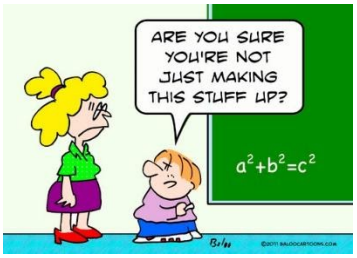
Unit 9: Exponential

Lesson 3:

Linear vs. Exponential Systems & Linear –Quadratic & Quad/ Exponential.

Objectives:

- Do Now:
  - Linear vs. Exponential
- Practice



Focus Questions:

- I can use the calculator to examine and analyze functions.
- I can solve systems of linear, exponential and quadratic functions in real-life applications graphically.
  - Quadratics
- Guided practice

Agenda:

- How can I use the calculator to graph functions in real life applications?
- How can I use the calculator to find a table of values of two functions?
- How can I use the calculator to find the output for a specific input in two functions?
- How can I use the calculator to find POI?

Vocabulary:

- System of equations
- **Point of Intersection (POI)**

Homework: HW 9-3: Systems

Quiz next block on lesson 1 and lesson 2

Warm up: Work with a partner.

Recall that linear functions have a constant **average rate of change (slope)**. That's, of course, why they have a constant amount added for every constant change in x. Let's examine the average rate of change for an increasing exponential.

Exercise #4: The exponential function $f(x)=4(2)^x$ is shown partially in the table below. Find the average rate of change over the various intervals given. This should be relatively simple because $\Delta x = 1$.

$m = \frac{\Delta y}{\Delta x}$

x	0	1	2	3	4
y	4	8	16	32	64

(a) $0 \le x \le 1$ $m = \frac{8-4}{1-0} = \frac{4}{1}$

(b) $1 \le x \le 2$ $m = \frac{16-8}{2-1} = \frac{8}{1}$

(c) $2 \le x \le 3$ $m = \frac{32-16}{3-2} = \frac{16}{1}$

(d) $3 \le x \le 4$ $m = \frac{64-32}{4-3} = \frac{32}{1}$

(e) What is clearly happening to the average rate of change as x gets larger?

y-values are multiplied by 2.

2) A population of fruit flies is growing at a constant rate of 6% per hour. The population at t = 0, with 28 flies.

$\frac{6}{100} = 0.06$

A) Find a formula that models the population P, as a function of the time in hours t & Identify the parameters of the scenario:

$P(t) = ab^t$, $P(t) = 28(1+0.06)^t$ (b)

B) What is the value of P(24), explain the meaning of the output ~~in the~~ context of the problem.

$P(24) = 28(1.06)^{24} = 113.37 \approx 113$

C) State the range of the population function over the domain interval $0 \le t \le 24$

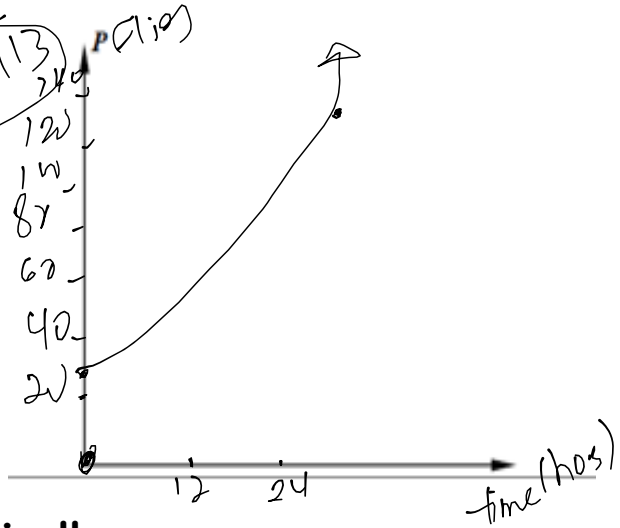
$y = 28(1.06)^x$

x	y
0	28
24	113.37

$28 \le y \le 113$

D) Using the graphing calculator, sketch a graph of this function over the interval

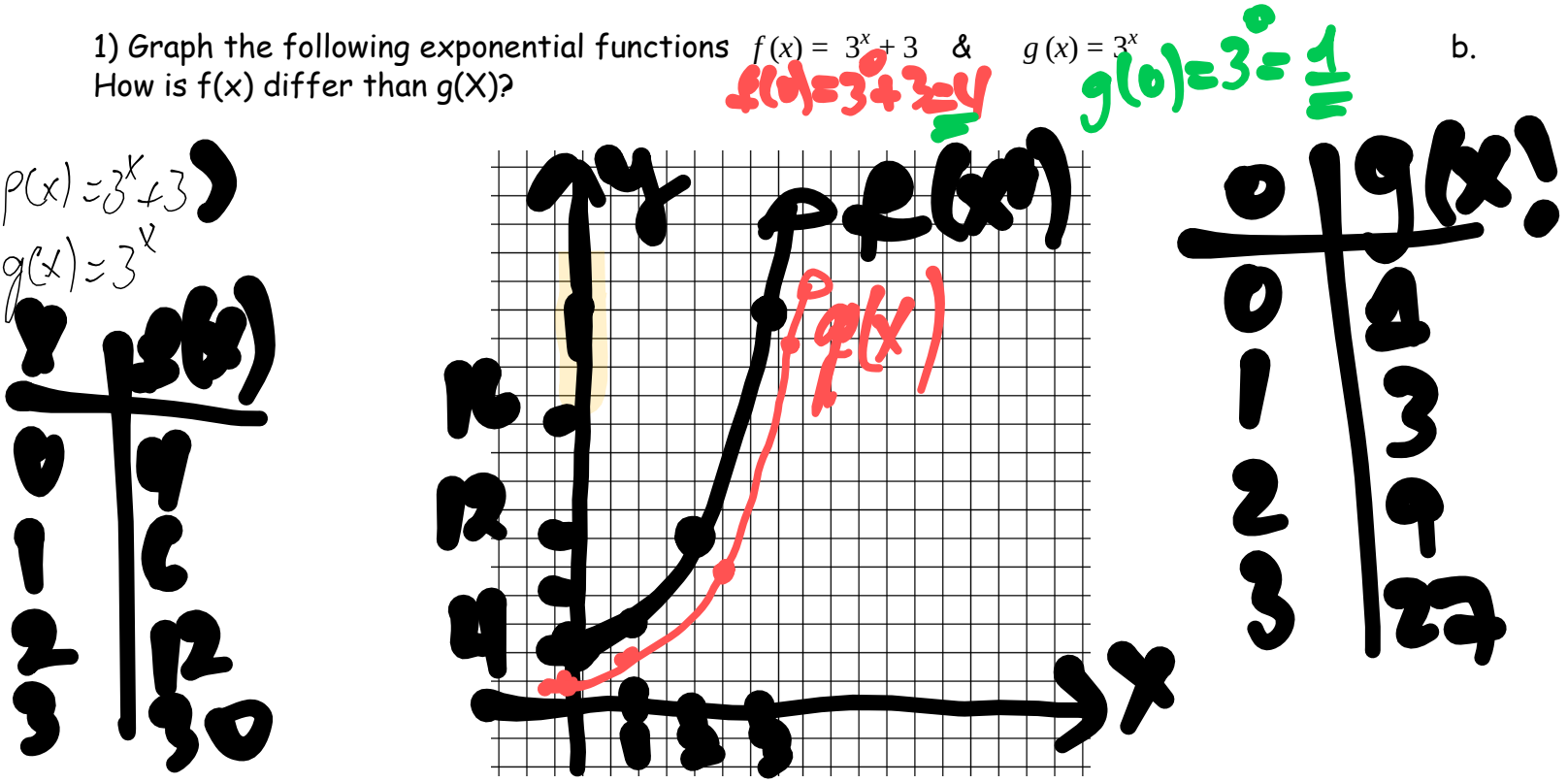
$0 \le t \le 24$ *and* $0 \le P \le 120$



Notes: Day 3: Systems of Equations graphically:

A system of equations is a set of two or more equations with the same variables, graphed in the same coordinate plane.

1) Graph the following exponential functions $f(x) = 3^x + 3$ & $g(x) = 3^x$ b. How is f(x) differ than g(X)?

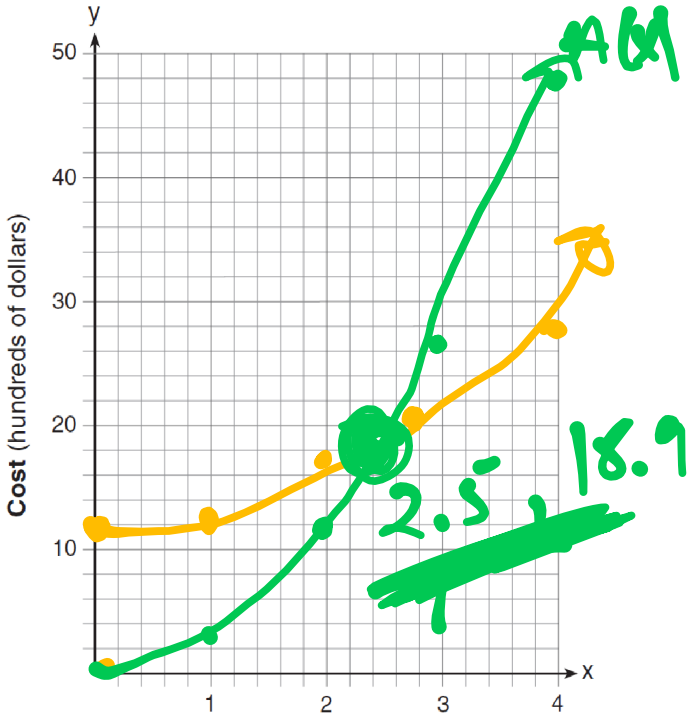


2)A company is considering building a manufacturing plant. They determine the weekly production cost at site *A* to be $A(x) = 3x^2$ while the production cost at site *B* is $B(x) = 12(\frac{6}{5})^x$, where *x* represents the number of products, *in hundreds,* and *A*(*x*) and *B*(*x*) are the production costs, *in hundreds of dollars*

a. Graph the production cost functions on the set of axes below and label them site *A* and site *B*.

b. State the positive value(s) of x for which the production costs at the two sites are equal. Explain how you determined your answer.

x	A(x)	B(x)
0	0	12
1	3	14.4
2	12	17.28
3	27	
4	48	



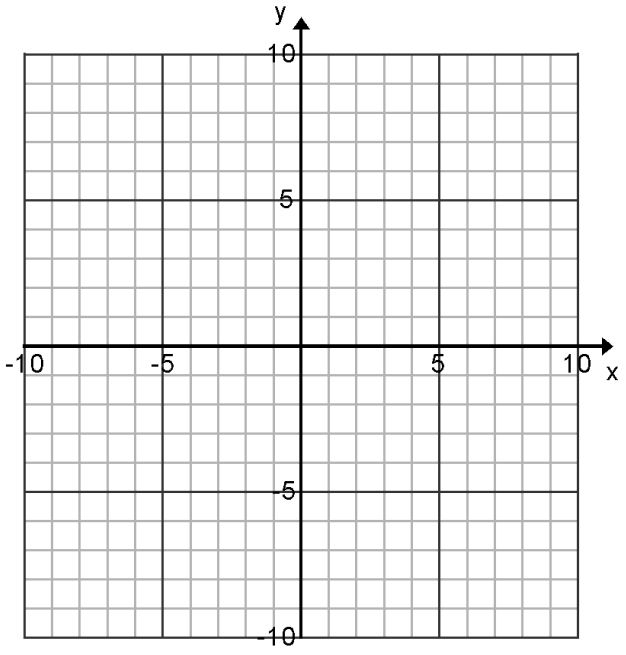
c. If the company plans on manufacturing 20 products per week, which site should they use? Justify your answer.

Exercise #2: If the savings in a bank account can be modeled by the function $S(t) = 250(1.045)^t$. Which of the following is true?

(1) The initial amount deposited was \$250 and the interest earned is 45%.
(2) The initial amount deposited was \$2.50 and the interest rate is 4.5%.
(3) The initial amount deposited was \$250 and the interest rate is 4.5%.
(4) The initial amount deposited was \$2.50 and the interest rate is 45%.

Homework:9-3 Name: _____ Date: _____

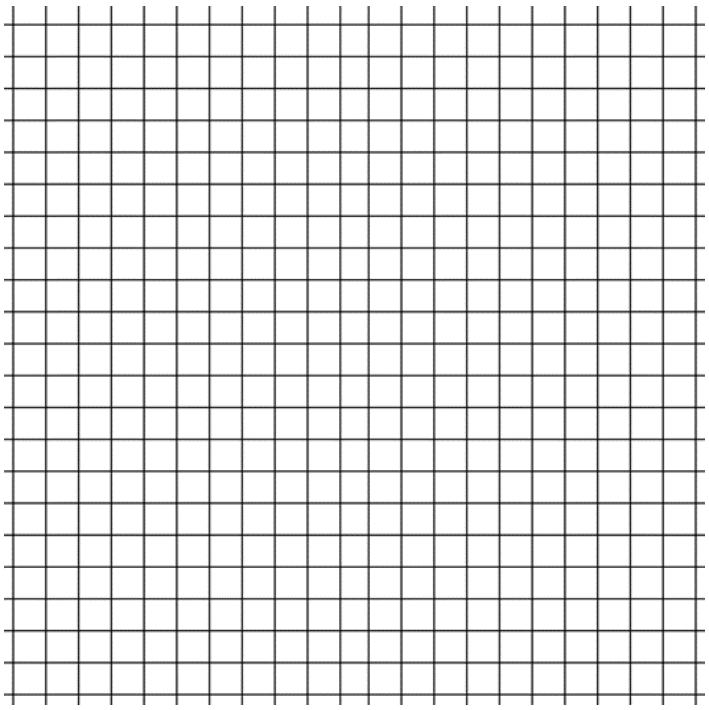
1. Let $f(x) = -.5x^2$ and $g(x) = 2x - 4$. On the set of axes below, draw the graphs of both functions. Then determine and state all values of x for which f(x) = g(x).



2) A manufacturing plant. They determine the weekly production cost at site *A* to be

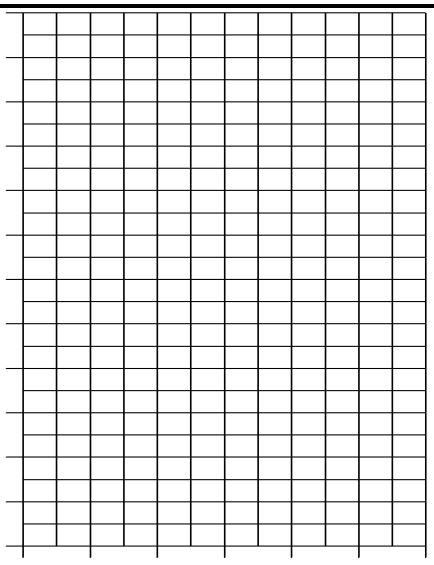
$A(x) = 4x^2$ while the production cost at site *B* is $B(x) = 4(2)^x$, where *x* represents the number of products, *in hundreds,* and *A*(*x*) and *B*(*x*) are the production costs, *in hundreds of dollars*.

d. Graph the production cost functions on the set of axes below and label them site A and site B. Include a table of values.



e. State the positive value(s) of x for which the production costs at the two sites are equal. Explain how you determined your answer.

3Use a graphing calculator to graph the function $y = 3(2)^x$. Does this function model exponential growth or decay? Justify your answer. **Over integral [0, 3]**



Which scenario represents exponential growth?

(1) A water tank is filled at a rate of 2 gallons/minute.

(2) A vine grows 6 inches every week.

(3) A species of fly doubles its population every month during the summer.

(4) A car increases its distance from a garage as it travels at a constant speed of 25 miles per hour.

List the four major formulas that you must make flash cards for: Hint☺

Rate of change	Growth and Decay
Simple interest	Compound interest

Extras:

(e)

x	0	1	2	3	4
y	16	20	25	$31\frac{1}{4}$	$39\frac{1}{16}$

Type: _____

Equation: _____

(f)

x	0	1	2	3	4
y	180	160	140	120	100

Type: _____

Equation: _____

2) Systems of Quadratic and Exponential functions:

2)Solve the following system <u>graphically</u> when

$f(x) = g(x)$

$f(x) = x^2 + 2x - 8$

$g(x) = 2^x - 7$