Lesson 7: Basic Rules of Differentiation

Rules (Incomplete!)

$f(x)$	$f'(x)$
c (constant)	0
x^n (n number)	nx^{n-1} ← POWER RULE
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
e^x	e^x

Ex 1 $\frac{d}{dx}[3] = \boxed{0}$

Ex 2 $\frac{d}{dx}[\sqrt{x}] = \frac{d}{dx}[x^{1/2}]$

$= \frac{1}{2}x^{\frac{1}{2}-1}$

$= \boxed{\frac{1}{2}x^{-\frac{1}{2}}}$

$= \boxed{\frac{1}{2\sqrt{x}}}$

Properties

1. $\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$
2. $\frac{d}{dx}[f(x) \pm g(x)] = \frac{d}{dx}[f(x)] \pm \frac{d}{dx}[g(x)]$

Ex 3 $\frac{d}{dx}[3\sin x] = 3\frac{d}{dx}[\sin x] = \boxed{3\cos x}$

Ex 4 $\frac{d}{dx}[x^2 - 3x] = \frac{d}{dx}[x^2] - \frac{d}{dx}[3x]$

$= 2x^{2-1} - 3(1)$

$= \boxed{2x - 3}$

Caution! $\frac{d}{dx}[f(x)g(x)] \neq \frac{d}{dx}[f(x)]\frac{d}{dx}[g(x)]$

$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] \neq \frac{\frac{d}{dx}[f(x)]}{\frac{d}{dx}[g(x)]}$

Ex 5 $\frac{d}{dx}[x^2] = 2x$ $\qquad \frac{d}{dx}[x \cdot x] \neq \frac{d}{dx}[x]\frac{d}{dx}[x] = 1 \cdot 1$

Ex 6 $\frac{d}{dx}[x(x+7)] = \frac{d}{dx}[x^2 + 7x] = 2x + 7$

Ex 7 $\frac{d}{dx}\left[\frac{x^2+1}{x^{1/2}}\right] = \frac{d}{dx}[(x^2+1)x^{-1/2}] = \frac{d}{dx}[x^2x^{-1/2} + x^{-1/2}]$

$= \frac{d}{dx}[x^{3/2} + x^{-1/2}]$

$= \boxed{\frac{3}{2}x^{1/2} - \frac{1}{2}x^{-3/2}}$