Precalc 11.2
Graph exponential functions and inequalities
Solve problems involving exponential growth and decay

Activity:

M&M activ

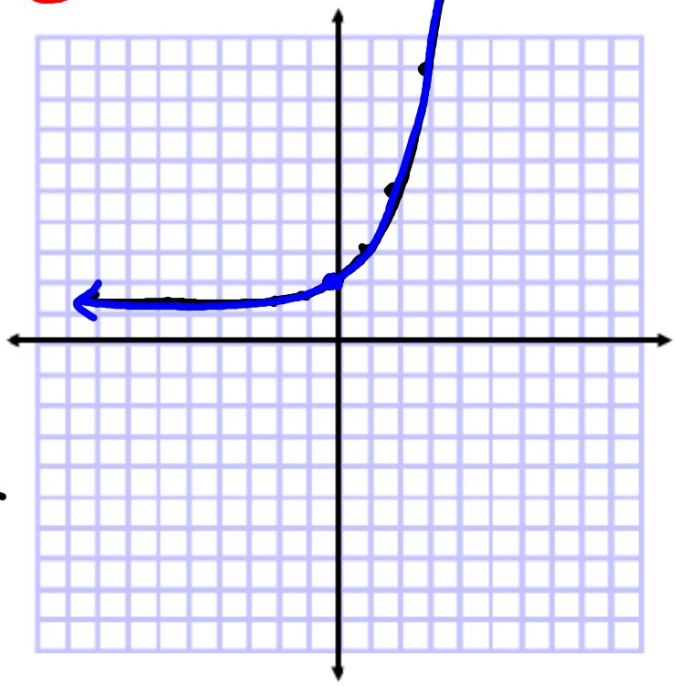
Trial # x	# m&m's face up	# to add	total y
1			2
2			4
3			6
4			10
5			14
6			21
7			37
8			56
9			88
10			123
11			

$y = 2^x + 1$

x	y
0	1
1	2
2	4
3	8
-1	$\frac{1}{2}$
-2	$\frac{1}{4}$

2^{-1}

2^{-2}



Desmos

GRAPHING CALCULATOR EXPLORATION

TRY THESE **Graph $y = b^x$ for $b = 0.5$, 0.75, 2, and 5 on the same screen.**

1. What is the range of each exponential function?
2. What point is on the graph of each function?
3. What is the end behavior of each graph?
4. Do the graphs have any asymptotes?

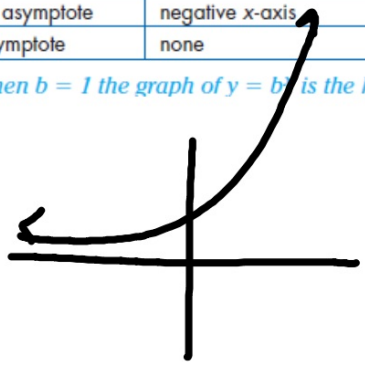
WHAT DO YOU THINK?

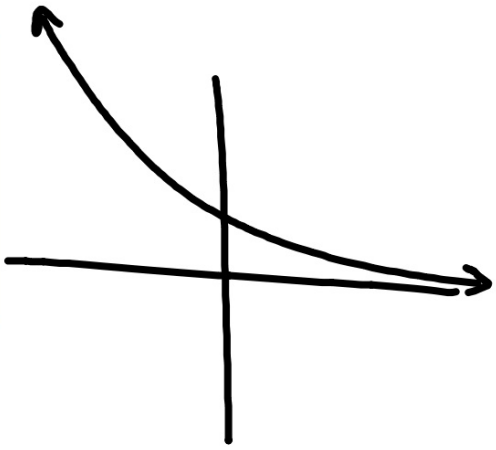
5. Is the range of every exponential function the same? Explain.
6. Why is the point at (0, 1) on the graph of every exponential function?
7. For what values of a is the graph of $y = a^x$ increasing and for what values is the graph decreasing? Explain.
8. Explain the existence or absence of the asymptotes in the graph of an exponential function.

P 705

Characteristics of graphs of $y = b^x$		
	$b > 1$	$0 < b < 1$
Domain	all real numbers	all real numbers
Range	all real numbers > 0	all real numbers > 0
y-intercept	(0, 1)	(0, 1)
behavior	continuous, one-to-one, and increasing	continuous, one-to-one, and decreasing
Horizontal asymptote	negative x-axis	positive x-axis
Vertical asymptote	none	none

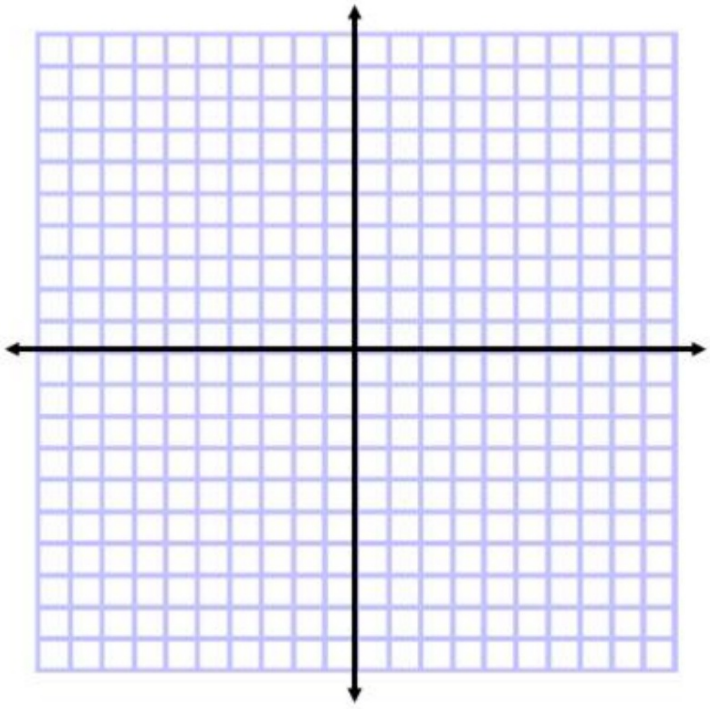
When $b = 1$ the graph of $y = b^x$ is the horizontal line $y = 1$.



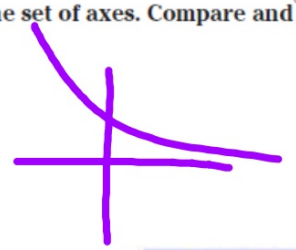


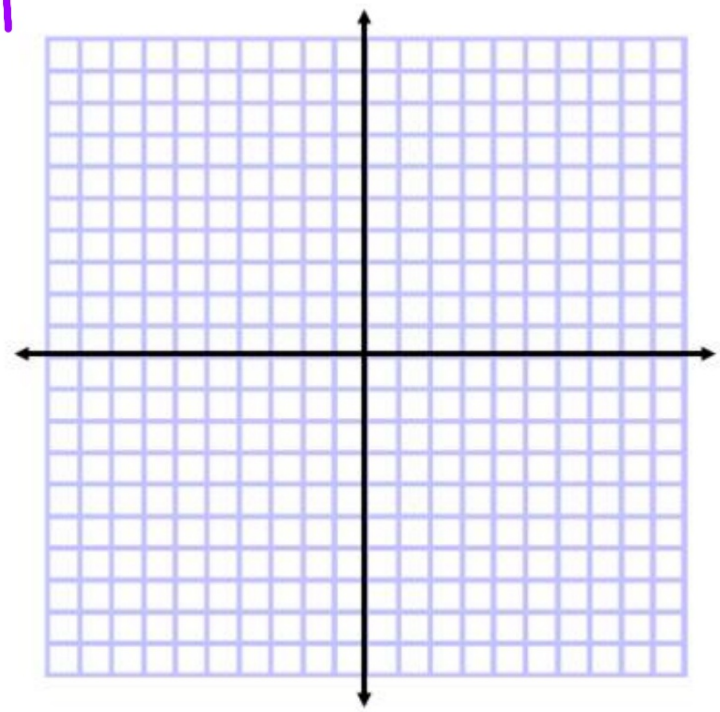
b>0 (will always be real)

1 a. Graph the exponential functions $y = 4^x$, $y = 4^x + 2$, and $y = 4^x - 3$ on the same set of axes. Compare and contrast the graphs.



b. Graph the exponential functions $y = \left(\frac{1}{5}\right)^x$, $y = 6\left(\frac{1}{5}\right)^x$, and $y = -2\left(\frac{1}{5}\right)^x$ on the same set of axes. Compare and contrast the graphs.





Exponential Growth or Decay	The equation $N = N_0(1 + r)^t$, where N is the final amount, N_0 is the initial amount, r is the rate of growth or decay per time period, and t is the number of time periods, is used for modeling exponential growth or decay.

$$N = N_0(1+r)^t$$

t= number of time periods (days, hours, years, etc.)

Compound Interest	The compound interest equation is $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where P is the principal or initial investment, A is the final amount of the investment, r is the annual interest rate, n is the number of times interest is paid, or compounded each year, and t is the number of years.

monthly

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

t=years

4 **FINANCE** Determine the amount of money in a money market account providing an annual rate of 5% compounded daily if Marcus invested $200 and left it in the account for 7 years.

0.05 → r

365 → n

T

P

$$A = 200\left(1+\frac{0.05}{365}\right)^{365\cdot 7}$$

$$= 200\left(1.000137\right)^{(2555)}$$

$$= 200\left(1.419\right) = \$283.81$$

11-28

Let's say your grandparents invested money (stock market) for you on the day you were born:
- earns 12% interest compounded daily
- you never add or take any out of the account
- they want you to be a millionaire on your 65th birthday

How much did they need to invest?