Dr. Katiraie MA115A Section 3.3 Quiz 3 Form B Name: Solutions

1. Suppose that in January there is a magnitude 2.5 earthquake hitting the east coast of the United States. Six months later, a magnitude 6.5 earthquake hits the west coast. How many times more intense was the west coast quake compared to the east coast quake?

$6.5 - 2.5 = 4.00$

Relative Intensity $= 10^{\wedge \text{Magnitude}} = 10^4 = \boxed{10000}$

The west coast quake was 10000 more intense than the east coast quake.

2. How many times more intense is a 5.0 magnitude earthquake compared to a 1.0 magnitude earthquake?

$5.0 - 1.0 = 4.0$

Relative Intensity $= 10^{\wedge \text{Magnitude}} = 10^4 = \boxed{10000}$ times

3. A speaker is playing music at 60 decibels. A second speaker playing the same music at the same decibel reading is placed beside the first. What is the decibel reading of the pair of speakers?

Relative Intensity of One speaker $= 1.26 \wedge 60$

Relative Intensity of a pair of speakers $= 2 * (1.26 \wedge 60)$

Decibel $= 10 \log(\text{Relative Intensity}) = 10 \log(2 * 1.26^{60}) \approx \boxed{63}$

4. If the per capita growth rate of the world population continues to be what it was in the year 2000, the world population t years after July 1, 2000, will be 6.085×1.0121^t billion. According to this formula, when will the world population reach 8 billion?

$8 = 6.085 \times 1.0121^t \Rightarrow \frac{8}{6.085} = 1.0121^t \Rightarrow t = \frac{\log\left(\frac{8}{6.085}\right)}{\log 1.0121}$

$t = 22.75$ years after July 1, 2000

5. The acidity of a solution is determined by the concentration H of hydrogen ions. The formula is $\text{pH} = -\log H$. The accompanying exponential formula is $H = 0.1^{\text{pH}}$. Lower pH values indicate a more acidic solution. Normal rain has a pH of 7.6. Suppose acid rain has a pH of 3.9. How many times as acidic as normal rain is this?

$H = 0.1^{7.6} = 2.5119 \times 10^{-8}$

$H = 0.1^{3.9} = 1.2589 \times 10^{-4}$

$\frac{1.2589 \times 10^{-4}}{2.5119 \times 10^{-8}} = 5011.8$

$\approx \boxed{5012 \text{ times}}$

6. What is the solution to $9.5 = 4.05^t$?

$t = \log_{4.05} 9.5 = \frac{\log 9.5}{\log 4.05} = 1.6095 \approx \boxed{1.61}$

7. You have \$400 and wish to buy a computer. You find an investment that increases by 7% each month, and you put your \$400 into the account. When will the amount enable you to purchase a computer costing \$1200?

$1200 = 400(1+0.07)^t \Rightarrow \frac{1200}{400} = 1.07^t$

$3 = 1.07^t \Rightarrow t = \log_{1.07} 3 = \frac{\log 3}{\log 1.07} \cong \boxed{16.24 \text{ months}}$

8. Suppose that a certain jet engine up close produces sound at 185 decibels. What is the decibel reading of a pair of nearby jet engines?

for one Jet engine Relative Intensity $= 1.26 \wedge \text{Decibels} = 1.26 \wedge 185$

A pair of Jet Engines $\Rightarrow$ Relative Intensity $= 2 * 1.26 \wedge 185$

Decibels $= 10 \log(\text{Relative Intensity})$

$= 10 \log(2 * 1.26^{185}) \cong \boxed{188.7}$ Decibels

9. From 1929 to the early 1930s, the prices of consumer goods actually decreased. Economists call this phenomenon *deflation*. The rate of deflation during this period was around 5% per year. Suppose this rate of deflation persisted over a period of 15 years. What would be the cost after 15 years of an item that costs \$2200 initially?

$2200(1-0.05)^{15} = 2200(0.95)^{15} \cong \boxed{\$1019.24}$

10. The energy released by an earthquake is related to the magnitude by an exponential function: Energy = 25,000 × $31.6^{\text{Magnitude}}$. The unit of energy in the above equation is a *joule*. One joule is approximately the energy expressed in lifting ¾ of a pound 1 foot. The earthquake that devastated a certain country on January 12, 2010 had a magnitude of 7.5 and killed hundreds of thousands of people. How much energy was released by this earthquake?

$\text{Energy} = 25000 * 31.6 \wedge 7.5 = \boxed{4.42 \times 10^{15} \text{ Joules}}$