Name: ______________________________ Date: ________________________

6.4 Power Law of Logarithms

BLM 6–5

1. Use the power law to evaluate without using a calculator.

a) $\log_3 27^7$ **b)** $\log_2 4^{-5}$

c) $\log_5 \sqrt[3]{25}$ **d)** $\log_8 \sqrt{2}$

2. Solve for *n*, correct to three decimal places.

a) $5 = 2.5^n$

b) $2000 = 500(1.045)^n$

3. A child is sitting on a moving swing. The horizontal displacement of the swing away from the vertical is modelled by the function $a = 2.7(0.9)^n$, where *a* is the displacement, in metres, and *n* is the number of swings since the child's father stopped pushing.

a) What is the displacement after the sixth swing?

b) After how many swings is the displacement less than 1 m?

4. Use a calculator to evaluate, to one decimal place.

a) $\log_9 12$ **b)** $\log_{0.25} 52$

5. Write as a single logarithm, then evaluate without a calculator.

a) $\dfrac{\log 16}{\log 4}$ **b)** $\dfrac{\log\left(\frac{8}{27}\right)}{\log\left(\frac{2}{3}\right)}$

6. Solve, to two decimal places.

a) $\log 4^x = 7$

b) $12 = \log_3 4^m$

7. Suppose the temperature of the atmosphere is increasing by 1% each year. The temperature *T* can be modelled by the function $y = 1758.27 + \log_{1.01} T$, where *y* is the year and *T* is the average temperature of the atmosphere, in degrees Celsius.

a) Verify that the average temperature was 12°C in 2008.

b) In what year will the average temperature be 15°C?

8. A particular radioactive isotope has a half-life of 400 years The time required for only *A*% of the original amount to remain is modelled by the function $t = -400\log_2\left(\frac{A}{100}\right)$, where *t* is the time , in years.

a) After how many years will only 25% of the original amount of radioactive isotope remain?

b) After 20 years, what percent of the original amount of radioactive isotope remains?

9. To understand why $\log_b 5$ is not defined when *b* = 1, do the following.

a) Let $x = \log_1 5$, convert to exponential form, and try to solve for *x*.

b) Use the power law to express $\log_1 5$ as a ratio of common logarithms.

In both cases, explain why $b \neq 1$.

10. Use Technology Graph $y = \log_a x$ as *a* varies from 2 to 10.

a) What kind of transformation appears to be occurring as a result of changing the value of *a*?

b) Write $y = \log_a x$ in terms of common logarithms. Explain how this way of writing the function relates to your answer to part a).

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