Math 125 Pre-Calculus
Fall 2017, Kenny Shah (5.1,5.2,5.3)

NAME: SOLUTIONS
CLASS TIME: 7&8

Quiz # 5

Please show all of your work for maximum credit. Good Luck!!!

1. **(3 points) Technetium - 99m is a radioactive substance used to diagnose brain diseases. Its half - life is approximately 6 hours. Initially you have 200 mg of technetium - 99m.**

   (a) Determine the number of hours needed for your sample to decay to 120 mg.

Sol $y = a \cdot b^t$; $b^6 = \frac{1}{2} \Rightarrow b = \left(\frac{1}{2}\right)^{\frac{1}{6}} = \boxed{0.8909}$

$y = 200(0.8909)^t$

$120 = 200(0.8909)^t$

$\frac{120}{200} = 0.8909^t$

$t = \frac{\ln\left(\frac{120}{200}\right)}{\ln(0.8909)}$

$\boxed{t \approx 4.42 \text{ hours}}$

2. **(2 points) Use properties of logs to expand the given expression** $\log_b\left(\frac{xy^3}{z}\right)$.

Sol $\log_b\left(\frac{xy^3}{z}\right)$

$= \log_b x + \log_b y^3 - \log_b z$

$\boxed{= \log_b x + 3\log_b y - \log_b z}$

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3. (2 points) Evaluate the following log expression in terms of x

$$\ln\left(e^4 \cdot \frac{1}{\sqrt{e^3}}\right)$$

Sol.

$$= \ln\left(\frac{e^4}{e^{3/2}}\right)$$

$$= \ln e^{4-\frac{3}{2}}$$

$$= \ln e^{\frac{8}{2}-\frac{3}{2}}$$

$$= \ln e^{\frac{5}{2}} = \boxed{\frac{5}{2}}$$

4. (3 points) If the hydrogen ion concentration of one substance is 5 times more than the hydrogen ion concentration of the other substance, then by how many units does its pH increase or decrease? Use pH = - log[H], to answer the given question.

Sol.

$$pH_{ORIG.} = -\log\left[H^+_{ORIG.}\right]$$

$$pH_{new} = -\log\left[5 \cdot H^+_{ORIG.}\right]$$

$$pH_{new} = -\left(\log 5 + \log H^+_{ORIG.}\right)$$

$$pH_{new} = -\log 5 + \left(-\log H^+_{ORIG.}\right)$$

$$pH_{new} = \boxed{-0.69897} + pH_{orig}$$

If H^+ increases by factor of 5, then pH decreases by 0.69897 units.