Math 122 Worksheet: Sections 1.5-1.7

Instructions: Answer all questions. Show all work and justify all your answers in **complete sentences.** Unless otherwise specified, **include the appropriate units in your answers** whenever units are included in the problem statement.

Problem 1) Simplify the Following Expressions. You should leave the numbers in exponential form (e.g., 2^7). If the expression is an exponential, simplify so there is only one base. If there is a logarithm in your answer, none of the logarithms should be decomposable using the rules of logs.

(a) $2^5 \cdot 2^7$

(b) $(3^3 \cdot 9^5)^{-2}$

(c) $(5^2)^4 \cdot 25^2 \cdot 125^{-5}$

(d) $\ln\left(3x^4y^{-7}\right)$

(e) $\ln\left(x\sqrt{y^2+z^2}\right)$

(f) $\ln\left(\dfrac{x-4}{y^2\sqrt[5]{z}}\right)$

Problem 2) Write each expression as a single logarithm. Justify each step with the appropriate rule of logarithm.

(a) $2\ln(x) + 5\ln(y) - \frac{1}{2}\ln(z)$

(b) $3\ln(t+5) - 4\ln(t) - 2\ln(s-1)$

(c) $\dfrac{1}{3}\ln(a) - 6\ln(b)$

Problem 3) Find an exponential function between each pair of points.

(a) $(0, 5)$ and $(2, 9)$

(b) $(2, 2)$ and $(3, 4)$

(c) $(3, 80)$ and $(6, 180)$

Problem 4) Suppose the world's population increased exponentially from 5.937 billion in 1998 to 7.238 billion in 2014 and continued to increase at the same rate from 2014 to 2015. Determine the world's population in 2015.

Problem 5) The number of passengers using a railway fell from $190,205$ to $174,989$ over a 5-year period. Find an exponential equation to model the number of customers in a given year.

Problem 6) If \$3000 is invested at 4% compounded monthly, then how long (in months) would it take for the investment to double?

Problem 7) Suppose \$3000 is invested at 4% compounded *continuously* instead. How long (in days) would it take for the investment to double?

Problem 8) The population of Kenya was 18.9 million in 1984 and 46.1 million in 2015. Assume the population increases exponentially.

(a) Suppose $P(t)$ is the population of Kenya, where t is the number of years since 1984. Find a formula for $P(t)$.

(b) Suppose $P(t)$ is the population of Kenya, where t is the number of years **since 1980**. Find a formula for $P(t)$.