Name Key ______________________________ Date________________ Hour____________

Section 9.6 – Exponential Growth and Decay

Alg 2 Trig G

Exponential Growth and Decay –

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

$A =$ final amount

$P =$ starting amount

$r =$ rate

$k =$ # of times per year

$t =$ time

1) Jack invests $50,000 in an account that earns 5% interest compounded two times per year. How long will it take him to have $180,000 in his account?

$$180000 = 50000\left(1+\frac{.05}{2}\right)^{2\cdot t}$$

$$3.6 = (1.025)^{2t}$$

$$\log 3.6 = 2t \cdot \log 1.025$$

$$51.8752 = 2t$$

$$\boxed{t = 25.94 \text{ years}}$$

2) Jill invests $100,000 in an account that earns 6% interest compounded quarterly. How long will it take her investment to double?

$$200,000 = 100,000\left(1+\frac{.06}{4}\right)^{4t}$$

$$2 = (1.015)^{4t}$$

$$\log 2 = 4t \cdot \log 1.015$$

$$46.5555 = 4t$$

$$\boxed{11.64 \text{ years} = t}$$

$$y = a(b)^x$$

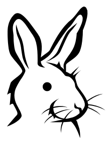
$y =$ *final amount*

$a =$ *starting amount*

$b =$ *growth or decay rate*

$x =$ *time*

3) A population of bunnies begins with 2 and doubles every year. After how many years will there be 30,000 bunnies?



$30000 = 2(2)^x$

$15{,}000 = 2^x$

$\log 15000 = x \cdot \log 2$

$\boxed{13.87 \text{ years} = x}$

4) The population of Greendale, WI was 16,541 in the year 1997. In 2002, the population reached 20,235. Determine the rate of growth per year for Greendale.

$20235 = 16541(r)^5$

$(1.2233)^{\frac{1}{5}} = (r^5)^{\frac{1}{5}}$

$\boxed{1.0411 = r}$

$y = 16541(1.0411)^x$

Use your equation from #4 to predict the following:

a) The population in the year 2011. $1997 - 2011 = 14$

$y = 16541(1.0411)^{14} = \boxed{29{,}071 \text{ people}}$

b) How many years will it take the population to reach 55,000 people?

$55{,}000 = 16541(1.0411)^x$

$3.3251 = 1.0411^x$

$\log 3.3251 = x \cdot \log 1.0411$

$\boxed{x = 29.83 \text{ years}}$

5) How long will it take a colony of bacteria to double in size if initially there are 5,000 and after 10 minutes there are 5,250? (remember, you will need to find your "b" value first!)

$5250 = 5000(b)^{10}$

$(1.05)^{\frac{1}{10}} = (b^{10})^{\frac{1}{10}}$

$\boxed{1.0049 = b}$

$10000 = 5000(1.0049)^x$

$2 = 1.0049^x$

$\log 2 = x \cdot \log 1.0049$

$\boxed{141.80 \text{ minutes} = x}$

6) An apple is sitting on the counter and it begins decaying. If the apple weighs 100 grams initially, and after 3 days there are only 60 grams, determine how long it will take for there to be only 5 grams remaining. (remember, you will need to find your "b" value…..)

$60 = 100(b)^3$

$(.6)^{\frac{1}{3}} = (b^3)^{\frac{1}{3}}$

$\boxed{.8434 = b}$

$y = 100(.8434)^x$

$5 = 100(.8434)^x$

$.05 = (.8434)^x$

$\log .05 = x \cdot \log .8434$

$\boxed{17.59 \text{ days} = x}$

7) The population of Algebraville is increasing exponentially (because algebra is awesome!). In the year 1995, there were 50,000 people. By 2005, there were 375,000 people. Write a general equation illustrating the population growth of Algebraville.

$375{,}000 = 50{,}000(b)^{10}$

$(7.5)^{\frac{1}{10}} = (b^{10})^{\frac{1}{10}}$

$\boxed{1.2232 = b}$

$y = 50{,}000(1.2232)^x$

Use your equation from #7 to predict the following:

a) The population in the year 2030.

$2030 - 1995 = 35$

$y = 50{,}000(1.2232)^{35}$

$\boxed{y = 57{,}727{,}339 \text{ people}}$

b) How many years will it take the population to reach 5,000,000 people?

$5{,}000{,}000 = 50{,}000(1.2232)^x$

$100 = (1.2232)^x$

$\log 100 = x \cdot \log 1.2232$

$\boxed{22.86 \text{ years} = x}$