Name: SOLUTIONS

Chapter 5 – Section 5.3 The Logarithmic Function

TICKET-IN-THE-DOOR

In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

State the domain and range for $y = \log x$ Domain: $x > 0$

Range: All Real Numbers.

Check your understanding:

1. What is the domain of the function $y = 5 + \ln(7 - x)$?

$7 - x > 0 \Rightarrow -x > -7 \Rightarrow \boxed{x < 7}$ or $\boxed{(-\infty, 7)}$

Sound in decibels is measured by comparing the sound intensity, I to a benchmark sound $I_0 = 10^{-16}$ watts/cm^2. Then the function is given by $N = 10 \log (I/I_0)$.

2. The noise level of a whisper is 30db. Compute the sound intensity of a whisper.

Sol: $30 = 10 \cdot \log\left(\frac{I}{10^{-16}}\right) \Rightarrow 3 = \log\left(\frac{I}{10^{-16}}\right) \Rightarrow 10^3 = \frac{I}{10^{-16}} \Rightarrow I = 10^3 \cdot 10^{-16}$

$\boxed{I = 10^{-13} \text{ watts/cm}^2}$

3. Death of hearing tissue begins to occur at a noise level of 180 db. Compute the sound's intensity at this noise level.

Sol: $180 = 10 \cdot \log\left(\frac{I}{10^{-16}}\right) \Rightarrow 18 = \log\left(\frac{I}{10^{-16}}\right) \Rightarrow 10^{18} = \frac{I}{10^{-16}} \Rightarrow I = 10^{18} \cdot 10^{-16}$

$\boxed{I = 10^2 \text{ watts/cm}^2}$

4. Sound A measures 15 decibels and sound B is 5 times as loud as sound A. What is the sound rating in decibels of sound B to the nearest integer?

Sol: $I_B = 5 \cdot I_A$

$N_B = 10 \cdot \log\left(5 \cdot \frac{I_A}{I_0}\right) = 10 \cdot \left[\log 5 + \log \frac{I_A}{I_0}\right] = 10 \log 5 + 10 \log \frac{I_A}{I_0}$

$= 7 + N_A$

$= 7 + 15 = \boxed{22 \text{ dB}}$

Find the hydrogen ion concentration, $[H^+]$, for substances where pH = -log $[H^+]$.

5. Lye, with a pH of 13.

Sol: $13 = -\log[H^+] \Rightarrow -13 = \log[H^+] \Rightarrow \boxed{[H^+] = 10^{-13}}$

6. Baking soda, with pH of 8.3

Sol: $[H^+] = 10^{-8.3}$

7. Hydrochloric acid with pH of 0.

Sol: $[H^+] = 10^0 = \boxed{1}$

SOLUTIONS

Chapter 5 – Section 5.4 Logarithmic Scales

TICKET IN THE DOOR

In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

Check your understanding:

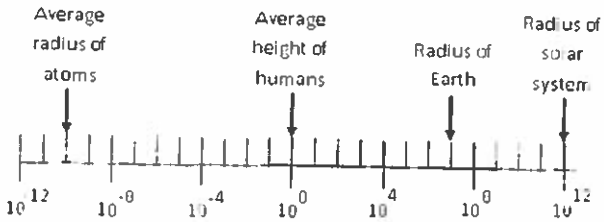
1. Compare \$0.10 and \$100,000. By how many orders of magnitude do they differ?

Sol: Ratio: $\frac{100{,}000}{0.10} = \frac{10^5}{10^{-1}} = 10^6 \Rightarrow$ 6 orders of magnitude.

2. Determine the order-of-magnitude difference between 10^{-2} and 10^{15}.

Sol: Ratio: $\frac{10^{15}}{10^{-2}} = 10^{17} \Rightarrow$ 17 orders of magnitude.

3. Using the graph, how many orders of magnitude larger is the radius of the solar system than the average radius of an atom?



Ratio: $\frac{10^{12}}{10^{-10}} = 10^{22}$

= 22 orders of magnitude

4. The pH scale measures the hydrogen ion concentration in a liquid, which determines whether the substance is acidic or alkaline. A strong acid solution has a hydrogen ion concentration of 10^{-1} M and would have a pH of 1. A neutral substance has a hydrogen ion concentration of 10^{-7} M and would have a pH of 7. How many orders of magnitude more hydrogen ions does a substance with a pH of 2.3 have than a substance with a pH of 8.3?

Sol: Ratio: $\frac{10^{-2.3}}{10^{-8.3}} = 10^{-2.3+8.3} = 10^6 \Rightarrow$ 6 orders of magnitude

The strength, W, of the seismic waves of an earthquake are compared to the strengths W_0 of the seismic waves of a standard earthquake. The Richter scale rating M is

$$M = \log \frac{W}{W_0}$$

5. The 1989 earthquake in California had a rating of 7.1 on the Richter scale.
   a. How many times larger than the California earthquake were the seismic waves in the March 2005 earthquake off the coast of Sumatra which measured 8.7 on the Richter scale?

$W_{2005} = 10^{8.7-7.1}$ $W_{CA1989} = 10^{1.6} W_{1989} = 39.8$ times more intense

6. How many orders of magnitude was the Sumatra earthquake compared to the 1989 California earthquake?

Sol: Ratio: $\frac{10^{8.7}}{10^{7.1}} = 10^{1.6} \Rightarrow$ 1.6 orders of magnitude.

SOLUTIONS

Section 6.1 Reflections and Symmetry

HOMEWORK DUE

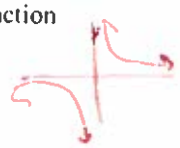
In order to be prepared for class you must watch the module and complete the following activity. This is due first thing when you get to class.

Given y = f(x), describe in words the transformation when k is a positive constant:

- y = -f(x) Reflection across the x-axis
- y = f(-x) Reflection across the y-axis

Check your understanding:

1. An odd function is decreasing and concave up in the first quadrant. How does the function behave in the third quadrant?



Sol: Decreasing & Concave Down

2. The graph of $f(x)$ contains the point (1, 1). What point must lie on the reflected graph if the graph is reflected about the y-axis?

Sol: (-1, 1)

3. The graph of $f(x)$ contains the point (5, 2). What point must lie on the reflected graph if the graph is reflected about the x-axis?

Sol: (5, -2)

4. The graph of $P(t)$ contains the point (5, 1). What is another point on the graph if $P(t)$ is an even function?

Sol: (5, -1)

5. Is the function $f(x) = x^5 - 4x^2 + 5$ odd, even, or neither?

Sol: $f(-x) = f(x) \Rightarrow$ Even

$f(-x) = (-x)^5 - 4(-x)^2 + 5$

$f(-x) = -x^5 - 4x^2 + 5 \neq f(x)$ Not Even

$-f(-x) = f(x) \Rightarrow$ Odd

$-(-x^5 - 4x^2 + 5) = x^5 + 4x^2 - 5 \neq f(x)$

Not Odd

6. Is the function $h(x) = \frac{2x^2}{5x^3}$ odd, even, or neither?

Sol: $h(-x) = \frac{2(-x)^2}{5(-x)^3} = \frac{2x^2}{-5x^3} \neq h(x) \Rightarrow$ Not Even

$-h(-x) = -\left(\frac{2x^2}{-5x^3}\right) = \frac{2x^2}{5x^3} = h(x) \Rightarrow$ Odd