MA1032 – Workshop – Chapters 3 & 4

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1. A town has a population of 3000 people at year $t = 0$. Write a formula for the population, P, in year t if the town

   (a) grows by 200 people per year.
   Solution. $P = f(t) = 3000 + 200t$ □

   (b) grows at a continuous rate of 6% per year.
   Solution. $P = f(t) = 3000e^{0.06t}$ □

   (c) shrinks by 4% per year.
   Solution. $P = f(t) = 3000(0.96)^t$ □

2. One of the functions in the table below is linear and the other is exponential. Find formulas of these functions.

x	-2	-1	0	1
$f(x)$	48	12	3	$\frac{3}{4}$
$g(x)$	$\frac{20}{3}$	$\frac{16}{3}$	4	$\frac{8}{3}$

   Solution. $f(x) = 3\left(\frac{1}{4}\right)^x$ and $g(x) = 4 - \frac{4}{3}x$. □

3. Find a formula for the exponential function. (See worksheet for the graph.)
   Solution. $P = f(x) = 50(0.8326)^x$ □

4. World poultry production was 69 million tons in the year 2001 and increasing at a continuous rate of 3% per year. Assume that this growth rate continues.

   (a) Write an exponential formula for world poultry production, P, in million tons, as a function of the number of years, t, since 2001.
   Solution. $P = f(t) = 69e^{0.03t}$ □

   (b) Use the formula to estimate world poultry production in the year 2005.
   Solution. 77.8 million tons □

(c) In what year does the world poultry production go over 90 million tons?
Solution. 2010 □

5. If $\ln 2 = a$ and $\ln 3 = b$, use properties of logarithms to write each logarithm in terms of a and b.

(a) $\ln 6$
Solution. $a + b$ □

(b) $\ln \frac{2}{3}$
Solution. $a - b$ □

(c) $\ln 24$
Solution. $3a + b$ □

(d) $\ln(2e)$
Solution. $a + 1$ □

6. The half-life of radioactive potassium is 1.3 billion years. If 10 grams is present now, how much will be present in 100 years?
Solution. 9.99 grams □

7. Solve for x:

(a) $3^x = 14$
Solution. $x = \frac{\ln 14}{\ln 3} \approx 2.402$ □

(b) $\log x + \log(x + 15) = 2$
Solution. $x = 5$ Notice that $x = -20$ is not a solution because then you would have to take the log of a negative number which is not possible. □