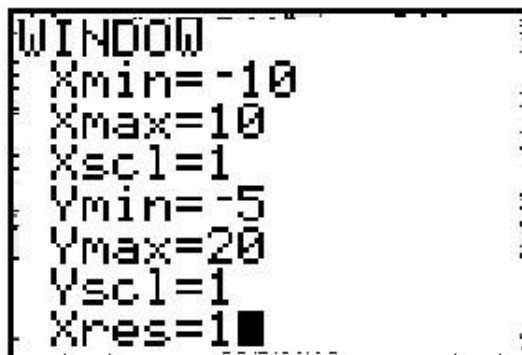


**Activity 1**  $y = ab^x$

Use your TI-83 graphing calculator to graph the following functions and answer the questions.

Suggested Window:



Title: Exploring Exponential Growth and Decay Functions

A. Graph the following exponential equation

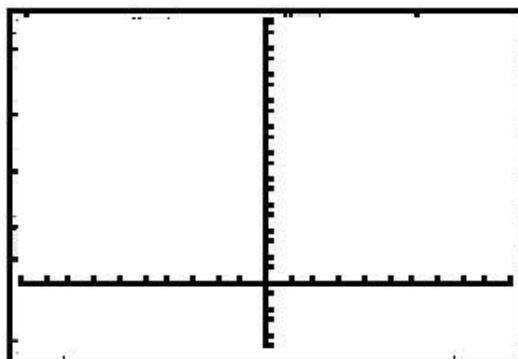
1.  $y = 2^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



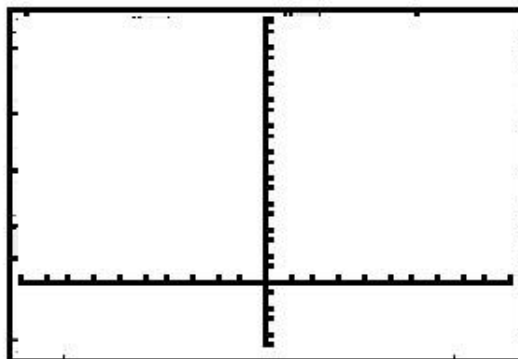
2.  $y = 3^x$

y-intercept  
\_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



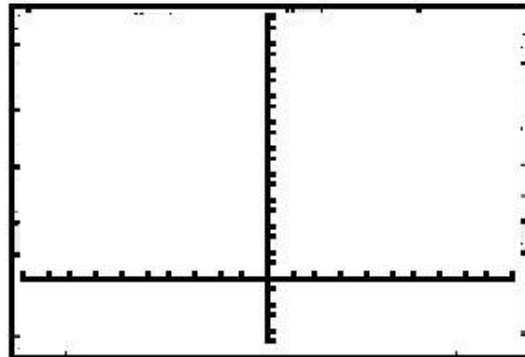
3.  $y = 10^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



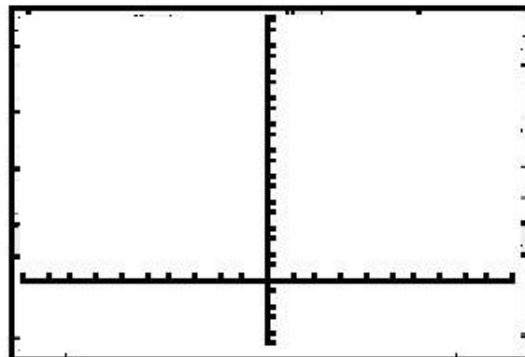
4.  $y = 1^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



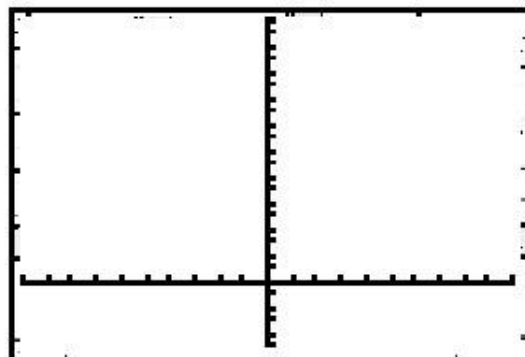
5.  $y = (1/2)^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



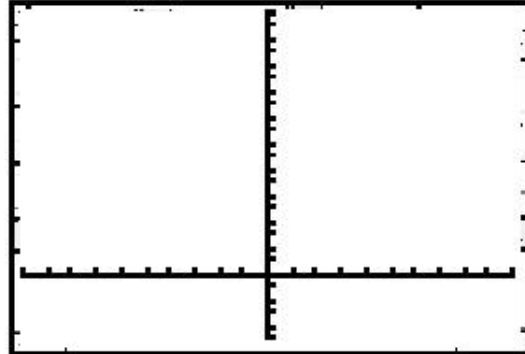
6.  $y = (1/3)^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



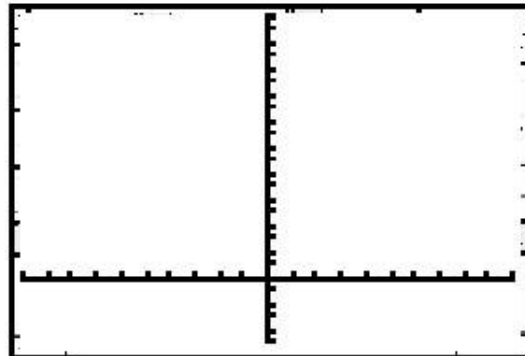
7.  $y = (1/10)^x$

a. y-intercept \_\_\_\_\_

b. increasing, decreasing, or neither  
(circle one)

c. a = \_\_\_\_\_

d. b = \_\_\_\_\_



8. What point do they all have in common? \_\_\_\_\_

9. List the equations that are increasing. \_\_\_\_\_

\_\_\_\_\_

10. List the equations that are decreasing. \_\_\_\_\_

\_\_\_\_\_

11. When an exponential graph is increasing , it shows exponential growth .  
What are the similarities of all the equations that produce such graphs?

\_\_\_\_\_

\_\_\_\_\_

12. When an exponential graph is decreasing , it shows exponential decay. What are the similarities of all the equations that produce such graphs?

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13. Are there any graphs which were not reflecting exponential growth or decay? Why? \_\_\_\_\_

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Activity 2  $y = ab^x$

1. Sam has \$300 to deposit into an account at 6% interest compounded annually. Given the exponential equation  $y = 300(1.06)^x$ , fill in the table for the future values:

$$y = 300(1.06)^x$$

x	years	0	1	2	5	10	20	25
y	\$							

a. Where did  $b=1.06$  come from? \_\_\_\_\_

b. If at the end of year 2 Sam adds \$200 to his account, how much will he have in more 10 years?

Answer \_\_\_\_\_

2. Country A has a declining population. In 1980, the population was 200,000 and it decreases at 3% a year. Given  $y = 200,000(.97)^x$ , fill in the table: \*\*remember,  $x = 0$  for 1980.\*\*

Year	1980	1981	1982	1985	1990	2000
x						
y						

a. Where did  $b=.97$  come from? \_\_\_\_\_

b. What was the population in 1970? \_\_\_\_\_

3. Write an exponential equation, given an initial amount of 500 and a increase of 7%. \_\_\_\_\_ decrease of 2% \_\_\_\_\_

4. Ana won \$100 and deposited it into a savings account earning 3% interest compounded annually. Write a model for this exponential function. \_\_\_\_\_  
Is it a growth or a decay? \_\_\_\_\_

a. How much will she have after 5 years?

b. When will her money triple?

5. A new car costs \$20,000. It depreciates in value at a rate of 16% each year. Write a model for this exponential function. \_\_\_\_\_

a. How much will the car be worth after 3 years?

b. How long will it be until the car is worth  $\frac{1}{4}$  of its original price?

### Activity 3

For this activity, you will be required to do some research.

Your great spinster aunt is very concerned that you will not remember her when she is gone. However, she is also very frugal. She is willing to give you some money to open a savings account. Her condition in giving you this money is that you find the bank that will give you the highest interest and you cannot make any withdrawals for 10 years.

1. How much money did your aunt give you? \_\_\_\_\_

2. Contact at least 3 financial institutions (either by phone, by looking in the newspaper, or looking on the internet). For this assignment, assume that the given interest rates are compounded annually.

	Financial Institution	Reference	Interest Rate
1			
2			
3			

3. Choose the bank which will give you the highest interest rate and write the mathematical model. \_\_\_\_\_

a. How much money will you have in the bank in 20 years?

b. When will your money double?

c. In year 10 you had to withdraw your initial deposit for a down payment on a house. What will the value be in year 20 now?

Activity 4: \_\_\_\_\_ The Penny Experiment

Materials:           1 roll of pennies per group  
                          Box or can  
                          TI-83 Graphing Calculator

Step 1: Working in groups, open roll of pennies and pour all 50 pennies onto a flat surface. Spread the pennies out and take out all the “heads up” pennies. Write in the table how many pennies you had remaining.

Step 2: Collect those that remain into your box or can, shake them up, and repeat.

Step 3: Repeat step 2 until you have eliminated all the pennies.

Toss #	Pennies Remaining
0	50

Once you have all the data, follow the directions to use the TI-83 calculator.



## Entering Penny Data in TI-83 Graphing Calculator

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Press STAT ; Press 1 (Edit)

Begin entering data in L 1 (toss#) and then in L2 (pennies remaining).

\*The last entry should be omitted from the data set. This data point is invalid where  $y=0$  for the equation  $y = abx$ .

L1	L2	L3	1
██████	-----	-----	

L1(1) =

Press 2nd STAT PLOT ; Press 1 (Plot 1); Put cursor on ON and enter.

Plot1	Plot2	Plot3
Off		
Type:		
Xlist:	L1	
Ylist:	L2	
Mark:		

Press ZOOM ; Press 9 (ZoomStat) and graph will appear.

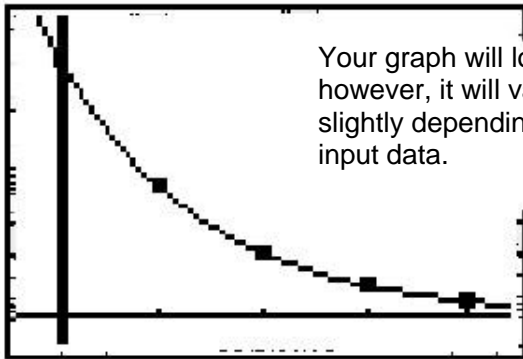
To find the best fit graph:

Press STAT ; Press CALC ; Press 0 (ExpReg); The word "ExpReg" will appear on your screen. Press ENTER . You will see the following screen:

ExpReg
$y = a * b^x$
$a = 5$
$b = .$
$r^2 = .$
$r = -$

The values which will appear here will vary depending on your input data.

Press Y=; Press VARS ; Press 5 (Statistics); arrow over to EQ and Press 1(RegEq). This will return you to the Y= screen with an exponential equation. Press GRAPH .



Your graph will look similar; however, it will vary slightly depending on your input data.

1. What is your exponential equation? (Look back at the Y= and round to the nearest hundredth). \_\_\_\_\_

2. What is the mathematical model for this exponential decay?  
\_\_\_\_\_

3. Explain why your equation does/does not match the mathematical model.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. What would allow your exponential equation to approach the mathematical model? \_\_\_\_\_  
\_\_\_\_\_

Performance Assessment

Student Response Sheet

Exponential Growth and Decay Functions

1. Identify the following equations as exponential growth or decay.

a.  $y = 3^x$  \_\_\_\_\_

b.  $y = (1/2)^x$  \_\_\_\_\_

c.  $y = 2000(.97)^x$  \_\_\_\_\_

d.  $y = 20(1 + .02)^x$  \_\_\_\_\_

e.  $y = 400(1.06)^x$  \_\_\_\_\_

f. Contrast the characteristics of an equation of exponential growth versus exponential decay.

2. Your dream car costs \$42,000. You find that depreciation is 16% per year.

a. Fill out the table using the formula  $42000(1-.16)^x$  to find the car's value in future years.

years	0	2	4	6	8	10
value						

b. If you could only afford a \$20,000 car, how old would the car be when you could afford it? Explain how you determined the car's age.

3. The population of Homeword County was 16,700 in 1900 and increased at a rate of 9% per year until 1950.
- What is the equation that best fits this situation. List the steps you used to find the equation.

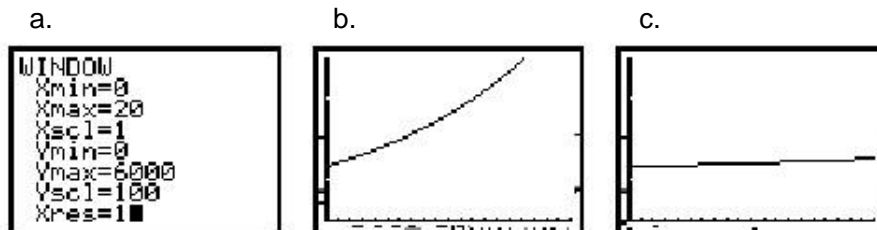
b. Fill out the table showing the population growth every 10 years.  
 HOMEWORD COUNTY

year	1900					
x						
population						

- If during the next 10 years there is a population boom and the population increases at a rate of 15%, find the population for 1960.
  - 2,939,723
  - 2,872,292
  - 5,023,656
  - 5,443,922,506

4. The artwork of an aging artist is appreciating at a rate of 7% a year. A new painting costs you \$2000.
- Write an equation for the given situation.

b. Using your graphing calculator, graph your equation and choose the best graph.



- Using your table function, how much is your painting worth after 5 years?

d. When will your painting have doubled in value?

e. If the artist dies after 5 years and because of his death his artwork now appreciates at 20% a year, how much will it be worth after 10 more years?

- a. \$12,383.47
- b. \$30,814.04
- c. \$6,979.99
- d. \$17,368.44

f. Fifteen years after you purchased the painting, it's discovered that the artist is a phony and his work now depreciates at a rate of 50% per year. What is the value of your painting after 15 more years? Explain how you determined the painting's value.

