Derivative Applications 3.3 – Higher Order Derivatives

Newton Notation

	_ , _ , , , , _ , _ ,
1st Derivative	f' or y'
2 nd Derivative	f'' or y''
3 rd Derivative	f''' or y'''
4 th Derivative	$f^{(4)}$ or $y^{(4)}$
N th Derivative	$f^{(n)}$ or $y^{(n)}$

Ex A: Find the first four derivatives of each function. #1) $f(x) = x^4 - x^3 + 6x^2 - x + 1$ (Use Newton)

#2)
$$y = 3x^{-1/2}$$
 (Use Newton)

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Leibniz Notation

1st Derivative
$$\frac{dy}{dx}$$
 or $\frac{d}{dx}f$

2nd Derivative $\frac{d^2y}{dx^2}$ or $\frac{d^2}{dx^2}f$

3rd Derivative $\frac{d^3y}{dx^3}$ or $\frac{d^3}{dx^3}f$

4th Derivative $\frac{d^4y}{dx^4}$ or $\frac{d^4}{dx^4}f$

Nth Derivative $\frac{d^ny}{dx^n}$ or $\frac{d^n}{dx^n}f$

#3)
$$f(x) = x^3 - 2x^2 + 6x - 11$$
 (Use Leibniz)

#4)
$$y = \frac{1}{x}$$
 (Use Leibniz)

#5)
$$\frac{d^2}{dx^2}(x^3 + x^2 + x - 1)|_{x=1}$$

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G Pop

The population of Gnadenhutten boomed after the arrival of the Gnaden Family Store. The population of the village is predicted to be $p(t) = \frac{t^2 - 1}{10t + 10}$ thousand people, where t is the number of years after the Gnaden Family Store moved to town.

a. Find p(8) and interpret your answer.

b. Find p'(8) and interpret your answer.

c. Find p''(8) and interpret your answer.

Chocolate Fever

The temperature of a chocolate bar is $T(x) = \frac{x}{x+1}$ hundred degrees F, where x is the seconds after the chocolate was taken out of the freezer and put under someone's armpit.

a. Find T(1) and interpret your answer.

b. Find T'(1) and interpret your answer.

c. Find T''(1) and interpret your answer.