

Math 1311
Section 5.2
Power Functions

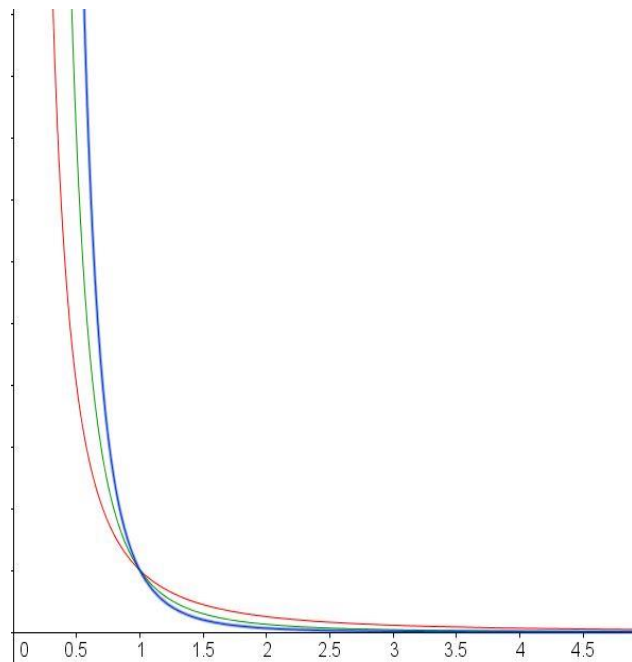
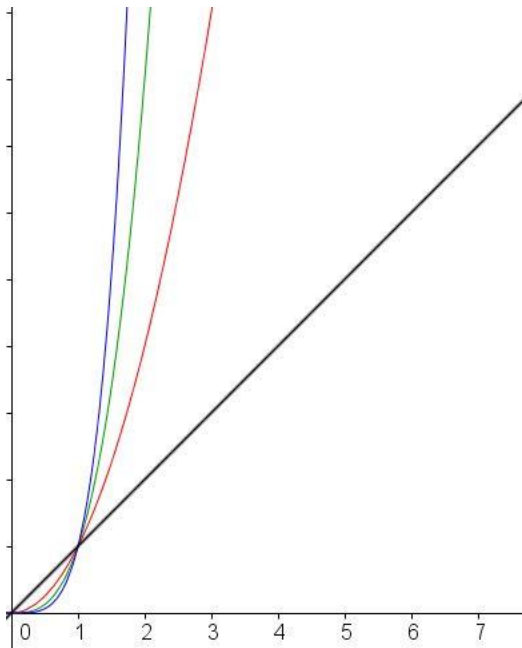
Recall, exponential functions of the form $f(x) = Pa^x$ has a fixed base a , and the exponent varies. For a power function this is reversed. There is a fixed exponent, and the base varies.

Power Functions

For a power function $f(x) = cx^k$

- k is called the power and it is the most significant part of a power function.
- The coefficient c is equal to $f(1)$.
- If k is positive, then f is increasing; larger, positive values of k cause f to increase more rapidly.
- If k is negative, then f decreases toward zero; negative values of k that are larger in size cause f to decrease more rapidly.

Graphs of power functions



b. Tripled.

c. Quadrupled

General Rule:

For a power function $f(x) = cx^k$, if x is increased by a factor of t , then f is increased by a factor of t^k .

Example 4: The speed at which certain animals run is a power function of their stride length, and the power is $k = 1.7$. If one animal has a stride length three times as long as another, how much faster does it run?

Example 5: Let $f(x) = cx^{2.53}$. By what factor must x be increased in order to triple the value of f ?

Example 6: Let $f(x) = cx^{1.47}$. If x is doubled in value, by what factor would f be increased?

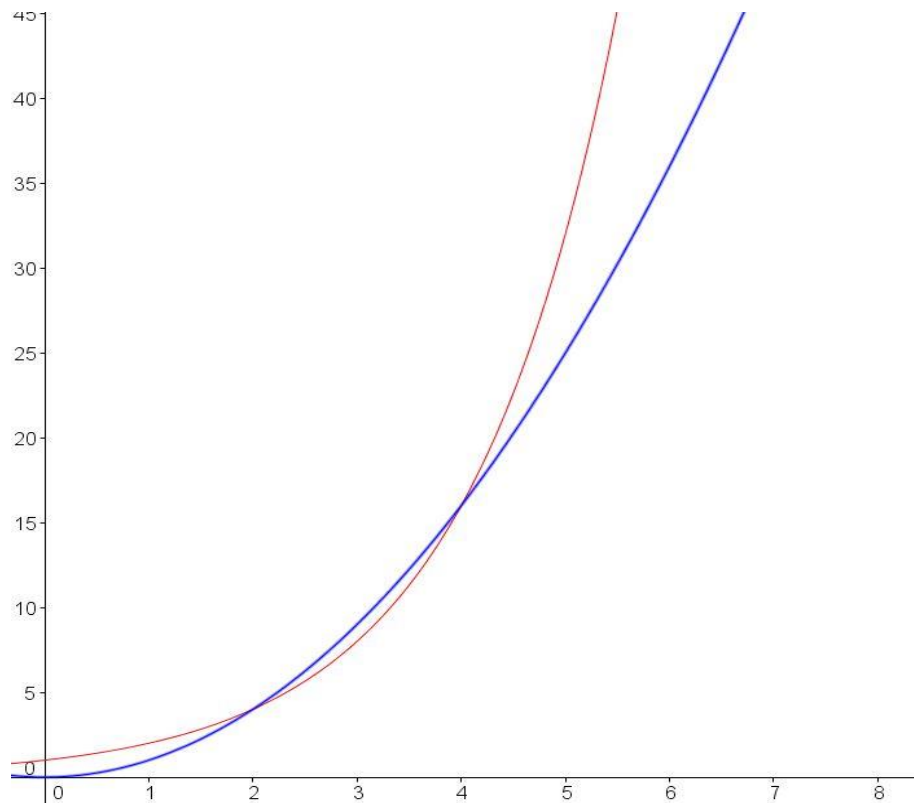
Example 7: Let $f(x) = cx^k$. Suppose $f(6.6)$ is 6.2 times as large as $f(x) = 1.76$. What is the value of k ?

Example 8: Let $f(x) = cx^{-1.32}$ and suppose $f(5) = 11$. Find the value of c .

Example 9: A biologist has determined that the weight of a certain fish is a power function of its length. He also has determined that when the length doubles, the weight increases by a factor of 7.4. What is the power k ?

Comparing Exponential and Power Functions

Example 10: Let's compare $f(x) = 2^x$ and $g(x) = x^2$.



Conclusion: Over a sufficiently large horizontal span, an exponential function (with base larger than 1) will increase much more rapidly than a power function.