Name_____

Activity - Derivatives of Power Functions

Follow the directions exactly to receive credit on this activity.

Part 1. Functions of the form $f(x) = x^n$, where $n = 1,2,3, \ldots$, are often called *power functions.*

(a) Use the limit definition of the derivative to find $f'(x)$ for $f(x) = x^2$.

(b) Use the limit definition of the derivative to find $f'(x)$ for $f(x) = x^3$.

(c) Use the limit definition of the derivative to find $f'(x)$ for $f(x) = x^4$. (Hint: $(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4$. Apply this rule to $(x + h)^4$ within the limit definition.)

(d) Based on your work in (a), (b), and (c), what do you conjecture is the derivative of $f(x) = x^5$? Of $f(x) = x^{13}$?

(e) Conjecture a formula for the derivative of $f(x) = x^n$ that holds for any positive integer n. That is, given $f(x) = x^n$ where n is a positive integer, what do you think is the formula for $f'(x)$?

Part 2.

Use the rule above to make a conjecture about the derivative of each of the following functions. For each, state your answer using full and proper notation, labeling the derivative with its name. For example, if you are given a function $h(z)$, you should write "$h'(z) =$" or "$\frac{dh}{dz} =$" as part of your response.

(a) $f(t) = \pi$

(b) $g(z) = z^{-2}$

(c) $h(w) = w^{3/4}$

(d) $p(x) = 3^{1/2}$

(e) $r(t) = \sqrt{t^3}$

(f) $\frac{d}{dq}[q^{-1}]$

(g) $m(t) = \frac{1}{t^3}$