Basic Derivative Rules
2.2 – Power Rule Applications

Ex A: Refining crude oil into various products such as gasoline, heating oil, and plastics requires heating and cooling of the oil. If the temperature of the oil at time x hours is $f(x) = x^2 - 7x + 150$ degrees Fahrenheit (for $0 \leq x \leq 8$), find the instantaneous rate of change of temperature at times $x = 6$ hours and $x = 2$ hours. (Use Leibniz's notation.)

    a.   Rate of Change after 6 hours:
    b.   Rate of Change after 2 hours

$$\boxed{f(x) = {}^\circ F \quad | \quad x = \text{hours} \quad | \quad f'(x) = {}^\circ F/h}$$

$$f'(x) = 2x - 7$$

a. $f'(6) = 2(6) - 7$

$$= 12 - 7$$

$$f'(6) = 5 \ {}^\circ F/h$$

After 6 hours the oil's temperature is increasing by 5 °F per hour.

b. $f'(2) = 2(2) - 7$

$$= 4 - 7$$

$$f'(2) = -3 \ {}^\circ F/h$$

After 2 hours the oil's temperature is decreasing by 3 °F per hour.

Ex B: Interpreting the units of derivatives.

#1) If $f(x)$ gives the population of a city in year x, what are the units of $f'(x)$?

$$f'(x) = \text{people}/\text{year}$$

#2) If $f(x)$ gives the height of a child in inches x years after being born, what are the units of the derivative?

$$f'(x) = \text{inches}/\text{year}$$

#3) If $f(x)$ gives the IQ of a college student after eating x Twinkies, what are the units of $\frac{dy}{dx}$?

$$\frac{dy}{dx} = \text{IQ points}/\text{Twinky}$$

#4) If $f(x)$ gives the number of cars sold on day x of advertising, what are the units of the derivative?

$$f'(x) = \text{cars}/\text{day}$$

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NDERIV

To use NDERIV, you first need to find it on your calculator. NDERIV is under MATH #8. You should now see "nDERIV(" on your calculator. After "nDERIV(" you need the following information…

nDERIV(your function, with respect to, for these values, the number of decimal places in the answer)

Ex: $\frac{d}{dx}(x^3 - 2x^2 + 8x - 4)\Big|_{x=5}$ with a precision of 0.01

nDERIV($x^3 - 2x^2 + 8x - 4$, x, 5, 0.01)

If you are doing nDeriv from the home screen, the third part "for these values" must be a single number. If you are doing nDeriv from the "y=" screen, you can either use a single number or all values of x.

nDERIV($x^3 - 2x^2 + 8x - 4$, x, x, 0.01)

nDERIV(y_1, x, x, 0.01)

(y_1 can be found in VARS, Y-VARS, then FUNCTION.)

Ex: nDERIV(y_1, x, x)

A car dealership's convertible sales can be approximated by the function $f(x) = -x^2 + 10x$, where x is the number of days after a 100º temperature day, and f(x) is the number of convertible sold on that day. The following table represents x, f(x), and f '(x).

Day x	0	1	2	3	4	5	6	7	8	9	10
Convertibles Sold f(x)	0	9	16	21	24	25	24	21	16	9	0
Instantaneous rate of change f '(x)	10	8	6	4	2	0	-2	-4	-6	-8	-10