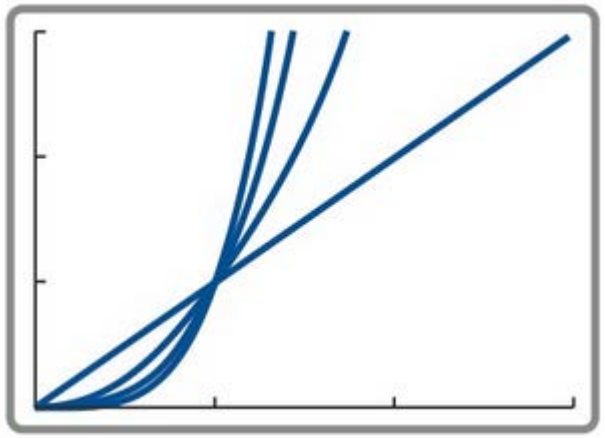
MATH 1311

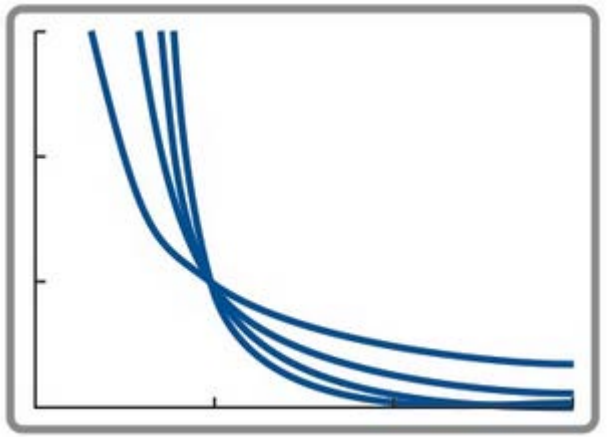
Section 5.2

Power Functions

Power Functions are in the form of $f(x) = cx^k$, where c and k are constants. (Notice the difference between this and the exponential function where the variable is in the exponent.



k-value positive



k-value negative

KEY IDEA 5.3 POWER FUNCTIONS

For a power function $f(x) = cx^k$ with c and x positive:

1. If k is positive, then f is increasing. Larger positive values of k cause f to increase more rapidly.
2. If k is negative, then f decreases toward zero. Negative values of k that are larger in size cause f to decrease more rapidly.

Example:

A falling object will travel $D = 16t^2$ feet in t seconds. If an object is dropped from a 150 foot building, how long will it take to reach the ground?

A cube has an edge measuring 2 inches. How will tripling the measure of the edge change the volume? ($v = e^3$)

A cube has an edge measuring 2 inches. How will tripling the measure of the edge change the volume? ($v = e^3$)

Original: $v = 2^3 = 8$ 8 cubic inches

New: $v = (3 \times 2)^3 = 6^3 = 216$ 216 cubic units

Notice that there was an increase of 216/8 = 27 times.

The new volume is 27 times the original.

Also, note that $27 = 3^3$.

KEY IDEA 5.4 HOMOGENEITY PROPERTY OF POWER FUNCTIONS

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

In a power function, the value of f(2) = 10 and the value of f(4) = 160. Find the equation of the power function.

KEY IDEA 5.4 HOMOGENEITY PROPERTY OF POWER FUNCTIONS

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

In a power function, the value of f(2) = 80 and the value of f(4) = 1280. Find the equation of the power function.

First off, $^{1280}/_{80} = 16$. We know that doubling the x-value increased the y-value 16 times.

Meaning the y-values changed by $2^n = 16$ times. We know that n = 4.

So our function is: $f(x) = cx^n = cx^4$.

Now, $f(2) = c2^4 = 16c = 80$. Therefore, $c = {}^{80}/_{16} = 5$. So the function is: $f(x) = 5x^4$.

Check your answer using f(4).

Try This:

The ascent of a spaceship is modelled by an exponential function. After 4 seconds, the ship has an altitude of 12288 feet, and after an additional 4 seconds the altitude is 786432 feet. Determine the power function that will represent the height of the ship.

The daily energy consumption of hotel is given by a power function based on the hours after midnight. At 2:00 am, the hotel is using 96 kwh and by 6:00 am the hotel is using 2592 kwh.

1. By what factor did the time increase between these points?
2. What is the ratio of kwh between these points?
3. What is the exponent of the function?

4. What is the coefficient for this situation?

5. What is the power function formula?

6. What is the energy usage at 8:00 am?

7. At that time will the energy usage be 768 kwh?