

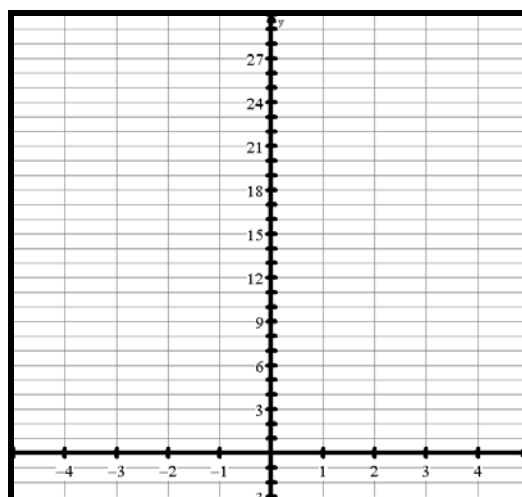
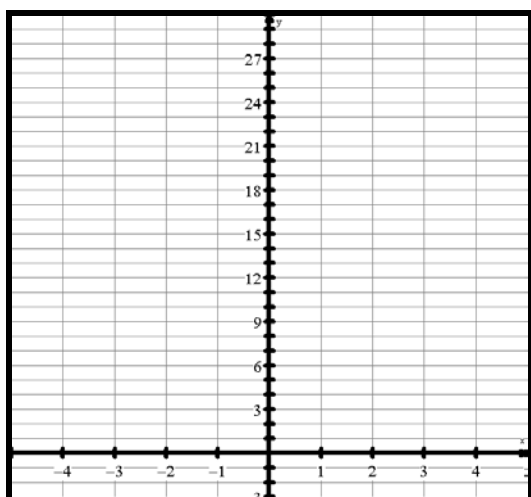
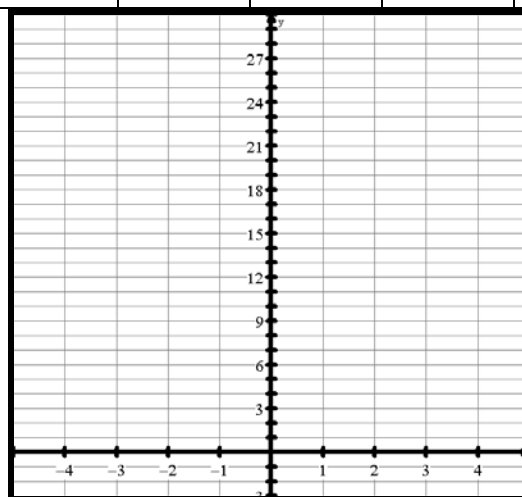
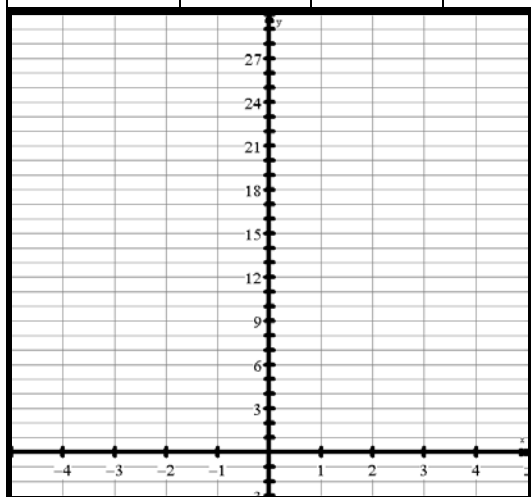
(A) Lesson Objectives:

- a. Introduce transforming exponential functions through several practical applications.
- b. Describe the main features of the graphs of exponential functions.
- c. Transform the graphs of exponential functions.

(B) Main Features of the Graphs of Exponential Functions

We will investigate several exponential functions You will first prepare a data table.

x	-4	-3	-2	-1	0	1	2	3	4
$y = 2^x$									
$y = 3^x$									
$y = \left(\frac{1}{2}\right)^x$									
$y = \left(\frac{1}{3}\right)^x$									



(C) Graphic Analysis

- a. What point do all graphs have in common?
- b. How are the y co-ordinates of the exponential graphs different for the different bases?
- c. Compare the graphs of $y = 2^x$ and $y = \left(\frac{1}{2}\right)^x$. Then compare the graphs of $y = 3^x$ and $y = \left(\frac{1}{3}\right)^x$. How are they alike or unlike?
- d. We will introduce the terms domain and range now. Define the terms domain and range. State the domain and range of (i) $y = 2^x$, $y = \left(\frac{1}{2}\right)^x$, $y = 3^x$, $y = \left(\frac{1}{3}\right)^x$.
- e. An asymptote is a line that a graph approaches as the x- or y-values get “big” on the graph.
- i. What happens to the y-values on the graphs of $y = 2^x$ and $y = 3^x$ as x approaches ∞ (x gets really big as a positive number)? As x approaches $-\infty$ (x gets really big as a negative number)?
- ii. What happens to the y-values on the graphs of $y = \left(\frac{1}{2}\right)^x$ and $y = \left(\frac{1}{3}\right)^x$ as x approaches ∞ (x gets really big as a positive number)? As x approaches $-\infty$ (x gets really big as a negative number)?
- iii. What horizontal line (a horizontal asymptote) do these graphs approach as x approaches ∞ (or $-\infty$)

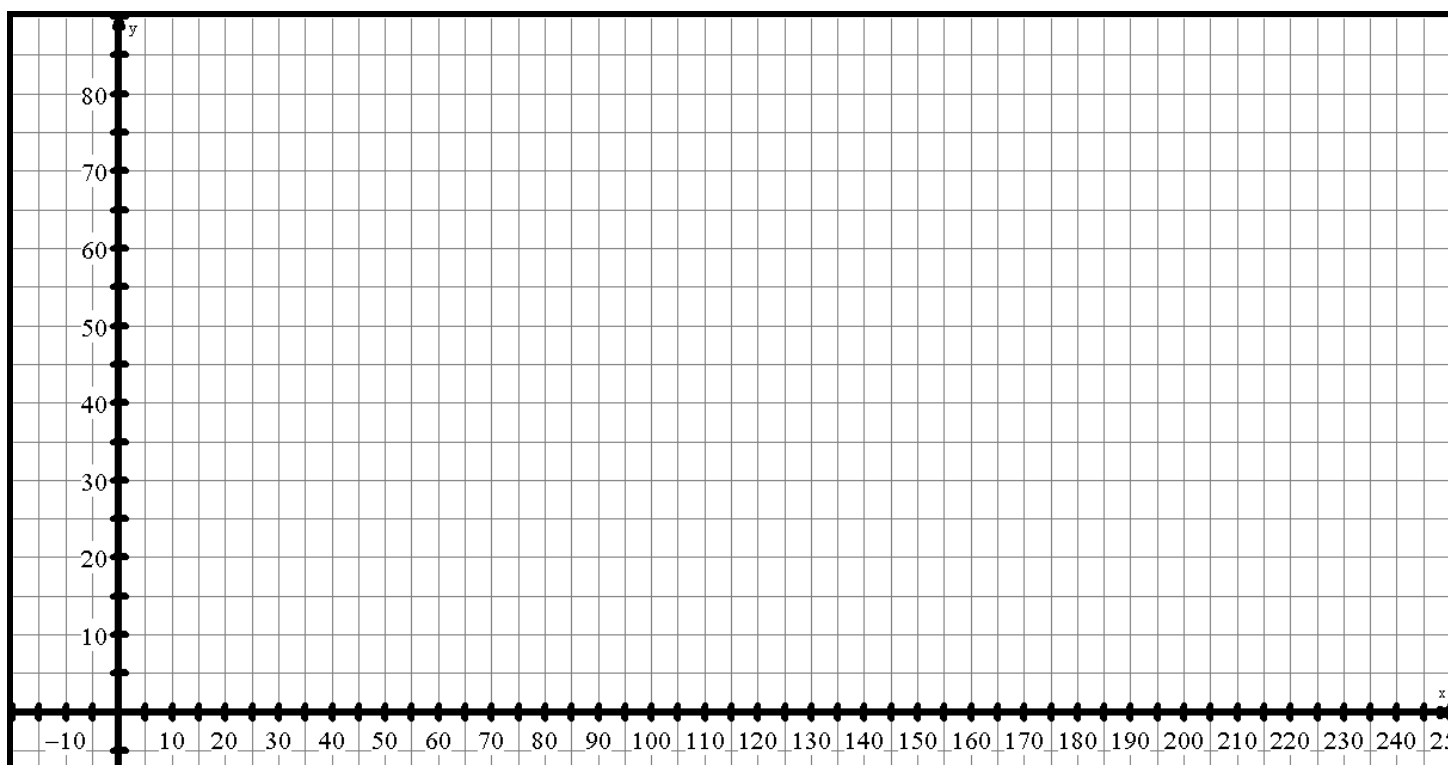
(D) **Investigations for Classwork** → Newton's Law of Cooling

The following data table shows the relationship between the time (elapsed from when I first poured the water into my coffee cup) and the temperature of my coffee:

<http://mrsantowski.tripod.com/IBSLY2/Assignments/NEWTONSLAWDATA.htm>

(a) Graph the data on a scatter plot

Provide a graph, showing the relationship between the temperature of my coffee and the cooling time.



(b) How can you graphically analyze the data to help determine a model for the data?

(c) How can you numerically analyze the data to help determine a model for the data?

(d) Write an equation to model the data. Justify your choice of models.

(E) Algebraic Investigations – In Class

1. Use your TI-84 to graph the following exponential functions in the form of $y = 2^x + d$:
 - a. (i) $y = 2^x$, (ii) $y = 2^x + 4$, (iii) $y = 2^x + 10$, (iv) $y = 2^x - 5$, (v) $y = 2^x - 12$
 - b. Explain what changes occur in the graph of the exponential function $y = 2^x$ as the value of d changes.

2. Use your TI-84 to graph the following exponential functions in the form of $y = a(2)^x = a2^x$:
 - a. (i) $y = 2^x$, (ii) $y = 2(2)^x$, (iii) $y = \frac{1}{4}(2)^x$, (iv) $y = -2(2)^x$, (v) $y = -\frac{1}{2}(2)^x$
 - b. Explain what changes occur in the graph of the exponential function $y = 2^x$ as the value of a changes.

3. Use your TI-84 to graph the following exponential functions in the form of $y = 2^{bx}$:
 - a. (i) $y = 2^x$, (ii) $y = 2^{2x}$, (iii) $y = 2^{\frac{1}{3}x}$, (iv) $y = 2^{-2x}$, (v) $y = 2^{-\frac{1}{2}x}$
 - b. Explain what changes occur in the graph of the exponential function $y = 2^x$ as the value of b changes.

(F) Homework/Resources

- **HW: from Textbook** →
- Video #1 → http://www.youtube.com/watch?v=6Db1wG_zudc&feature=related
- Video #2 → <http://www.youtube.com/watch?v=cexbHJ2aWnU&feature=relmfu>
- Online Applet → <http://www.analyze-math.com/expfunction/expfunction.html>