Honors 1 Name: ____________________________________

Chapter 7 Notes

7.1 – Applying Exponent Product Properties

Lead-In: In 2003, the US Department of Agriculture (USDA) collected data on 10^3 bee colonies. If each colony contains 10^4 bees, how many bees did the USDA include in their study?

Exponents are used to communicate repeated ________________________________

a^2	a^3	$a^2 \cdot a^3$
$6n^3 \cdot 2n^7$	$(3pt^3)(p^3t^4)$	**Product of Powers Rule**

Power of Powers Property

$(x^2)^3$	$(y^3)^5$	**Power of Power Property**

Example: **Simplify** $[(2^3)^2]^4$.

A 2^{24} **B** 2^{12} **C** 2^{10} **D** 2^9

Power of a Product Property

$(6x)^4$	$(4m^2n)^3$	**Power of Product Property**

Challenging Ones!!!

$((x^2y)^6)^5$	$(3xy^4)^2[(-2y)^2]^3$

7.2 – Applying Exponent Properties Involving Quotients, Negative Exponents and Zero Exponents

Lead-In: To measure the brightness (luminosity) of a star, we measure how much power it puts out, in watts. Our Sun produces 10^{26} W, and Canopus has a luminosity of 10^{30} W. How many times more power does Canopus produce?

$\frac{a^5}{a^3}$	*Example*:	**Quotient of Powers Rule**

All Exponent Properties

$a^m \cdot a^n = a^{m+n}$	$(a^m)^n = a^{mn}$	$(ab)^m = a^m b^m$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\frac{a^m}{a^n} = a^{m-n}$

Examples

$\frac{5^3 \cdot 5^5}{5^2}$	$\left(\frac{2a^4b^3}{ab^2}\right)^2$	$\frac{2s^3t^3}{st^2} \cdot \frac{(3st)^3}{s^2t}$

a. Tabular Fill in the table from left to right

Power	3^4	3^3	3^2	3^1	3^0	3^{-1}	3^{-2}	3^{-3}	3^{-4}
Value									

Negative and Zero Exponents

$a^0 =$

$a^{-n} =$

$\frac{1}{a^{-n}} =$

What about $\frac{1}{4^{-1}}$?

Example

Method 1 $\frac{-8x^2y^8z^{-5}}{12x^4y^{-7}z^7} = \left(\frac{-8}{12}\right)\left(\frac{x^2}{x^4}\right)\left(\frac{y^8}{y^{-7}}\right)\left(\frac{z^{-5}}{z^7}\right)$ $= \left(\frac{-2}{3}\right)(x^{2-4})(y^{8-(-7)})(z^{-5-7})$	Method 2 $\frac{-8x^2y^8z^{-5}}{12x^4y^{-7}z^7}$	$\frac{(5pr^{-2})^{-2}}{(3p^{-1}r)^3}$	$\left(-\frac{3xy^4z^2}{x^3yz^4}\right)^0$

7.3 – Rational Exponents

$\left(\sqrt{5}\right)^2 =$, so $\sqrt{5}$ is equal to 5 to what power?

What if this was the cube root of 5?

What if this was the nth root of 5?

KeyConcept $b^{\frac{1}{2}}$

Words	For any nonnegative real number b, $b^{\frac{1}{2}} = \sqrt{b}$.
Examples	$16^{\frac{1}{2}} = \sqrt{16}$ or 4 $\quad 38^{\frac{1}{2}} = \sqrt{38}$

KeyConcept $b^{\frac{1}{n}}$

Words	For any positive real number b and any integer $n > 1$, $b^{\frac{1}{n}} = \sqrt[n]{b}$.
Example	$8^{\frac{1}{3}} = \sqrt[3]{8} = \sqrt[3]{2 \cdot 2 \cdot 2}$ or 2

Write each in radical form or with an exponent.	Simplify and state the answer.
$25^{\frac{1}{2}}$ $\qquad 2\sqrt{x}$	$\sqrt[3]{27}$ $\qquad \sqrt[5]{32}$

If we can do fractions like 1/2, 1/3, and 1/4, how do we interpret exponents with other fractions?

$64^{\frac{2}{3}}$

$36^{\frac{3}{2}}$

KeyConcept $b^{\frac{m}{n}}$

Words	For any positive real number b and any integers m and $n > 1$, $b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m$ or $\sqrt[n]{b^m}$.
Example	$8^{\frac{2}{3}} = \left(\sqrt[3]{8}\right)^2 = 2^2$ or 4

Example: Putting all the pieces together.

$(8^2)^{2/3}$	$(81^{1/4})^{-2}$	Solve for x. $9^x = 27$

7.5 Day 1 – Write and Graph Exponential Growth Functions

Lead – In : You have $10 in a bank account and are given each of the following options:

a) $50 will be added to the account each week

b) The account will double each week

Which is the better deal after 4 weeks? After 6 weeks?

Weeks	0	1	2	3	4	5	6
$							

Weeks	0	1	2	3	4	5	6
$							

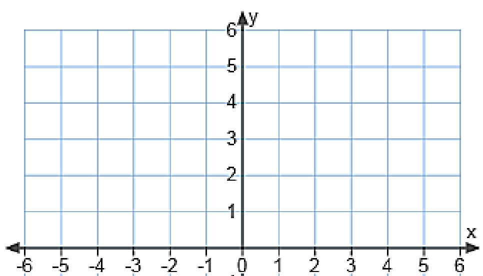
Example: Write an equation for the function.

x	-2	-1	0	1	2
y	-4	-1	2	5	8

x	-2	-1	0	1	2
y	2	4	8	16	32

Example: Graph the function $y = 2^x$ and identify the domain and range. Note: $y = 2^x = 1(2^x)$

x	y
-2	
-1	
0	
1	
2	

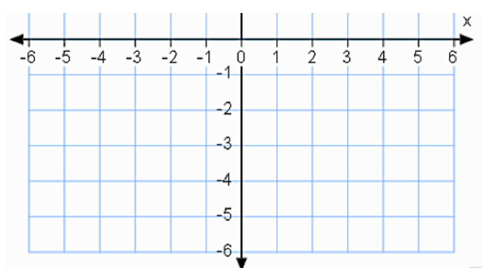


Domain:

Range:

Example: Graph the function $y = -4(1.5)^x$ and identify the domain and range.

x	y
-2	
-1	
0	
1	
2	



Domain:

Range:

Example: The function $C = 179(1.029)^t$ models the amount of soda, in billions of liters, consumed in the world, where t is the years after 2000.

a) What does the y-intercept represent in this context?

b) What are realistic domain and ranges?

c) Use the equation to estimate the amount of soda consumed throughout the world this year.

Exponential Growth Functions

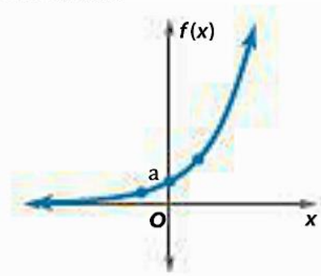
Equation: $f(x) = ab^x$, $a > 0$, $b > 1$

Domain: ____________ **Range:** __________

y-intercept: __________ **x-intercept:** ______

End behavior: as x increases, $f(x)$ ___________

as x decreases, $f(x)$ ___________________



7.5 Day 2 – Write and Graph Exponential Decay Functions

Lead-In: Take a piece of yarn 1yd long and cut it in half. Continue this process.

Stage	Number of Pieces	Length of Each Piece
0	1	1
1		
2		
3		
4		

a) Write a function for the number of pieces at stage *x*.

b) Write a function for the length of each piece at stage *x*.

Example: Write the equation for the exponential function.

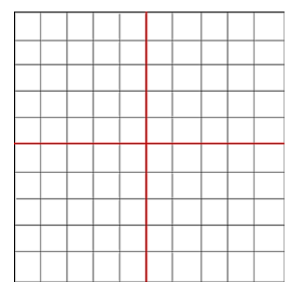
x	-2	-1	0	1	2
y	32	16	8	4	2

Exponential Growth Functions: Ex:

Exponential Decay Functions: Ex:

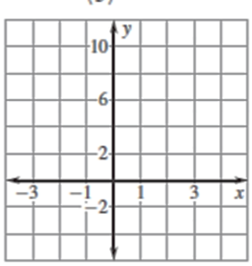
Example:

Graph $f(x) = 2\left(\frac{1}{2}\right)^x$ and $g(x) = 2(2)^x$ on the graph to the right and compare.



Example: Graph and state the domain and range of each.

$y = 2 \cdot \left(\frac{1}{5}\right)^x$

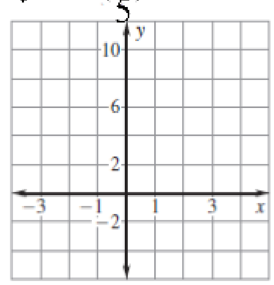


x			0		
y					

Domain:

Range:

$y = 2(\frac{1}{5})^x - 3$



x			0		
y					

Domain:

Range:

Example: Determine whether the set of data shown below displays exponential behavior. If so, write an exponential equation. If not, explain why not.

x	-2	-1	0	1	2
y	−4/3	−4	-12	-36	-108

x	-2	-1	0	1	2
y	−18	−12	-6	0	6

x	-4	-2	0	2	4
y	1/16	1/4	1	4	16

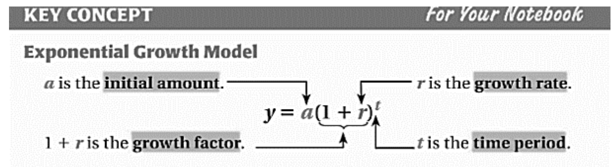
7.6 – Growth and Decay Equations

Modeling Population Growth

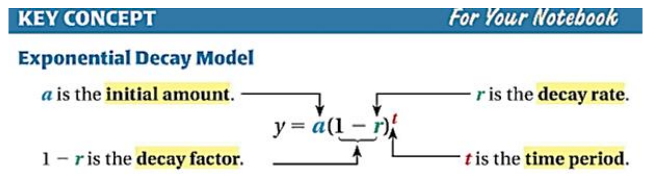
The population of Helena in the year 2000 was 23,000. The U.S. Census Bureau found that the population then increased, on average, by 2% each year. What was the population in 2005?

Year	0	1	2	3	4	5
Population						

Example: An investor places $250,000 in an account that earns 4% interest each year. How much will it be worth in 5 years?



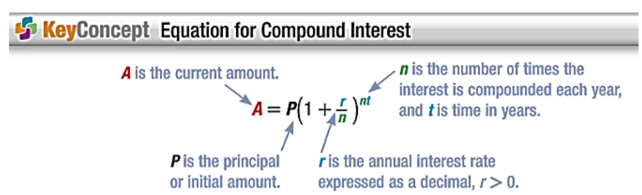
Decay Example: A car is purchased for $18,996. The car depreciates at a rate of 15% per year. After 6 years, the owner is offered $7500 for it. Is this a fair deal?



Exponential Situations Example: Write a formula for each situation.

A rare coin is purchased from a dealer at a value of $300. The value of the coin increases 7.5% each year.	There is originally 5.4 grams of a radioactive element that decays at a rate of 4.69% per year.	In 1850, there were 20 million bison in the United States, but they began to decline by 2% each year.

Compound Interest:



Example: Re-answer the savings account example from above if the interest is compounded:

Monthly:

Daily:

Example: Match the graph to its equation.

$y = 2(0.2)^x$

$y = 2(0.8)^x$

$y = (1.5)^x$