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## LOPE OF TANGENT LINE

$\frac{y}{x} = \frac{f(x+h)-f(x)}{(x+h)-x} = \frac{dy}{dx} = \frac{f(x+h)-f(x)}{h}$ (as h goes to 0)

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

$\frac{dy}{dx} = \frac{((x+h)^2)-(x^2)}{h}$

$\frac{dy}{dx} = \frac{(x^2+2xh+h^2)-x^2}{h}$

$\frac{dy}{dx} = \frac{2xh+h^2}{h}$

$\frac{dy}{dx} = 2x+h$

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

## NOTATIONS

$f'(x)$, $y'$ > prime

$\frac{dy}{dx}$ derivative of y with respect to x (NOUN)

$\frac{d}{dx}$ take derivative with respect to x (VERB)

## TRIGONOMETRY

$\frac{d}{dx}\sin x = \cos x$

$\cos x = \sin x$

$\tan x = \sec^2 x$

$\cot x = -\csc^2 x$

$\sec x = \sec x(\tan x)$

$\csc x = -\csc x(\cot x)$

## PRODUCT RULE

$\frac{d}{dx}(uv) = u\frac{du}{dx} + v\frac{du}{dx}$

## QUOTIENT RULE

$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\,du - u\,dv}{v^2}$

## IDENTITIES

tan = sin/cos    cot = 1/tan = cos/sin

sec = 1/cos    csc = 1/sin

## CONSTANT

$\frac{d}{dx}(c) = 0$

## POWER RULE

$\frac{d}{dx}(x^n) = nx^{n-1}$

## CONSTANT MULTIPLE

$\frac{d}{dx}(cv) = c\frac{du}{dx}$

## SUM RULE

$\frac{d}{dx}(u+v) = \frac{dv}{dx} + \frac{du}{dx}$

## DIFFERENCE RULE

$\frac{d}{dx}(u-v)$

## CHAIN RULE

$\frac{dy}{dx} = \frac{dy}{du} \times \frac{dv}{dx}$

## SHORT METHOD

$y = g(f(x))$, $\frac{dy}{dx} = g'(f(x)) \times f'(x)$

$y = (f(x))^n$, $\frac{dy}{dx} = n(f(x))^{n-1} \times f'(x)$

## FUNCTIONS OF THE FORM $e^{f(x)}$

$y = e^x \quad \frac{dy}{dx} = e^x$

$y = ke^x \quad \frac{dy}{dx} = ke^x$

$y = e^{kx} \quad \frac{dy}{dx} = ke^{kx}$

$y = e^{f(x)} \quad \frac{dy}{dx} = f'(k)e^{f(x)}$