Name:____ Per: ____ Date:__________

Logarithm Functions

1. In 2009 the population of Brockton was 89,000 and growing at a rate of 1.3%, in the same year, New Bedford's population was 78,000 and growing at 3.5%. In which year will the populations be the same?

$$89000(1.013)^x = 78000(1.035)^x$$

$$\frac{89000}{78000} = \left(\frac{1.035}{1.013}\right)^x \qquad \log_{\frac{1.035}{1.013}} \frac{89000}{78000}$$

$$x = 6 \qquad \boxed{2015}$$

2. There were 50 elephants on a reservation in 2014 and growing at a rate of 2.4% per year, in Africa there were 500 elephants but their population is decreasing at rate of 7.8%, in what year will the population be the same?

$$50(1.024)^x = 500(.922)^x$$

$$\frac{50}{500} = \left(\frac{.922}{1.024}\right)^x \qquad \log_{\frac{.922}{1.024}} \frac{50}{500} \qquad \approx 22 \text{ years}$$

$$\boxed{2036}$$

3. In 1980 the minimum wage was \$4.75 and increasing at a rate of 1.1% per year and in Europe the minimum wage was \$3.50 and increasing at a rate of 2.2% in which year will the wages be the same?

$$4.75(1.011)^x = 3.5(1.022)^x \qquad \boxed{2008}$$

$$\frac{4.75}{3.50} = \left(\frac{1.022}{1.011}\right)^x \qquad \log_{\frac{1.022}{1.011}} \frac{4.75}{3.50}$$

$$\approx 28$$

4. You have two investment options, they are both CD's compounded monthly. The first you can deposit $10,000 at a rate of 4.8% and the other you can only deposit $5,000 but the rate is 10.8%, how many year before the investments are equal?

$$10000(1.004)^{12t} = 5000(1.009)^{12t}$$

$$\frac{10000}{5000} = \left(\frac{1.009}{1.004}\right)^{12t}$$

$$\log_{\frac{1.009}{1.004}} \frac{10000}{5000}$$

139.5 months

$\boxed{11.6 \text{ years}}$

5. You have an investment option a CD compounded monthly at a rate of 3.6% in which you invest $12,000 and you have a taken a loan which is compounded monthly at a rate of 7.2% and you borrow $8,000, when will your investment equal your loan?

$$12000(1.003)^{12t} = 8000(1.006)^{12t}$$

$$\frac{12000}{8000} = \left(\frac{1.006}{1.003}\right)^{12t}$$

$$\log_{\frac{1.006}{1.003}} \frac{12000}{8000}$$

135.76

$\approx$ 11.3 years

6. If a population of 2.2 million is growing continuously at a rate of 3.2% and another population of 1.8 million is growing continuously at a rate of 3.8% per year, how many years before they are equal?

$$2.2e^{.032t} = 1.8e^{.038t}$$

$$\frac{2.2}{1.8} = \frac{e^{.038t}}{e^{.032t}}$$

$$\frac{2.2}{1.8} = \left(\frac{e^{.038}}{e^{.032}}\right)^{t}$$

$$\frac{2.2}{1.8} = (e^{.006})^{t}$$

33.445

$$\ln(2.2/1.8) = .006t$$