Exponential Relations – Unit 3

Tentative TEST date_____

Reflect – previous TEST mark _____, Overall mark now_____.
Looking back, what can you improve upon?

Learning Goals/Success Criteria

Use the following checklist to help you determine what you know well and where you need additional review.

DAYS & Pages	Can you…	No, I cannot. I need to learn this.	I kind of get it. I don't get the right answers very often.	I get it. I could work on being more consistent.	Yes, I can. I have perfected this!
Day 1 Pg 2-3	Apply the exponent laws (multiplication, division, power of power, zero and negative exponent)?	☐	☐	☐	☐
Day 2 Pg 4-5	Recognize an exponential relation from a table of values?	☐	☐	☐	☐
	Recognize an exponential relation from a graph?	☐	☐	☐	☐
	Recognize an exponential relation from an equation?	☐	☐	☐	☐
Day 3 Pg 6-7	Graph an exponential relation given an equation or a table of values?	☐	☐	☐	☐
	Calculate the common ratio for an exponential equation (growth or decay factor)?	☐	☐	☐	☐
	Understand the difference between exponential growth and exponential decay?	☐	☐	☐	☐
	Create an equation for an exponential relationship?	☐	☐	☐	☐
Day 4 Pg 8-9	Answer questions about exponential relationships in the context of real-life questions using a graph, table of values or equation?	☐	☐	☐	☐
	Use information from a real-life situation to model a quadratic relation (create an equation or graph or table of values)?	☐	☐	☐	☐
Day 5 Pg 10-12	REVIEW				

DAY 1 – Exponent Laws

1. Write each as a single power and then evaluate if possible.

a. $14^{7} \times 14^{8} \div 14^{13}$	b. $5^{35} \div \left(5^{26} \times 5^{7}\right)$	c. $\left(\frac{4^{9}}{4^{6}}\right)^{3}$
d. $\frac{16^{15}}{16^{12} \times 16^{2}}$	e. $2^{6} \times 2^{9} \div 2^{14}$	f. $3^{72} \times 3^{2} \div 3^{72}$
g. $\left(\frac{6^{14}}{6^{13}}\right)^{7} \div 6^{5}$	h. $\left(\frac{2^{14}}{2^{12}}\right)^{3} \times \left(\frac{2^{9}}{2^{8}}\right)^{2}$	i. $\left(x^{4} \div x^{2} \times x^{3}\right)^{2}$

2. State each as a power with a positive exponent.

a. 3^{-2}	b. 5^{-3}	c. $\left(\frac{1}{2}\right)^{-8}$

3. State each as a power with a negative exponent.

a. $\frac{1}{100}$	b. $\frac{1}{2^{9}}$	c. 25

4. Write each as a single power and then evaluate if possible.

a. $3^6 \div 3^9$	b. $\left(2^{-2}\right)^3$	c. $\left(13^4 \div 13^{10}\right)^0$
d. $\dfrac{5^8}{5^6 \times 5^4}$	e. 10^{-1}	f. $3^{-2} + 9^0$
g. $4^0(6+9)$	h. $8^2 \times 4^{-3}$	i. $\left(x^4 \div x^0 \times x^{-3}\right)^{-2}$

More Practice:

1. $8^{-3} \times 8^{-6}$
2. $5^7 \div 5^{10}$
3. $10^{-7} \times 10^7$
4. $(4x^2)(-2x^3)$
5. $(3a^{-2})^{-1}$
6. $\left(\dfrac{1}{3^{-2}}\right)^2$
7. $\left(\dfrac{2}{5}\right)^{-2}$
8. $(10x^5) \div (5x^2)$
9. $(2y^3)^2(y^{-3})$
10. $(-5x^6)^0$

DAY 2 – Characteristics of Exponential Relations

1. Use the mathematical models to determine whether the relation is exponential. Give a reason for each answer.

a.

$$y = 9x^3$$

yes / no ?

Reason: _____

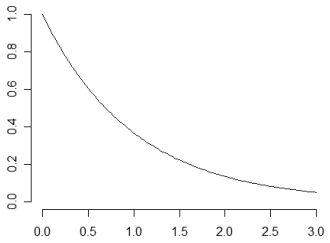
b.

x	*y*	1st Ratios
1	4	
2	16	
3	64	
4	256	
5	1024	

yes / no ?

Reason: _____

c.



yes / no ?

Reason: _____

d.

$$y = 6^x$$

yes / no ?

Reason: _____

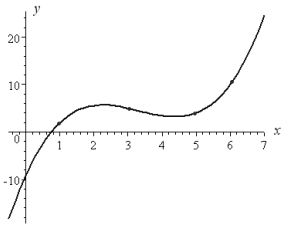
e.

x	*y*	1st Ratios
−2	0.5	
−1	1	
0	2	
1	4	
2	8	

yes / no ?

Reason: _____

f.



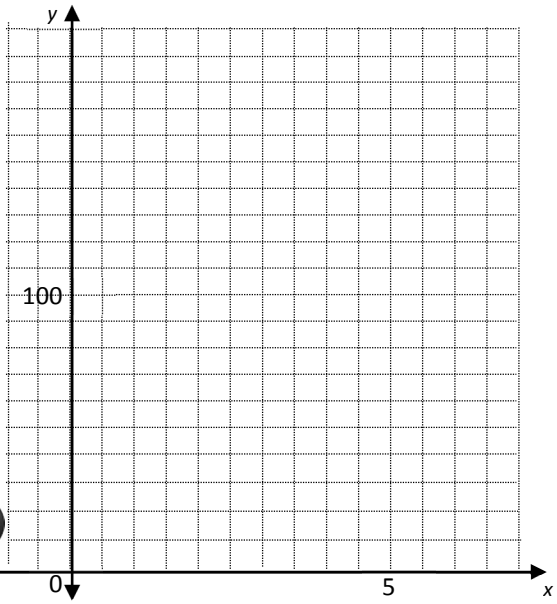
yes / no ?

Reason: _____

2. A pressure reader is used to measure the sound intensity of a bell. The relation $P = 200(0.5)^t$ estimates the sound pressure, *P*, in pascals, after *t* seconds.

a. Complete the table and sketch a graph for this relation.

t	$200(0.5)^t$	*P*	1st Ratios
0			
1			
2			
3			
4			



b. Is this relationship exponential.
Give a reason for your answer.

3. On a television game show, the cash prizes were designed to resemble exponential growth. The prizes are listed below.
   a. Show that these cash prizes do not actually grow exponentially.
   b. Make a new table of 15 cash prizes that do grow exponentially. Start at $100.

$100	
$200	
$300	
$500	
$1000	
$2000	
$4000	
$8000	
$16 000	
$32 000	
$64 000	
$125 000	
$250 000	
$500 000	
$1 000 000	

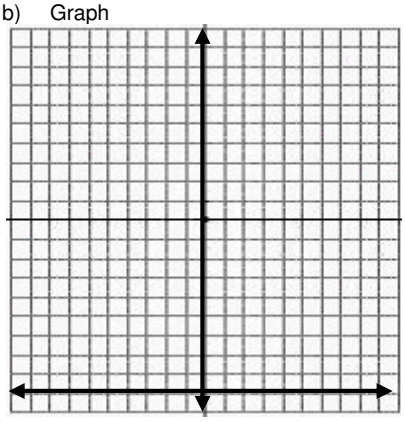
   c. Which game show would you like to participate on? Why?

4. A club uses email to contact its members. The chain starts with 2 members who each contact three more members. Then those six members each contact 3 members, and so the contacts continue.

a)

x part of chain	y number of members contacted	1st ratios.
0	2	
1		

b) Graph



c) State the x and y intercepts

DAY 3 – Exponential Relationships

1. Sketch each of the following exponential relations on the grid provided.

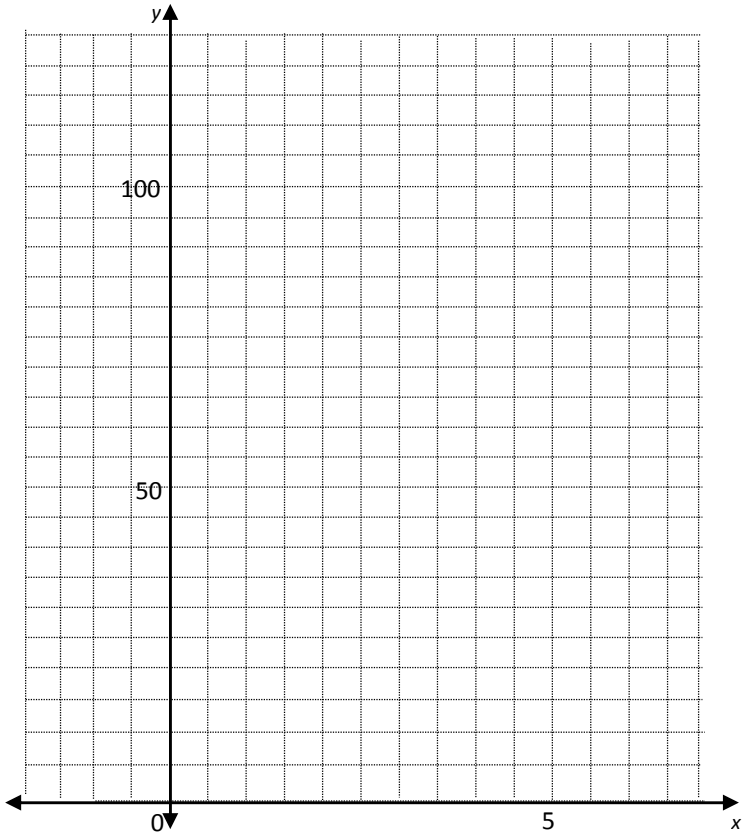
   a. $y = 5^x$ b. $y = 2^x$ c. $y = \left(\frac{1}{2}\right)^x$ d. $y = \left(\frac{1}{5}\right)^x$

x	5^x	y
–1	5^{-1}	$\frac{1}{5}$=0.2
0		
1		
2		
3		

x	2^x	y
–2		
0		
2		
4		
6		

x	$\left(\frac{1}{2}\right)^x$	y
–2		
–1		
0		
1		
2		

x	$\left(\frac{1}{5}\right)^x$	y
–2	$\left(\frac{1}{5}\right)^{-2} = \frac{1^{-2}}{5^{-2}} = \frac{5^2}{1^2}$	25
–1		
0		
1		
2		



2. Consider each graph from #1. How does the value of the base in each exponential relationship indicate what the graph will look like? Create a rule.

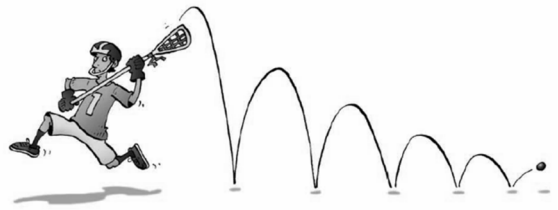
3. For each exponential relationship,

	Day / **# of Fruit Flies** / **1st ratios** 0 / 30 / 1 / 120 / 2 / 480 / 3 / 1920 /	**Number** / **Area** / **1st ratios** 0 / 500 / 1 / 100 / 2 / 20 / 3 / 4 /
a. state whether the relationship is growth or decay		
b. state the equation		

4. A rubber ball drops from a height of 200 cm and bounces several times. After each bounce, the ball rises to 80% of its previous height.

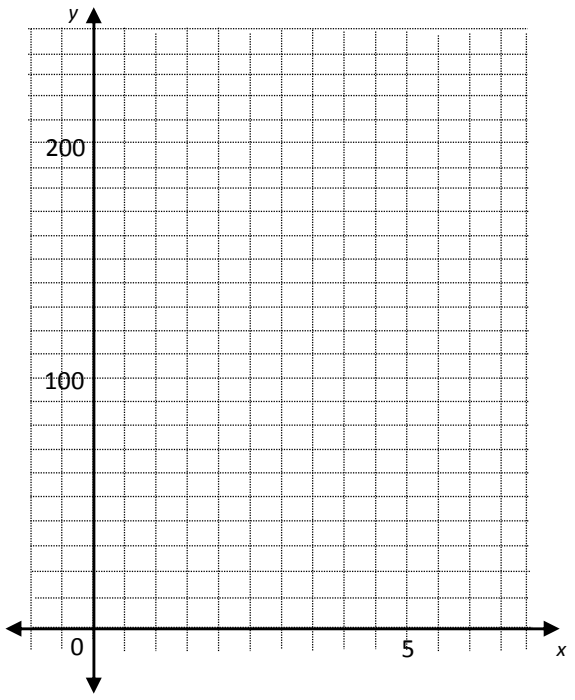
   a. Create a table of values to record the data for the first 5 bounces.

Number of Bounces	Height
0	
1	
2	
3	
4	
5	



   b. Write an equation to model the height, *h*, of the ball.

   c. Draw a graph to model the change in height of the ball.



DAY 4 – Solving Problems with Exponential Relations

1. Durham Region's Population, *P*, is projected to grow until 2031 based on the relation $P = 610\ 000(1.029)^n$, where *n* is the number of years after 1990.
   a. What does 610 000 represent?
   b. What is the growth rate?
   c. What is the projected population in 2010?
   d. What was the population in 1980?

2. A stamp has a current value of $1.50. The value is going to increase by 7% every year.
   a. Write an equation to model the relation.

   b. What was the value of the stamp 5 years ago?
   c. What is the value of the stamp in 10 years?

3. You purchased a 2010 Camaro for $35 000. The value of the Camaro decreases by 12% every year.
   a. Write an equation to model the relation.

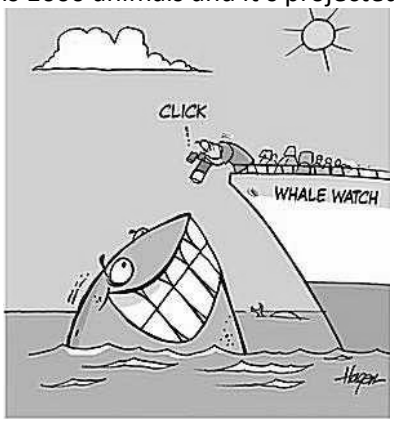
   b. What is the value of the Camaro in 3 years?
   c. What is the value of the Camaro in 7 years?

4. You purchased a $500 Canada Savings Bond. It's value is going to increase by 3% every year.
   a. Write an equation to model the relation.

   b. What is the value of the bond in 10 years?

   c. What is the value of the bond in 20 years?

5. The Beluga Whale is one of Canada's Endangered Species. It's current population is 1000 animals and it's projected to decrease by 5% every year.
   a. Write an equation to model the relation.



   b. What will the population be in 10 years?

   c. What was the population 5 years ago?

REVIEW

1. Write each as a single power and then evaluate if possible. No decimals or negative exponents!

j. $4^6 \times 4^3$	k. $\left(3^2\right)^3$	l. $7^5 \div 7^3$
m. 8^{-4}	n. $10^{-4} \div 10^{-4}$	o. $\left(2x^6y^3\right)^6$
p. $\left(x^5y^9\right)\left(x^{12}y^{-5}\right)$	q. $4^3 \times 2^{-2}$	r. $\left(x^8 \div x^7 \times x\right)^{-5}$

2. Explain how the value of the base of an exponential relation can tell you what the graph of the relation will look like.

3. Explain how to differentiate between exponential growth and decay from
   a. an equation?

   b. a table of values?

   c. a graph?

4. The amount of ASA (acetylsalicylic acid) in your bloodstream decreases exponentially with time. The following formula describes the amount of ASA in a typical patient's bloodstream in $\mu g/cm^3$ in terms of time t in hours after the peak dosage is: $A = 40(0.758)^t$
    a. What is the initial dosage of ASA in the bloodstream?

    b. At what rate does ASA decay in the bloodstream?

    c. How much ASA would be left in the patient's bloodstream after 5 hours?

5. The population of a town is 23 000. Each year, the population increases at a rate of 3.4%.
    a. Write an equation to model the relation.

    b. What was the population 10 years ago?

    c. What will the population be in 8 years?

6. The population of ticks in Yarmouth is growing by 15 % per year. Estimates put the present population at 20 000 per square kilometre.
    a. Write an equation to model this relation.

    b. Estimate the population per square kilometre in 5 years.

7. In 2011, Joel purchased a Ferrari for $120 000. The car depreciates by 4% per year.
    a. Write an equation to model this relation.

    b. Calculate the value of his Ferrari after 5 years.

    c. How much will the car depreciate in 5 years?

8. A dose of Acetaminophen is broken down by the body at a rate of 17% per hour. If Shannon takes 1000 mg at 7 am, how much Acetaminophen will remain in her system at 12 noon? (Begin by writing an equation to model the relation.)