3.3 Rules for Differentiation Day 1

Constant rule

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

$x^3 + x^2$

$3x^2 + 2x$

Power rule

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

Ex 1) $y = x^3$ $\frac{dy}{dx}\, x^3 = 3x^2$

Ex 2) $y = x^{10}$ $\frac{dy}{dx}\, x^{10} = 10x^9$

Ex 3) $y = \sqrt{x}$ $\frac{dy}{dx}\, x^{1/2} = \frac{1}{2}x^{-1/2}$ $\frac{1}{2} - 1 = -\frac{1}{2}$

$= \frac{1}{2\sqrt{x}}$ or $\frac{1}{2\sqrt{x}} \cdot \frac{\sqrt{x}}{\sqrt{x}} = \frac{\sqrt{x}}{2x}$

Ex 4) $y = \frac{1}{x^3}$

$\frac{dy}{dx}\, \frac{1}{x^3} = \frac{dy}{dx}\, x^{-3}$

$= -3x^{-4}$

$= \frac{-3}{x^4}$

$x^{-4} = \frac{1}{x^4}$

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

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

Constant multiple rule

$$\frac{d}{dx}\, c\cdot f(x) = c\cdot \frac{d}{dx}\, f(x)$$

Ex 5) $y = 5x^2$ $\frac{dy}{dx}5x^2 = 5\cdot\frac{dy}{dx}x^2 = 5\cdot 2x = 10x$

Ex 6) $y = 3x^6$ $\frac{dy}{dx}3x^6 = 3\cdot 6x^5 = 18x^5$

Ex 7) $y = \frac{2}{x^3}$ $\frac{dy}{dx}(2x^{-3}) = 2\cdot -3x^{-4} = \frac{-6}{x^4}$

Ex 8) $f(x) = 6x^3$

A) Find the slope at x = 2

$f'(x) = 6\cdot 3x^2 = 18x^2$

$f'(2) = 18(2)^2 = 18\cdot 4 = 72 = m$

B) Where is the slope of the tangent horizontal?

$18x^2 = 0$

$x^2 = 0$

$x = 0$

$(0,0)$

$x = 0$

$(0)^3 = 0$