Pre-Calculus 30
2.2 Exponential Word Problems

Name: Key

1. The population of wolves in a forest is increasing at a rate of 2.5% per year. The initial population is 240 wolves. 1.025 P=1
   a) Write an exponential function that relates the population and the time, in years, from now.

$$y = 240(1.025)^x$$

   b) What will be the population in 6 years?

$$y = 240(1.025)^6 = 278 \text{ wolves}$$

   c) In how many years will the population double?

$$480 = 240(1.025)^x$$
$$2 = 1.025^x$$

$x = 28$ years

2. A certain culture of bacteria, triple (b) every 25h. (P) The initial count of shows 1000 (a) bacteria present.
   a) Write an exponential function that models the given conditions.

$$y = 1000(3)^{x/25}$$

   b) Approximately how many bacteria will there be in 4 days? 96h

$$y = 1000(3)^{96/25} = 67943 \text{ bacteria}$$

   c) How many bacterial were there 3 days prior to the count? -72h

$$y = 1000(3)^{-72/25} = 42 \text{ bacteria}$$

   d) When will there be 10000 bacteria?

$$10000 = 1000(3)^{x/25}$$
$$10 = 3^{x/25}$$

$Y_1 = 10$
$Y_2 = 3^{(x/25)}$ Intersection: (52, 10)

$x = 52$ hours

100 − 1 = 99% = 0.99 remains

3. After each washing, 1% of the dye in blue jeans is washed out. How much of the original dye remains after 50 washings?

$y = 0.99^{x} = 0.99^{50} = 0.61 =$ 61% remains

4. A certain culture of bacteria, triple every 20h. The initial count shows 2 bacteria present.
   a) Write an exponential function that models the given conditions.

$y = 2(3)^{x/20}$

   b) Approximately how many bacteria will there be in 6 days?

$6 \text{ days} \times \frac{24 \text{ h}}{1 \text{ day}} = 144 \text{ h}$

$y = 2(3)^{144/20} =$ 5449 bacteria

   c) At what time will there be 1000 bacteria??

$1000 = 2(3)^{x/20}$

$500 = 3^{x/20}$

$x = 113$ hours

5. The intensity of the light below the surface of a particular lake is reduced by 4% for every meter below the surface.

96% remains = 0.96

   a) Write an exponential function that models the intensity of the light at any depth below the surface.

$y = 0.96^{x}$

   b) What percent of the original intensity of light remains 10 m below the surface?

$y = 0.96^{10} = 0.66 =$ 66% remains

   c) Use a graph to determine how far below the surface the light has to travel for the intensity to be 30% of the surface intensity.

0.30

$0.30 = 0.96^{x}$

$x = 29$ m

6. In your quest for greatness you discover a new element. The half-life of the newly discovered element is 5.6 hours.
   a) Write an exponential function that models the half-life of the element for any initial amount.

$y = 100(1/2)^{t/5.6}$

100 means everything will be in percents.

   b) What percent of the original element is there in 3 days?

$y = 100(1/2)^{72/5.6} = 0.013\%$ (72h)

   c) Use a graph to determine when there will be 15% of the element remaining.

$15 = 100(1/2)^{t/5.6}$

$t = 15$ hours

7. The population of a town is increasing at an average rate of 1.5%/ month. If there are 2301 people in the town this month. (1.015)
   a) How many people will be in the town 2 years from now?

$y = 2301(1.015)^{x}$ (24m)

$= 2301(1.015)^{24} =$ 3289 people

   b) How many people were in the town two years ago?

(-24m)

$y = 2301(1.015)^{-24} =$ 1610 people

   c) How many months will it take for the population to reach 2850 people?

$2850 = 2301(1.015)^{x}$

$x = 14$ months