Exponential Functions

Objective: SWBAT

- Classify an exponential function as representing exponential growth or exponential decay
- Determine the multiplier for exponential growth and decay
- Write and evaluate exponential expressions to model growth and decay situations

Language Objective: SWBAT use a table to classify the characteristics of linear, quadratic and exponential functions regarding their respective exponents and bases

Agenda

1) Take out **HW** to be checked
2) **Do Now** - Linear, Quadratic or Exponential?
3) **Classify** - with Table
4) **Expert Posters** - Worksheet #2
   -solve assigned problem
   - make a poster
   - Finish worksheet #2
5) **Exit Ticket**

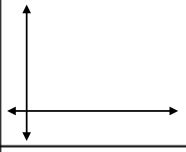
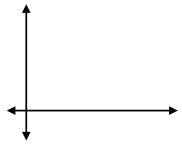
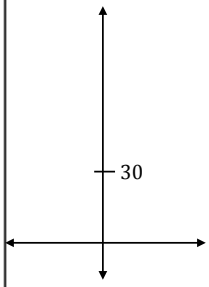
HW: "Day 3 Homework" worksheet

Do Now:

Determine if linear (L), quadratic (Q) or exponential (E).

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

Classify:

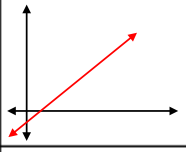
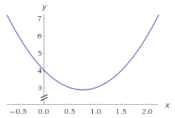
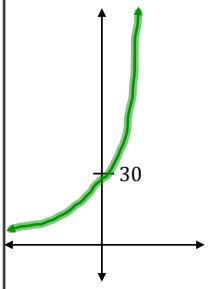
Equation Type	Base	Highest exponent	Example	Sketch
Linear			$f(x) = 2x - 4$	
Quadratic			$f(x) = 2x^2 - 3x + 4$	
Exponential			$f(x) = 30(1.04)^x$	

Do Now:

Determine if linear (L), quadratic (Q) or exponential (E).

1. $y = (x-2)(x+2)$	2. $y = 2 + 2x + 2^x$	3. $y = \frac{1}{2}x - 2x + 2^{-1}x$
Quadratic	*Exponential*	*Linear*

Classify:

Equation Type	Base	Highest exponent	Example	Sketch
Linear	x	1	f(x) = 2x – 4	
Quadratic	x	2	$f(x) = 2x^2 - 3x + 4$	
Exponential	Number 0<b<1 *or* b>1 (i.e. 2, 4, 5.8, 0.79… etc.)	x	$f(x) = 30(1.04)^x$	

WORKSHEET #2

Practice with growth and decay word problems Name _____

For all problems, identify the key parts of an exponential grow/decay word problem (that is, the initial value, the value of n, and the base you will use). Then write the equation and find the solution.

1. You have a cell culture of 2 cells that triples in population every 30 minutes. What is the cell population after 8 hours?

2. You have a bacterial cell culture of 10,000 cells and each hour the population is two-thirds of what it was. (The company is testing a new antibiotic.) After 1 day, how many bacterial cells are left?

3. You are studying a fungus that is spreading at the rate of 5% an hour. If the initial growth consisted of 100 cells, how many cells are there after 10 hours?

4. You are treating a bacterial growth with a new medication. You begin with 10,000 cells and your medication reduces the population by 8% an hour. After 12 hours, how many cells do you have?

5. The population of NNHS was 1800 students in 2009. If the city assumes a growth rate of 1.5% a year over the next 5 years, what will be the enrollment in 2014?

6. Caffeine is eliminated from the blood stream of a child at the rate of about 25% per hour. Assume a child drinks a soft drink with 30 milligrams of caffeine after school (at 3 o'clock). How much caffeine is still in his system by 9 o'clock that night?

7. An adult eliminates caffeine at the rate of 15% and hour. If an adult has a soda at 3 o'clock, how much caffeine remains by 9 o'clock?

8. If you have $4000 in a savings account that pays 4.5% interest a year, how much money will you have after 5 years?

9. If you buy a car for $23,000 and the car depreciates in value at an average rate of 15% a year, what is your car worth after 6 years?

10. You invest $10,000 in an account that is earning 5% a year. Your brother invests $5000 in an account that is earning 10% a year. Who has more money at the end of 10 years?

Score: _____/7 Name _____

Exit Ticket

Determine if linear (L), quadratic (Q) or exponential (E).

1. $y=(x-3)(x+5)$	2. $y=5+7x+2^x$	3. $y=3x-.05x+2x$

4. (5) The population of NNHS was 1800 students in 2009. If the city assumes a growth rate of 1.5% a year over the next 5 years, what will be the enrollment in 2014?

Score: _____/7 Name _____

Exit Ticket

Determine if linear (L), quadratic (Q) or exponential (E).

1. $y=5x-.25x+2x$	2. $y=(x-4)(x+3)$	3. $y=7+9x+2^x$

4. (9) If you buy a car for $23,000 and the car depreciates in value at an average rate of 15% a year, what is your car worth after 6 years?

Score: _____/7 Name _____

Exit Ticket

Determine if linear (L), quadratic (Q) or exponential (E).

1. $y=(x-3)(x+5)$	2. $y=5+7x+2^x$	3. $y=3x-.05x+2x$
Quadratic	***Exponential***	***Linear***

4. (5) The population of NNHS was 1800 students in 2009. If the city assumes a growth rate of 1.5% a year over the next 5 years, what will be the enrollment in 2014?

$$(1800)(1.015)^5 \approx 1{,}939.11 \approx 1{,}939 \text{ students}$$

Score: _____/7 Name _____

Exit Ticket

Determine if linear (L), quadratic (Q) or exponential (E).

1. $y=5x-.25x+2x$	2. $y=(x-4)(x+3)$	3. $y=7+9x+2^x$
Linear	***Quadratic***	***Exponential***

4. (9) If you buy a car for $23,000 and the car depreciates in value at an average rate of 15% a year, what is your car worth after 6 years?

$$(23000)(0.85)^6 \approx \$8{,}674.44$$

Day 3 Homework:

Practice Problems

1) The population of Brazil was about 162, 661,000 in 1996 and was projected to grow at a rate of 7% per decade.

a) Write a formula that represents the population after n years:_____

b) Use this to estimate the population in 2026:_____

c) Estimate the population in 2041:_____

d) Estimate what the population was in 1946:_____

2) A vitamin is eliminated from the bloodstream at a rate of about 20% per hour. The vitamin reaches a peak level of 300 milligrams.

a) Write a formula to determine the amount of vitamin remaining in the bloodstream after n hours:

_____

b) Estimate how much remains after 2 hours:_____

c) Estimate how much remains after 7 hours:_____

3) Find the multiplier for each rate of exponential growth or decay:

a) 7% growth:_____ b) 11.3% growth:_____ c) 20% decay:_____

d) 0.6% growth:_____ e) 6.25% decay:_____ f) 0.7% decay:_____

4) Predict the population of bacteria for each situation and time period. Start by writing a general equation

a) 55 bacteria double every hour. Equation: $A = 55(2)^n$

3 hours:_____ 5 hours:_____

b) 33 E. coli bacteria double every 30 minutes. Equation:_____

1 hour:_____ 6 hours:_____

c) 225 bacteria *triple* every hour Equation:_____

2 hours:_____ 3 hours:_____

Day 3 Homework:

Practice Problems

1) The population of Brazil was about 162, 661,000 in 1996 and was projected to grow at a rate of 7% per decade.

a) Write a formula that represents the population after n years: $(162{,}661{,}000)(1.07)^{(n/10)}$

b) Use this to estimate the population in 2026: $(162{,}661{,}000)(1.07)^{3} \approx$ **199,266,719 ppl**

c) Estimate the population in 2041: $(162{,}661{,}000)(1.07)^{4.5} \approx$ **220,551,714 ppl**

d) Estimate what the population was in 1946: $(162{,}661{,}000)(1.07)^{5} \approx$ **228,140,467 ppl**

2) A vitamin is eliminated from the bloodstream at a rate of about 20% per hour. The vitamin reaches a peak level of 300 milligrams.

a) Write a formula to determine the amount of vitamin remaining in the bloodstream after n hours: $(300)(0.80)^{n}$

b) Estimate how much remains after 2 hours: $(300)(0.80)^{2} =$ **192 mg**

c) Estimate how much remains after 7 hours: $(300)(0.80)^{7} =$ **62.91 mg**

3) Find the multiplier for each rate of exponential growth or decay:

a) 7% growth: **1.07** b) 11.3% growth: **1.113** c) 20% decay: **0.80**

d) 0.6% growth: **0.06** e) 6.25% decay: **0.9375** f) 0.7% decay: **0.93**

4) Predict the population of bacteria for each situation and time period. Start by writing a general equation

a) 55 bacteria double every hour. Equation: $A = 55(2)^{n}$

3 hours: **440** 5 hours: **1,760**

b) 33 E. coli bacteria double every 30 minutes. Equation: $33(2)^{n}$

1 hour: **132** 6 hours: **135,168**

c) 225 bacteria *triple* every hour Equation: $225(3)^{n}$

2 hours: **2,025** 3 hours: **6,075**

Day 3 Homework continued...

Vocabulary
in the context of
Compound Interest.

Directions: Look up the following vocabulary words until you can and fill in the appropriate number into the definition.

Simple Interest = _____

Compound Interest = _____

Annually = _____ time / year

Semi-annually = _____ times / year

Quarterly = _____ times / year

Monthly = _____ times / year

Weekly = _____ times / year

Bi-weekly = _____ times / year

Daily = _____ times / year

Day 3 Homework continued...

Vocabulary
in the context of
Compound Interest.

Directions: Look up the following vocabulary words until you can and fill in the appropriate number into the definition.

Simple Interest = _____*interest payable only on the principal*_____

Compound Interest = _____*interest paid on both the principal and on accrued interest.*_____

Annually = _____*1*_____ time / year

Semi-annually = _____*2*_____ times / year

Quarterly = _____*4*_____ times / year

Monthly = _____*12*_____ times / year

Weekly = _____*52*_____ times / year

Bi-weekly = _____*104*_____ times / year

Daily = _____*365*_____ times / year