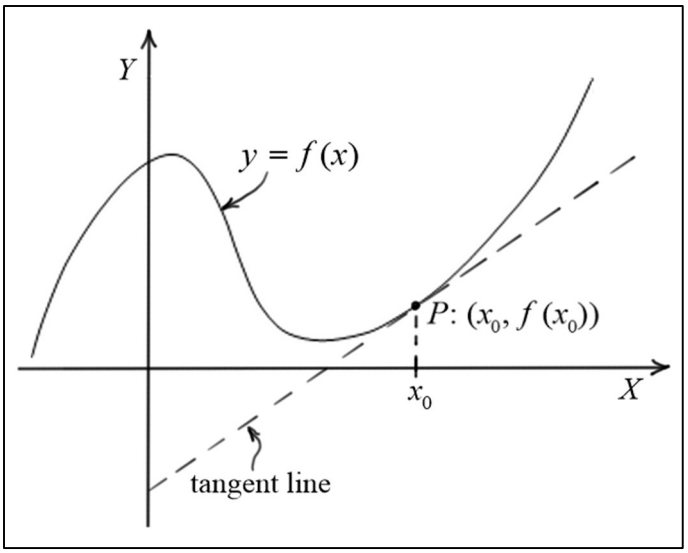
Elementary Engineering Mathematics
Equations Sheet #6 – Derivatives/Differentiation

1. Definition of the Derivative of a function:

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



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