Section 13.1 (Exponential Functions)

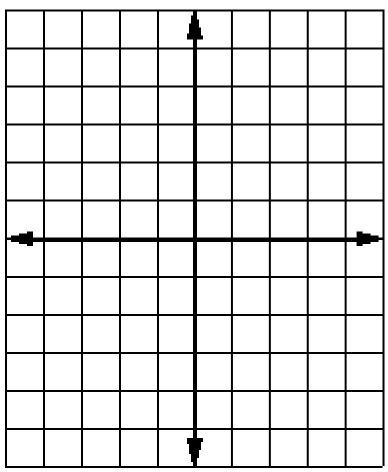
The applications of exponential functions are tremendous and being able to evaluate and graph them are good skills for finding models that fit real world data.

The objectives for this section are:

- Recognize an exponential equation
- Identify the base in an exponential equation
- Evaluate exponential Functions
- Graph exponential functions

Let's graph first: $y = f(x) = a^x$

1. $y = f(x) = 3^x$



Use Graphing Calculator to graph:

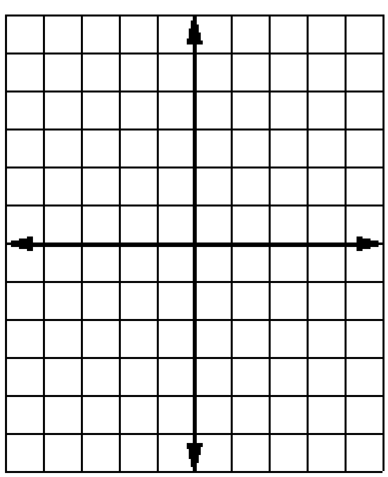
$y_1 = 2^x$

$y_2 = 3^x$

$y_3 = 10^x$

a) The graph increases from left to right when $a > 1$
b) The greater "a" is, the steeper the curve
c) The x-axis is an asymptote where y=0
d) All of these cross the y-axis at (0,1)

2. $y = f(x) = \left(\frac{1}{2}\right)^x$



Use Graphing Calculator to graph:

$y_1 = \frac{1}{2}^x$

$y_2 = \frac{1}{3}^x$

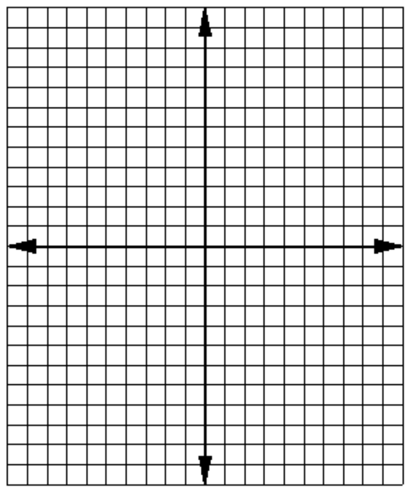
$y_3 = \frac{1}{5}^x$

a) The graph decreases from left to right when $0 < a < 1$
b) The smaller "a" is, the steeper the curve
c) The x-axis is an asymptote where y=0

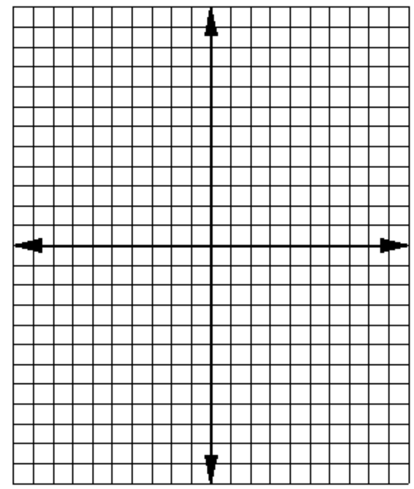
d) All of these cross the y-axis at (0,1)

Section 13.1 (Exponential Functions)

Graph $y = 6^{x-4}$

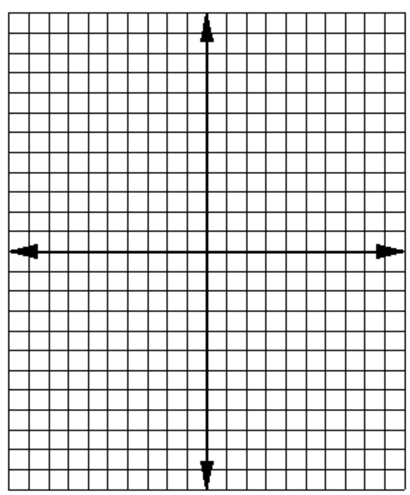


Graph $y = 2^{x-3} + 1$



Let's compare a function and it's inverse on the same set of axis:

$$y = 2^x \qquad \textit{and} \qquad x = 2^y$$



Note that the graph of the function and it's inverse are reflected across the line y = x.

Before we go on to applications, let's determine whether the given functions are exponential functions, whether they are increasing or decreasing exponentially and identify their base:

$y = 2^x$

$y = \left(\frac{1}{2}\right)^x$

Section 13.1 (Exponential Functions)

The bacteria Escherichia coli are commonly found in the human bladder. Suppose that 3000 of the bacteria are present at time t = 0. Then *t* minutes later, the number of bacteria present can be approximated by

$$N(t) = 3000(2)^{t/20}$$

How many bacteria will be present after 10 min? 20 min? 30 min? 40 min? 60 min?

Time *t*	Bacteria *N(t)*
10	
20	
30	
40	
60	

Graph the function below:

Take a look at this graph on the graphing calculator as well.

Section 13.1 (Exponential Functions)

A photocopier is purchased for $5200. Its value each year is about 80% of the value lf the preceding year. Its value, in dollars, after t years is given by the exponential function:

$$V(t) = 5200(0.8)^t$$

Find the value of the machine after 0 years? 1 years? 2 years? 5 years? 10 years?

Years *t*	Value *V(t)*
0	
1	
2	
5	
10	

Graph the function below:

Take a look at this graph on the graphing calculator as well.