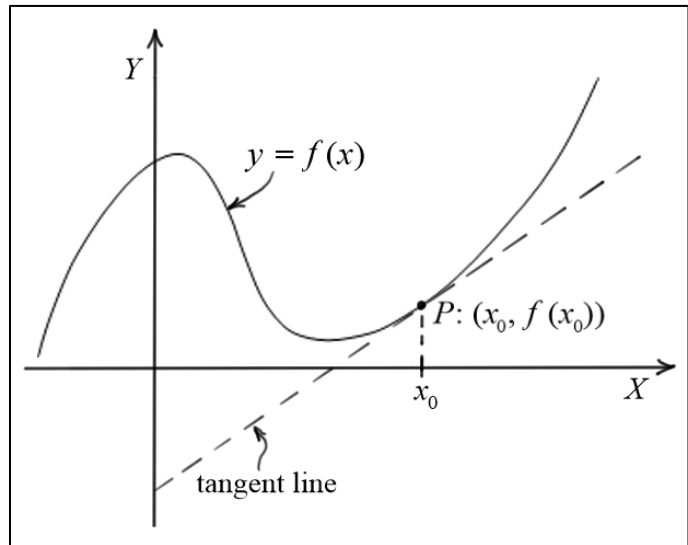


Elementary Engineering Mathematics

Equations Sheet #6 – Derivatives/Differentiation

1. Definition of the Derivative of a function:

$$\lim_{h \rightarrow 0} \left(\frac{f(x_0 + h) - f(x_0)}{h} \right) = \left. \frac{df}{dx} \right|_{x=x_0} = f'(x_0)$$



2. Table of derivatives of some common functions used in engineering

Name	Function, $f(x)$	Derivative, $f'(x) = \frac{df(x)}{dx}$
Constant	a	0
Polynomial terms	$a x^n$	$n a x^{n-1}$
Exponential	e^{ax}	$a e^{ax}$
Sine	$\sin(ax)$	$a \cos(ax)$
Cosine	$\cos(ax)$	$-a \sin(ax)$

3. Some basic rules of differentiation

	Name	Formula
1	Summation rule	$\frac{d}{dx}(f(x) + g(x)) = f'(x) + g'(x)$
2	Multiplication by a constant, a	$\frac{d}{dx}(a f(x)) = a f'(x)$
3	Product rule	$\frac{d}{dx}(f(x) g(x)) = f'(x)g(x) + f(x)g'(x)$
4	Chain rule	$\frac{d}{dx}(f(y(x))) = \frac{df}{dy} y'(x)$