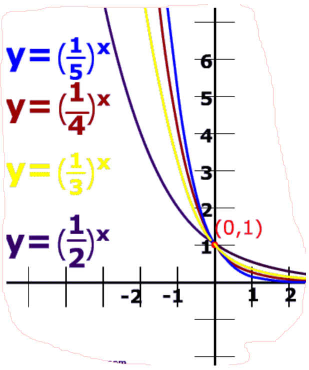
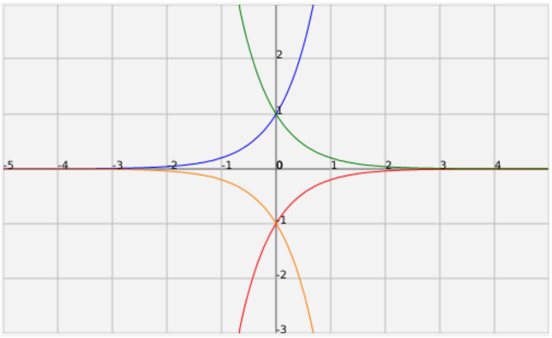
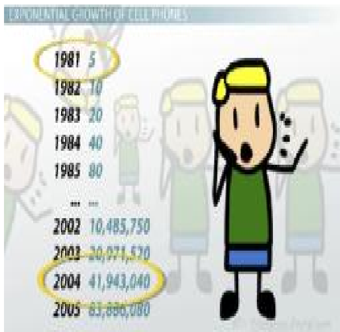
Unit 3:

Exponential and Logarithmic Functions







PartI: Exponential Functions

Lesson 1

Characteristics of Exponential Functions

The graph of an exponential function is a function of the form $y = c^x$ where c is a constant, $c > 0$ and x is a variable.

Example 1. Investigating the graph of an exponential function.

Graph the exponential function $y = 3^x$

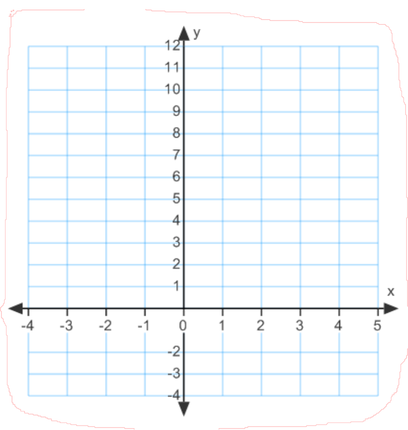
Identify,

domain and range

x-intercept and
y-intercept

The equation of the horizontal asymptote

x	y
-3	
-2	
-1	
0	
1	
2	



What happens if 0 < c < 1 ? $y = c^x$

Graph the exponential function $y = \left(\frac{1}{3}\right)^x$

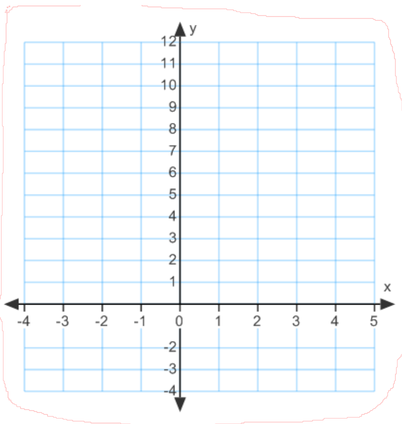
Identify,

domain and range

x-intercept and
y-intercept

The equation of the
horizontal asymptote

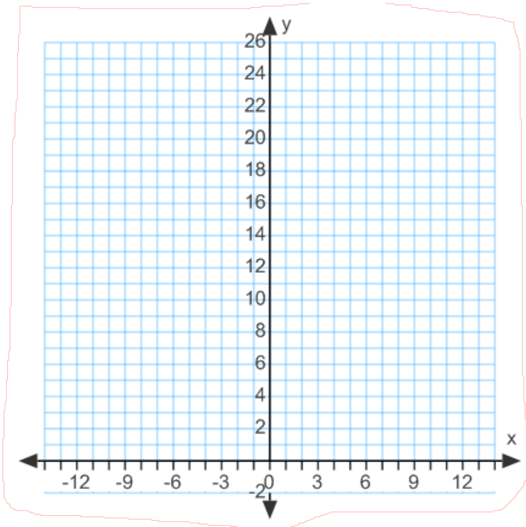
x	y
-3	
-2	
-1	
0	
1	
2	



Your Turn: Graph the function $f(x) = 5^x$

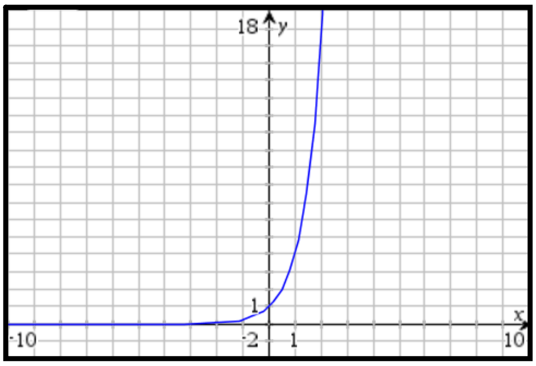
Identify the domain, range, any intercepts, whether the graph is an increasing or decreasing function and the equation of the horizontal asymptote.

x	-2	-1	0	1	2
$f(x)$					

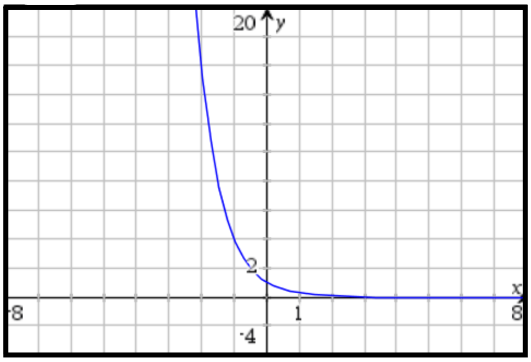


Example 2: Write the exponential functions from the given graphs.

Hint: Look for a pattern in the ordered pairs.



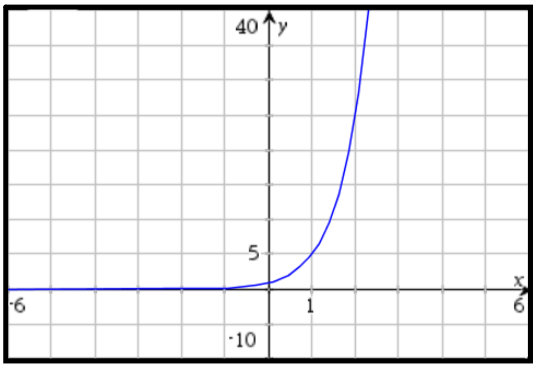
x	-1	0	1	2
$f(x)$				



x	-1	0	1	2
$f(x)$				

Your Turn: What function of the form $y = c^x$ can be used to describe the graph below ?

x	-1	0	1	2
$f(x)$				



Example 3: Exponential Growth and Decay. Applications of the Exponential Function.

Investigate: A certain type of bacteria is doubling every 30 minutes.

Number of doubling periods, n .	Number of bacteria present, B.
0	1
1	2
2	
3	
4	
5	

1. Complete the table.

2. Write an equation that relates B to n .

3. After 2 hours, how many bacteria will result from a single bacterium?

4. If there were 100 bacteria initially in a sample of the same type, how many bacteria would there be 2 hr later? What equation would give the number of bacteria after n doubling periods, for this sample?

5. A culture has a bacterial count of 500 at the start. What equation would give the number present t hours from now?

An exponential function is a function of the form, $f(x) = a \cdot c^x$ where a is a constant and c > 0.

In the above function:

a would represent the initial amount of bacteria, or value or light or.......
c represents the growth or decay factor.
- If something is doubling c is equal to 2.
- If something is growing at a rate of 7% c is equal to 1.07, that is the original amount and the amount of growth.
- If something is decaying c may be equal to 0.5

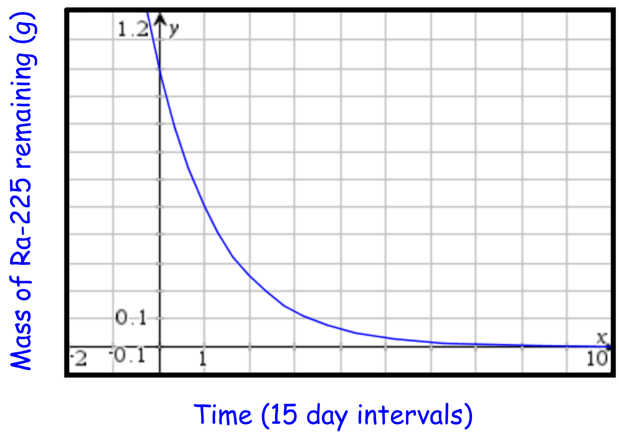
- x is the amount of time something takes to double or half or grow or decay....
- x is sometimes expressed as $\dfrac{time\ passed}{doubling\ time}$ or.... $\dfrac{time\ passed}{half-life}$ $\dfrac{t}{p}$

A radioactive sample of radium (Ra-225) has a half-life of 15 days. The mass, m in grams, of Ra-225 remaining over time, t, in 15 day intervals, can be modeled using the exponential graph shown.

1. What is the initial mass of Ra-225 in the sample?

2. What value does the mass of Ra-225 approach over time?

3. Write the exponential decay model that relates the mass of Ra-225 to time in 15 day intervals.



4. Write the exponential model that relates the mass of Ra-225 to time passed.

5. Estimate how many days it would take for Ra-225 to decay to $\frac{1}{30}$ of its original mass.

Your Turn: A certain bacteria population triples every week.

Write an exponential growth model of the form $N = n(G)^{\frac{t}{p}}$ that relates the number of bacteria, N, to the time passed since the initial count, n. G is the growth factor, and p is the tripling period.

Homework

1. Assignment Handouts:
   BLM 7-1; Prerequisite Skills
   BLM 7-1; Characteristics of Exponential Functions

2. Text Pages 342 - 345, Exercises # 1 - 11, 13, C1, C2

Attachments

Translations Assignment 1.doc