MONTGOMERY COLLEGE
Department of Mathematics
Rockville Campus

Name: Solutions

MA 160 Dr. Katiraie Sections 1.3 -- 1.6 Quiz 2 (20 POINTS)

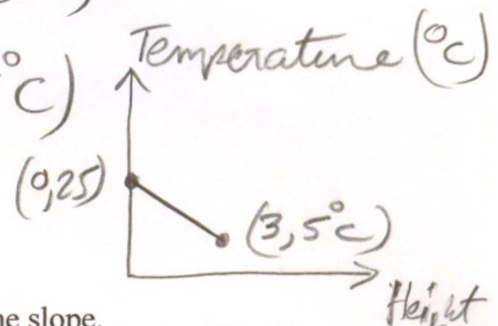
1. As dry air moves upward, it expands and cools. Suppose that the ground temperature is 25°C and the temperature at a height of 3 km is 5°C. (4 POINTS)

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{change in output}}{\text{change in input}}$$

(0, 25°C)

(3, 5°C)

a) You want to describe this situation with a function. Determine the input and output variables, draw and label two axes, then plot and label the two points you were given.



b) Determine the slope of the line between your two points, and interpret the slope.

$m = \frac{25-5}{0-3} = \frac{-20}{3} \frac{°C}{Km}$ For Every 1Km Altitude the temperature decreases by $\frac{20}{3} \frac{°C}{Km}$

c) Use the point-slope form of the equation of a line $y - y_1 = m(x - x_1)$ or use the slope-intercept form of the equation of a line $y = mx + b$ to find a linear equation for your function.

$y - 25 = -\frac{20}{3}(x - 0)$

$\boxed{y = \frac{-20}{3}x + 25}$ °C

d) Use your equation to determine the air temperature at an elevation of 2.5 km.

$y = \frac{-20}{3}(2.5) + 25 = \boxed{8.33\ °C}$

2. Assume that the population of bacteria doubles every hour. The colony of bacteria starts out with 1000 bacteria. Let f(t) represent the population of bacteria at time t, where **t is in hours.** (3 points)

a. Find the formula for f(t) $= \boxed{1000(2)^t}$

b. Predict when there will be 300,000 bacteria.

$300000 = 1000(2)^t$

$300 = 2^t$

$\log 300 = t \log 2$

$t = \frac{\log 300}{\log 2} = \boxed{8.23 \text{ HRS}}$

Predict the population after 4 hours.

$= 1000(2)^4 = \boxed{16000 \text{ Bacteria}}$

3. The following table represents an exponential function of the form $y = C a^x$.
Find the value of C and a, and write the formula for the function in the form $y = C a^x$.
(Please show all the mathematical steps very clearly) (2 points)

x	y
1	42
2	6
3	6/7
4	6/49

$* \frac{1}{7}$

$* 1/7$

$a = \frac{1}{7}$

$42 = C\left(\frac{1}{7}\right)^1$

$C = 294 \Rightarrow \boxed{y = 294\left(\frac{1}{7}\right)^x}$

4. Let $f(x) = (4)^x$ Evaluate f at the indicated values. (2 points)

a. $f(0) = 4^0 = 1$

b. Find x when $f(x) = \frac{1}{64}$

$\frac{1}{64} = 4^x$

$\log \frac{1}{64} = x \log 4 \Rightarrow x = \frac{\log\left(\frac{1}{64}\right)}{\log 4}$

$x = -3$

5. Let $f(x) = (0.2)^x$ Evaluate f at the indicated values. (3 points)

a. $f(0) = 0.2^0 = 1$

b. $f^{-1}(3125)$

$3125 = 0.2^x$

$\log 3125 = x \log 0.2$

$x = \frac{\log 3125}{\log 0.2} = \boxed{-5}$

c. Find x when $f(x) = \frac{1}{625}$

$\frac{1}{625} = 0.2^x$

$\log\left(\frac{1}{625}\right) = x \log 0.2$

$x = \frac{\log(1/625)}{\log(0.2)} = \boxed{4}$

6. Solve the following algebraically
(Please Round your answers to two decimal places) (6 points)

a) $10(4)^x = 10930$

$4^x = 1093$

$\log 4^x = \log 1093$

$x = \frac{\log 1093}{\log 4} = \boxed{5.05}$

b) $3(5)^x - 756 = 0$

$3(5)^x = 756$

$5^x = \frac{756}{3}$

$5^x = 252$

$x = \frac{\log 252}{\log 5}$

$\boxed{x = 3.44}$

c) $8\ln(x) = 32$

$\ln x = 4$

$x = e^4 = \boxed{54.60}$

d) $20e^x - 30 = 0$

$20e^x = 30$

$e^x = \frac{3}{2}$

$x = \ln\left(\frac{3}{2}\right) = \boxed{0.41}$