# More Power to Ya!

*calculus.power2ya.89t*

**Name** _____

**Class** _____

Before beginning this activity, make sure that your calculator is in split-screen mode. To do this, press [MODE], then press [F2]. Change the **Split Screen** option to **2:TOP-BOTTOM**. For **Split 1 App**, select Text Editor. For **Split 2 App**, select **Home**.

Press [APPS], select **Text Editor**, and open *calculus.power2ya*. Press [F3] to select "Script view." Press [F4] to execute each command line. Be sure to read each line that does not begin with **C:**.

**Problem 1 – Graphical Exploration**

In the first part of the script, you will see the graph of $y1(x) = x^n$ and its derivative. The function is graphed first, then its derivative.

- What is the relationship between the degree of $y1(x)$ and the degree of its derivative?

**Problem 2 – Defining the Derivative of $x^n$**

Advance through the algebraic discovery part of the script by pressing [F4]. Examine the various derivatives of $x^n$, where $n$ is an integer, below.

$$\frac{d}{dx}\left(x^2\right) = 2 \cdot x \qquad \frac{d}{dx}\left(x^3\right) = 3 \cdot x^2 \qquad \frac{d}{dx}\left(x^4\right) = 4 \cdot x^3 \qquad \frac{d}{dx}\left(x^5\right) = 5 \cdot x^4$$

- What patterns do you observe in the derivatives above?

- Create at least four other "true" examples. Include nonpositive values of $n$. Test your examples on the TI-89 by toggling down to the Home screen (Press [2nd] + [APPS] and then press [HOME]).

- Create a rule for taking the derivative of $x^n$ with respect to $x$.

Toggle back to the script to execute the last commands. This will define the function $f(x) = x^n$ and evaluate the limit $\lim_{h \to 0}\left(\frac{f(x+h)-f(h)}{h}\right)$.

- How does this compare to the rule you found for taking the derivative of $x^n$?

**Extension**

- Does the Power Rule apply when $n$ is a non-integer, rational number? (Press [F3], select **2:Clear split** and press [HOME] to use the Home screen to test your conjecture.)

- Expand the binomial $(x + h)^n$. Without the calculator, use this to evaluate the limit considered above.