Warm-up

Friday, April 3, 2015

1. What transformations were applied to the cubic function that resulted in the function $f(x) = -2(x+4)^3 - 7$?

2. Find the vertex of the function $f(x) = -(x+3)^2 - 5$?

3. Find the vertex of the function $f(x) = 2x^2 + 13x - 7$

4. A virus has struck the Charlotte area and is turning people into zombies. You were just infected with the virus. If you infect 2 people every hour. How many people will be infected with the virus in 10 hours?

10
9
8
7
6
5
4
3
2
1

Let's map out the zombie question

Hour	People Infected	Zombies	Exponentially
0		1	1×2^0
1		2	1×2^1
2		4	1×2^2
3		8	1×2^3
4		16	1×2^4
5		32	1×2^5
6		64	1×2^6
7		128	1×2^7
8		256	1×2^8
9		512	1×2^0
10		1024	1×2^0

Objectives

Use the formulas for exponential growth and decay to solve real world problems.

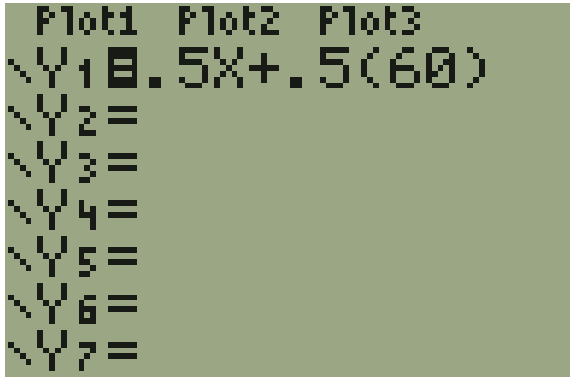
Calculate financial investment outcomes using periodic and continuously compounding interest formulas.

Homework

Packet Page 7-10, all even problems

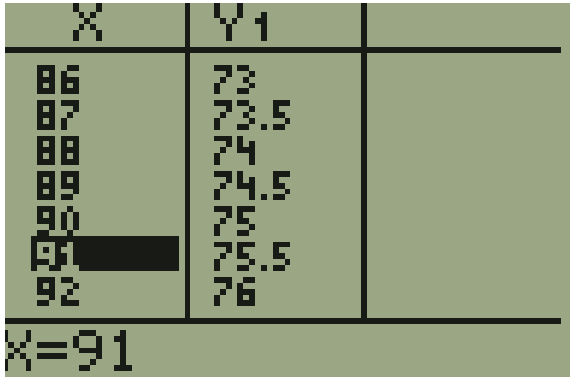
To figure out how your Q3 grade will impact your final grade…

Put this formula in y=
The number in ( ) should be your Q3 grade.



Now go to the table. [2nd][GRAPH]

Look for the grade you want in y1. The corresponding x value is the grade you need to earn this quarter to get that grade.



A	100-93
B	92-85
C	84-77
D	76-70
F	Below 70, Failing

What does an exponential function look like?

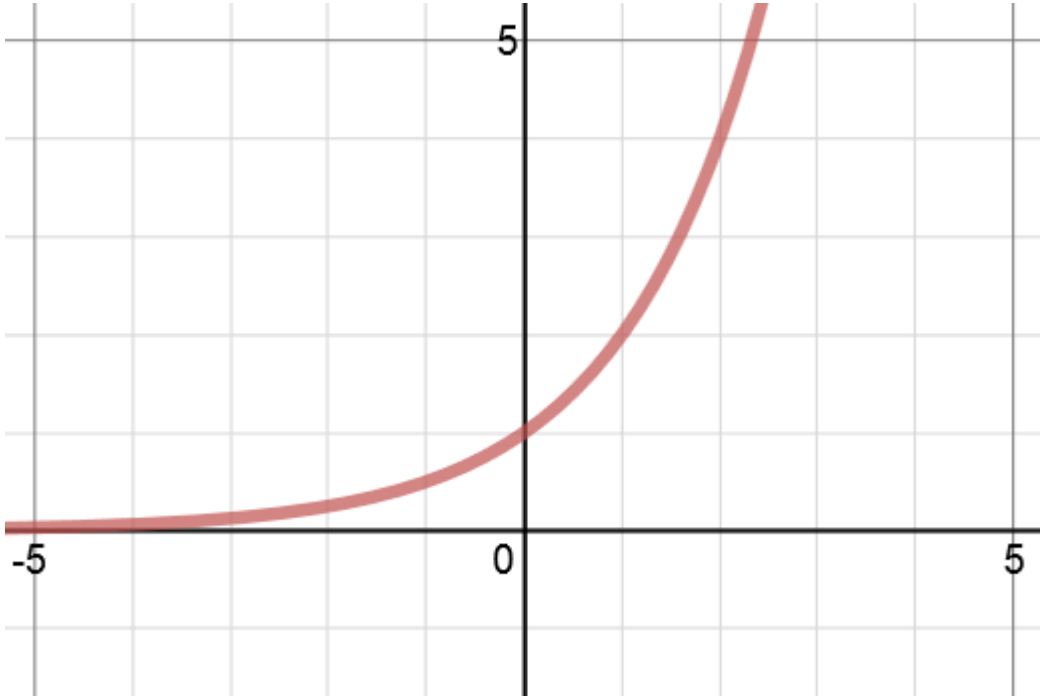
$y = ab^x$

$a > 0$ and $b > 0$

y intercept, $(0,a)$

Domain is all real numbers

Range $(0, \infty)$



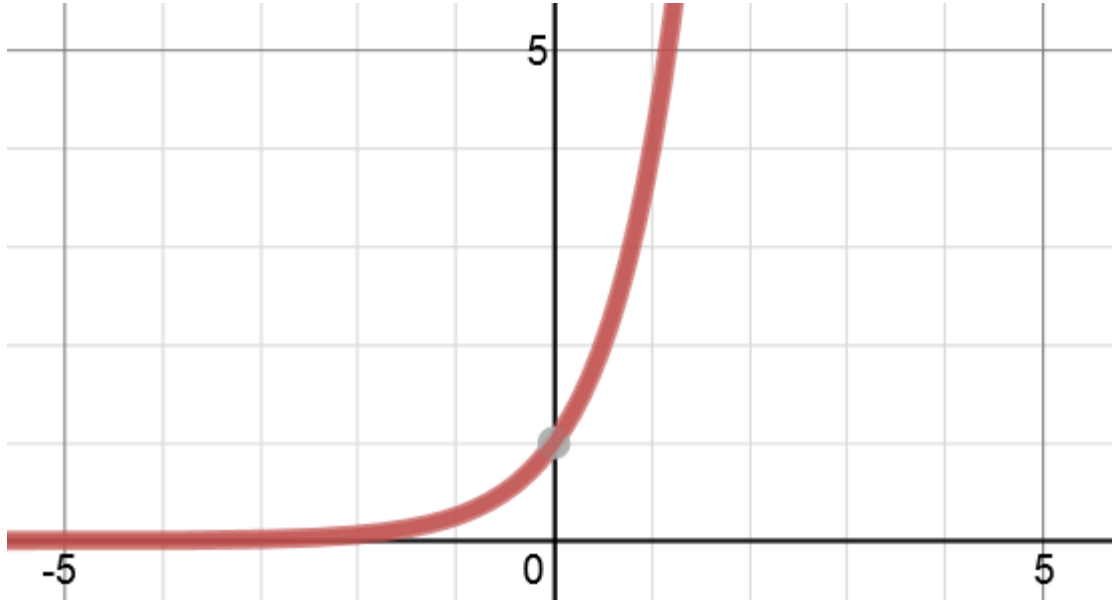
So what is **a** for the function pictured in the graph?

The value of **b** determines if the function models exponential growth or decay.

If **b > 1** then the model represents **growth**.

$y = 4^x$

X	Y
0	1
1	4
2	16
3	64
4	128

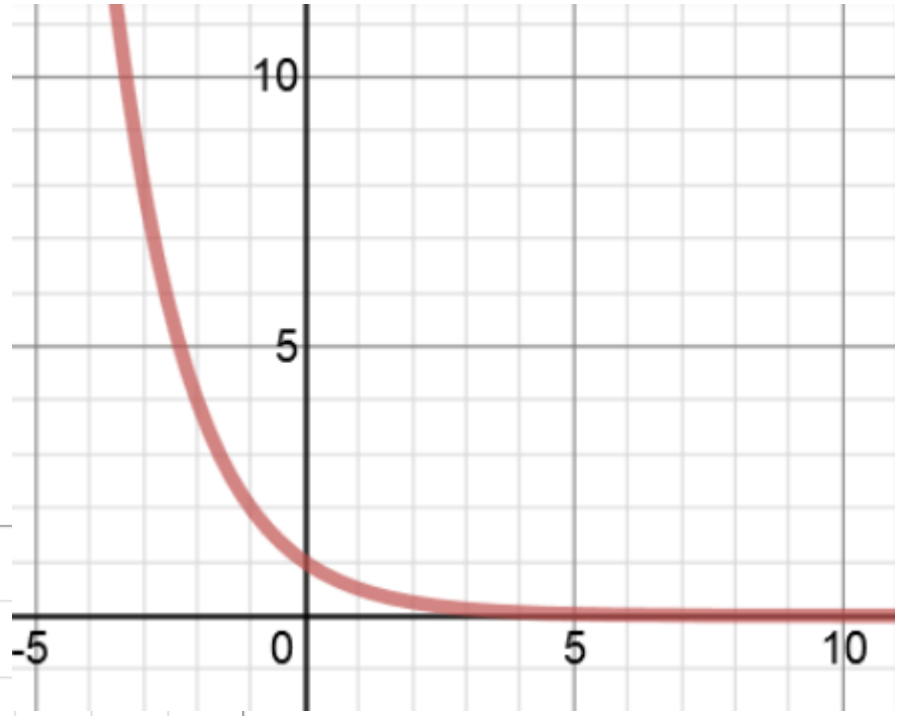


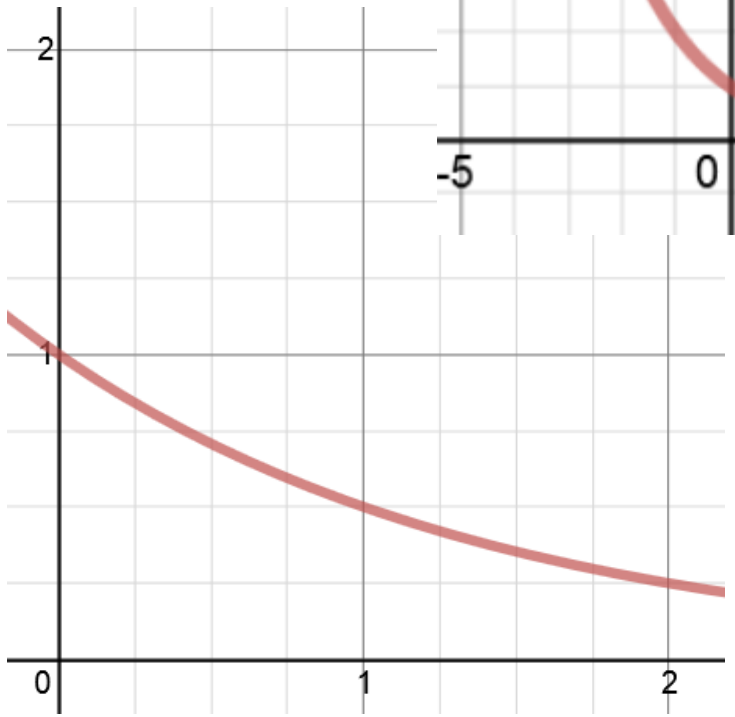
The value of b determines if the function models exponential growth or decay.

If 0 < b < 1 then the model represents **decay**.

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

X	Y
0	1
1	½
2	¼
3	$^1/_8$
4	$^1/_{16}$



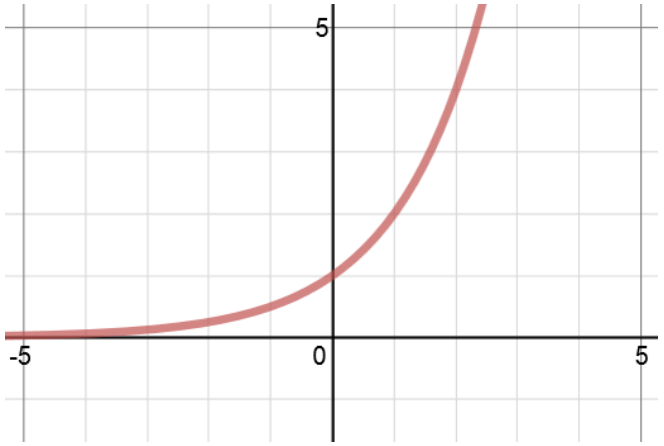


But how does **a** affect the function?

$$y = ab^x$$

When we talk about growth and decay, a is what we start with.

y intercept, (0,**a**)



Initial investment

Starting populating

Let's use what we know to analyze the following exponential equations.

	1. $y = 4^x$	2. $y = (½)^x$	3. $y = 2(3)^x$
Growth or decay?	**Growth**	**Decay**	**Growth**
Y intercept?	**(0,1)**	**(0,1)**	**(0,2)**
Model starting Value?	**1**	**1**	**2**

Let's use what we know to analyze the following exponential equations.

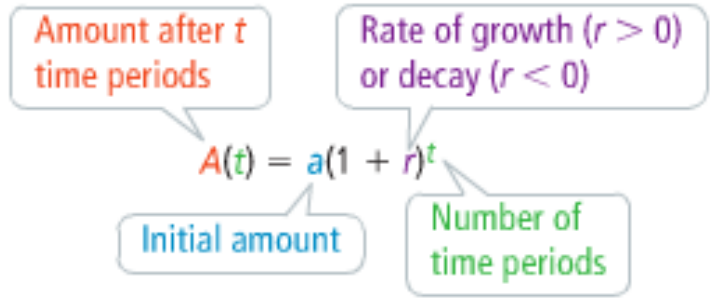
	1. $y = 12(0.95)^x$	2. $y = 0.25(2)^x$	3. $y = 3(4)^x$
Growth or decay?	**Decay**	**Growth**	**Growth**
Y intercept?	**(0,12)**	**(0,0.25)**	**(0,3)**
Model starting Value?	**12**	**0.25**	**3**

When we model real world applications of exponential functions we use the following formula.

take note

Key Concept Exponential Growth and Decay

You can model exponential growth or decay with this function.



For growth or decay to be exponential, a quantity changes by a fixed percentage each time period.

These formulas are on page 1 of your study guide. Simple Interest Growth and Decay.

You invested $1000 in a savings account at the end of the 6^{th} grade. The account pays 5 percent annual interest. How much money will be in the account after 6 years?

Our model: $A(t) = a(1+r)^t$

Where A(t) is What we're trying to find

a is $1000

r is 5%, .05 in decimal form

t is 6, the number of years invested

$A(t) = 1000(1+.05)^6$

$= \$1,340.10$

Zombies can multiply at an alarming rate when each zombie creates one new zombie every hour by biting anything moving on the neck. How many zombies will we have at the end of one day?

Our model: $A(t) = a(1+r)^t$

Where	A(t) is	Zombies at the end of the day.
	a is	1
	r is	100 percent, written as 1
	t is	24 hours

$A(t) = 1(1+1)^{24}$

$= 16,777,216$

Complete problems 1-8 on the Exponential Growth and Decay Word Problems worksheet.

You can work with the person sitting next to you or individually.

Eight random students will be selected to present their solution to the class.

In the previous problems, you were calculating simple interest. BUT, banks don't calculate interest at the end of the year. Banks may pay interest monthly, quarterly or continuously.

We use a slightly different formula when we calculate compound interest.

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

Where	$A(t)$ is	The amount of money we end up with
	P is	The amount of money we start with
	r is	The rate written as a decimal *(80% is written as 0.8)*
	t is	The number of years the money is invested
	n is	The number of times interest is paid in each year

Congratulations! You won $1000 from the local quick pick. You want to put it away in a savings account for 3 years. Should you invest it with **Wells Fargo who pays 4% and compounds monthly**? Or should you invest with **Bank Of America who pays 4.5% and compounds quarterly**?

Wells Fargo

$A(t) = P(1+{}^{r}/_{n})^{nt}$

P is 1000

r is .04

t is 3

n is 12

A(t) = $1127.27

Bank Of America

$A(t) = P(1+{}^{r}/_{n})^{nt}$

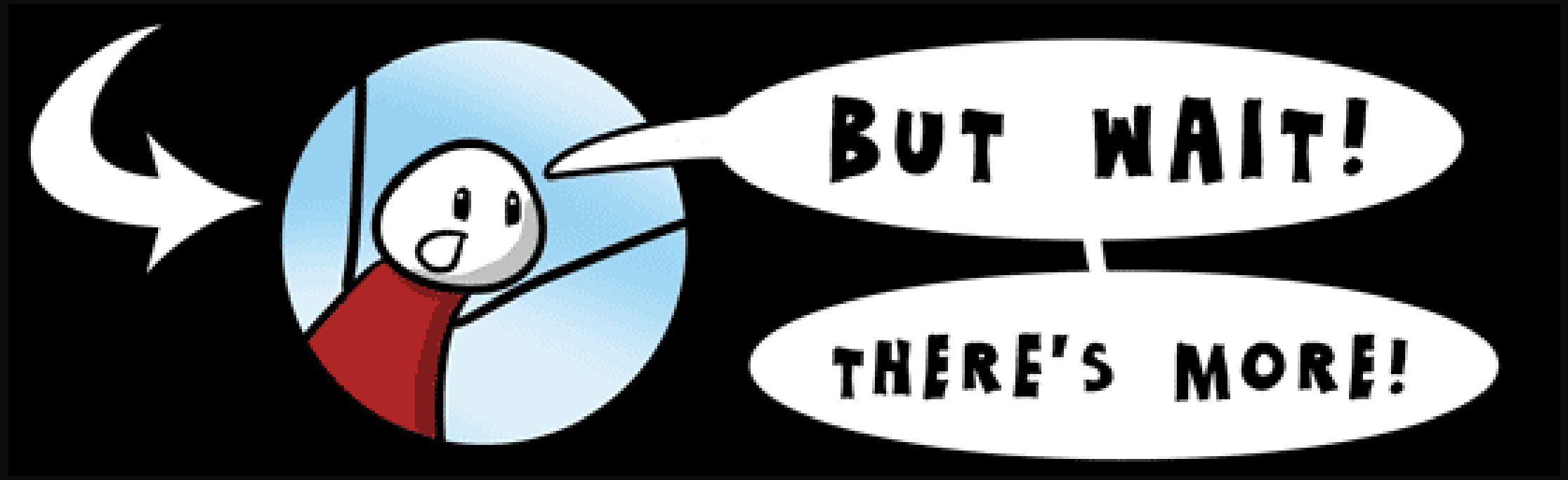
P is 1000

r is .045

t is 3

n is 4

A(t) = $1143.67



Yet another way to earn interest….

Continuously Compounded Interest

You already know about two special numbers $\boldsymbol{i}$ and $\boldsymbol{\pi}$. There's yet another one you need to know about; Euler's number, $\boldsymbol{e}$.

$$i = \sqrt{-1}$$

$$\pi \cong 3.14 \ldots$$

$$e \cong 2.71 \ldots$$

This number is used when interest is compounded continuously (or an infinite amount of times) within a time period.

Continuously Compounded Interest

We've been using this formula…

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

For continuously compounded interest, we use this formula…

$$A(t) = Pe^{rt}$$

Where $\boldsymbol{P}$ is the original investment, $\boldsymbol{r}$ is the interest rate (decimal) and $\boldsymbol{t}$ is time.

You invest $2500 in a savings account at First National Bank of Davis which pays 4% interest compounded continuously. If you keep the money in the account for 10 years, how much money will you end up with?

This word tells us to use this formula.

$$A(t) = Pe^{rt}$$

$$A(t) = 2500e^{(.04)(10)}$$

$$A(t) = 3729.56$$

Complete the remaining
Exponential Growth and Decay Word Problems
worksheet.