3.3 Day 2 — High Order Derivatives

Friday, September 13, 2019 1:47 PM

1^{st} derivative $\frac{d}{dx}(f(x)) = y' = f'(x) = \frac{dy}{dx}$

2^{nd} derivative $\frac{d}{dx}(f'(x)) = y'' = f''(x) = \frac{d^2y}{dx^2}$

3^{rd} " " $\frac{d}{dx}(f''(x)) = y''' = f'''(x) = \frac{d^3y}{dx^3}$

4^{th} " " $\frac{d}{dx}f'''(x) = y^{(4)} = f^{(4)}(x) = \frac{d^4y}{dx^4}$

n^{th} " " $y^{(n)} = f^{(n)}(x) = \frac{d^ny}{dx^n}$

Find the first 3 derivatives of $y = x^5 - \frac{1}{2}x^4 + 6x^2 + 1$

$$y' = 5x^4 - 2x^3 + 12x + 0 = \frac{dy}{dx}$$

$$y'' = 20x^3 - 6x^2 + 12 = \frac{d^2y}{dx^2}$$

$$y''' = 60x^2 - 12x = \frac{d^3y}{dx^3}$$

Find $\frac{d^2y}{dx^2}$ given $y = x^3 - x + 4$

$$\frac{dy}{dx} = 3x^2 - 1$$

$$\frac{d^2y}{dx^2} = 6x$$

Given $f(x) = \frac{1}{3}x^3 - x^2 - 8x + 1$

a. Find when the tangent line is parallel to the x-axis.

$f'(x) = 0$ $\qquad$ $f'(x) = x^2 - 2x - 8$

$x^2 - 2x - 8 = 0$

$(x-4)(x+2) = 0$

$x = 4 \quad x = -2$

b. If possible, Find when the rate of change of $f(x)$ is -5.

$f'(x) = -5$ $\qquad$ $x^2 - 2x - 8 = -5$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x = 3$

$x = -1$

Ending Question

$$\lim_{h \to 0} \frac{(3+h)^2 - 9}{h} \stackrel{?}{=} \lim_{x \to 3} \frac{x^2 - 9}{x - 3}$$

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h} \qquad \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

$f(x) = x^2$ $\qquad$ $f'(3)$

$f'(x) = 2x \qquad f'(3) = 6$