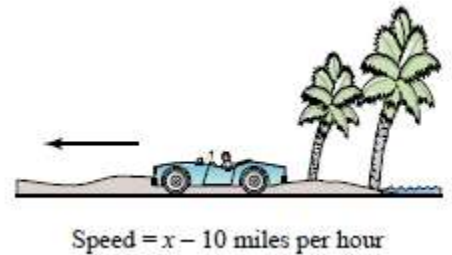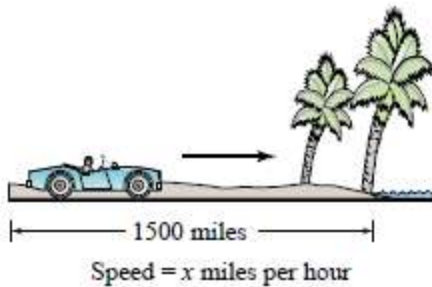Name _____ Date: _____

Algebra 2 U6D8 Graphing Exponential Equations

Warm Up

1) Susan drove 1500 miles to Daytona Beach for spring break On the way back she averaged 10 miles per hour less, and the drive back took her 5 hours longer. Find her average speed on the way to the beach. T = D/T.

1500 miles
Speed = x miles per hour

Speed = $x - 10$ miles per hour

	D	R	T	
Going	1500	x	$\dfrac{1500}{x}$	← Shorter time
Returning	1500	$x - 10$	$\dfrac{1500}{x - 10}$	← Longer time

The equation below can be used to calculate since there is a difference of 5 hours between the two times.

$$\frac{1500}{x - 10} - \frac{1500}{x} = 5$$

2) In the equation $N = 0.5(1.21)^t$, N represents the number of snowboarders in millions and t represents the number of years since 1988. Find the year in which the number of snowboarders will be exceed 10 million.

3) In an experiment a lethal pathogen is introduced into a colony of bacteria. The number of live bacteria remaining B is represented by the equation $B = 6{,}000{,}000e^{-0.16t}$, where t is time in hours since the start of the experiment.

    a) What does the number 6,000,000 represent in the above equation?

    b) What does the number -0.16 represent in the above equation?

    c) How many bacteria will remain alive be after 3 days (72 hours)?

4) The half-life of a medication is the amount of time for half of the drug to be eliminated from the body. The half-life of *Advil* or ibuprofen is represented by the equation $R = M(0.5)^{\frac{t}{2}}$, where R is the amount of Advil remaining in the body, M is the initial dosage, and t is time in hours.

    a) A 200 milligram dosage of Advil is taken at 1:00 pm. How many milligrams of the medication will remain in the body at 6:00 pm?
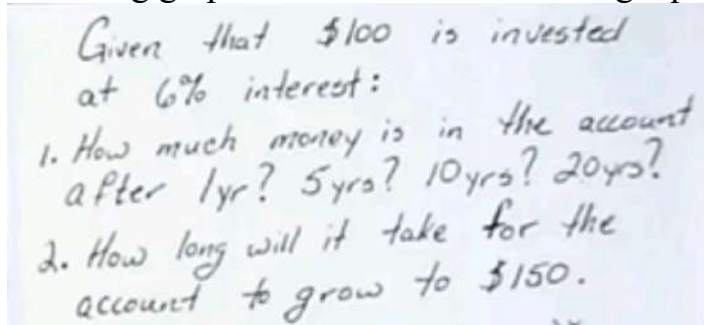
    b) What is the half-life of Advil?

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Algebra 2 U6D8 Graphing Exponential Equations

Video Lessons

Lesson 1: http://www.youtube.com/watch?v=7oO_DywrQ3U
Follow along with your calculator to answer the question below. Make sure to show work by
sketching graphs and tables and recording equations used.

Given that $100 is invested
at 6% interest:
1. How much money is in the account
   after 1yr? 5yrs? 10yrs? 20yrs?
2. How long will it take for the
   account to grow to $150.

Lesson 2: http://www.youtube.com/watch?v=4Wb-T8bcqZM
Follow along with your calculator to answer the question below. Make sure to show work by
sketching graphs and tables and recording equations used.

Use a table and a graph to solve the equation to one decimal place.
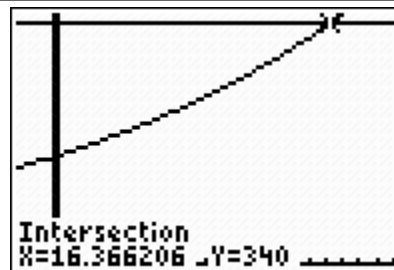
$$3^x = 57$$

Lesson 3:

. Solve for *x,* to the *nearest thousandth*:

$$150e^{0.05x} = 340$$

Proceed as in #1 & #2. Adjust the window as to see the
point of intersection of the two functions.

Answer to the nearest hundredth:

Intersection
X=16.366206 Y=340

WINDOW
Xmin=-2
Xmax=20
Xscl=1
Ymin=-1
Ymax=350
Yscl=.1
Xres=1

Directions: Show work by writing equations and sketching graphs. Also make sure to record
your window. These are notes, so make sure they are clearly labeled for future use.

4) Since January 1980, the population of the city of Brownville has grown according to the mathematical model $y = 720{,}500(1.022)^x$, where x is the number of years since January 1980.

    a) Explain what the numbers 720,500 and 1.022 represent in this model.

    b) If this trend continues, use this model to predict the when the population of Brownville will reach 1,000,000. (Round to the nearest tenth of a year.)

5) After an oven is turned on, its temperature, T, is represented by the equation $T = 400 - 350(3.2)^{-0.1m}$, where m represents the number of minutes after the oven is turned on and T represents the temperature of the oven, in degrees Fahrenheit. How many minutes does it take for the oven's temperature to reach 300°F? Round your answer to the *nearest hundredth of a minute*.

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Algebra 2 U6D8 Graphing Exponential Equations

Mixed Growth & Decay Practice

Spongebob is given a $10,000 CD for his high school graduation. Knowing that Bob would spend the money immediately his parents put the money into a very long term CD offering a 5% interest rate calculated annually.

Patrick is also given a $10,000 CD at 5% but his bank is compounding interest quarterly (4 times a year).

As incredible as it sounds Sandy Cheeks is also given a $10,000 CD at 5% but her bank is compounding interest continuously.

For each of the above write the equation representing the total value of each investment as a function of time.

Interval	Equation
Bob (Annually)	
Patrick (Quarterly)	
Sandy Cheeks (Continuously)	

Bob, Patrick, and Sandy all forget about their investment until they meet at their 50 year high school reunion. The money will come in handy since they have each just retired. Each calls their respective banks and is amazed to learn the value of their investments. How much is each of their accounts worth?

	Value after 50 Years
Bob (Annually)	
Patrick (Quarterly)	
Sandy Cheeks (Continuously)	

Directions: Create an expression that can be used to solve each problem. Then evaluate.

1. A bank account balance, b, for an account starting with s dollars, earning an annual interest rate, r, and left untouched for n years can be calculated as $b = s(1 + r)^n$ *(an exponential growth formula)*. Find a bank account balance to the *nearest dollar*, if the account starts with $100, has an annual rate of 4%, and the money left in the account for 12 years.

2. In 1985, there were 285 cell phone subscribers in the small town of Centerville. The number of subscribers **increased** by 75% per year after 1985. How many cell phone subscribers were in Centerville in 1994? (Don't consider a fractional part of a person.)

3. Each year the local country club sponsors a tennis tournament. Play starts with 128 participants. During each round, half of the players are eliminated. How many players remain after 5 rounds?

4. If you start a biology experiment with 5,000,000 cells and 45% of the cells are dying every minute, how long will it take to have less than 1,000 cells?

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Algebra 2 U6D8 Graphing Exponential Equations

Blast From the Past

Simplify the following expressions. Be sure to note any restrictions that apply.

1) $\dfrac{x+9}{x^2+7x-18}$

2) $\dfrac{x^2-4}{x^2+2x}$

Multiply or divide and then simplify your answers.

3) $\dfrac{18a^2x}{5b^3}\bullet\dfrac{-x}{27a}\bullet\dfrac{3b}{x^2}$

4) $\dfrac{-8x^3y}{-3y}\div\dfrac{(4xy)^2}{9}$

5) $\dfrac{4x-20}{4x+20}\bullet\dfrac{3x^2+30x}{3x^2-15x}$

6) $\dfrac{5xy^3-5x^2y^2}{5x^2y+5xy^2}\div\dfrac{x^2-y^2}{(x+y)^2}$

7) $\dfrac{2x^2-9x-5}{x+2}\bullet\dfrac{x^4-16}{2x^2-3x-2}\div\dfrac{25-x^2}{x+5}$

8) $\dfrac{9}{10a}+\dfrac{4a}{5b}$

9) $\dfrac{x+2}{x-1}-\dfrac{x-3}{x+1}$

10) $\dfrac{x-5}{2x-6}-\dfrac{x-7}{4x-12}$

11) $\dfrac{1}{4a^2-4a+1}+\dfrac{1-a}{1-2a}$

12) $\dfrac{3x+3}{x^2+2x+1}+\dfrac{x-1}{x^2-1}$

Solve for x in each problem below. Be sure to check each answer to see if you have any extraneous solutions.

13) $-\dfrac{x}{2}+\dfrac{3x}{4}=1$

14) $\dfrac{8x-1}{12}-\dfrac{4x+5}{4}=x$

15) $\dfrac{2x}{x-8}-\dfrac{5}{2}=\dfrac{x+8}{x-8}$

16) Kristen & Aleia take turns feeding the animals on the farm. Kristen can feed all the animals in 50 minutes. Aleia takes an hour and a half to feed the animals. How long would it take the girls if they worked together?

How long would it take if Aleia worked for 30 minutes on her own and then Kristen came to help her finish?

5. The resale value of a car can be calculated using the model $V = C(1 - R)^t$ where C is the original cost of the car, R is the rate of depreciation, t is the number of years since purchasing the car, and V is the current value of the car.

a) Knowing a car is five years old and is worth $8,000 with a depreciation rate of 12%, what was the original cost of the car?

b) Another car originally cost $32,000 and depreciates at a rate of 9% per year. How long would it take, to the nearest tenth of a year, for the car to be worth one-fourth of its original value?

Population Growth

6. A colony of 1,000 ants can increase by 15% in a month. How many ants will be in the colony after 10 months?

Mortgage

7. There is a relationship between the mortgage amount, the number of payments, the amount of the payment, how often the payment is made, and the interest rate. The following formula illustrates the relationship:

$$P = \frac{r \cdot M}{1 - \left(1 + \frac{r}{n}\right)^{-nt}} \div n$$

where P = the payment, r = the annual rate, M = the mortgage amount, t = the number of years, and n = the number of payments per year.

What is the monthly payment on a mortgage of $75,000 with an 8% interest rate that runs for 20 years, 25 years, 30 years? How much interest is paid over 20 years, 25 years, 30 years?

Practice

8. On the grid, sketch the graph of $y = \left(\dfrac{3}{2}\right)^x$.

   a. Is this exponential growth or decay?

      How do you know?

   b. What is the domain?

   c. What is the range?

   d. Is the function one-to-one?

   e. Is the function onto?

   f. Write the equation of the asymptote.