sqrt{1-(x^2+5)^2}$

$f(x) = \arctan(x^2+5) \to f'(x) = 2x/1+(x^2+5)^2$

$f(x) = \operatorname{arccot}(x^2+5) \to f'(x) = -2x/1+(x^2+5)^2$

$f(x) = 5x^2+3x^7 \to f'(x) = 10x+21x^6$

$f(x) = 5x^2 . 3x^7 \to f'(x) = 10x . 3x^7 + 21x^6 . 5x^2$

$f(x) = \sin(2x).5x \to f'(x) = 2\cos(2x).5x + 5\sin(2x)$

$f(x) = \sin(2x)/5x \to f'(x) = (2\cos(2x).5x - 5\sin(2x))/(5x)^2$