#3 Pre-Calculus Worksheet

Name: Key

Logarithmic Functions

Rewrite each expression in logarithmic form.

1. $3^2 = 9$

$\log_3 9 = 2$

2. $10^{-3} = 0.001$

3. $e^3 \approx 20$

$\log_e 20 = 3$

$\ln 20 = 3$

4. $\left(\frac{1}{2}\right)^{-3} = 8$

Rewrite each expression in exponential form.

5. $\ln 6 \approx 1.8$

$6 = e^{1.8}$

6. $\log_3 81 = 4$

7. $\log 100 = 2$

$100 = 10^2$

8. $\log_{16} 4 = \frac{1}{2}$

Use the definition of logarithmic function to evaluate each logarithm. NO CALCULATOR! HINT: set = x

9. $\log_3 9 = x$

$9 = 3^x$

$3^2 = 3^x$

$\boxed{x = 2}$

10. $\log_5 \frac{1}{125}$

$\boxed{x = -3}$

11. $\log_2 \sqrt[4]{8} = x$

$2^x = 2^{\frac{3}{4}}$

$\boxed{x = \frac{3}{4}}$

12. $\log_4 16^{1.2}$

$\boxed{x = 2.4}$

13. $\log_2(-16) = x$

$2^x = -16$

$2^x = -2^4$

no solution.

14. $\ln e^{4.5}$

$x = 4.5$

15. $\log_{\frac{1}{4}} 256$

$\frac{1}{4}^x = 256$

$2^{-2x} = 2^8$

$-2x = 8$

$\boxed{x = -4}$

16. $\log 0.001$

$\boxed{x = -4}$

Solve each equation WITHOUT A CALCULATOR.

17. $4^{x+7} = 8^{x+3}$

$2^{2(x+7)} = 2^{3(x+3)}$

$2x + 14 = 3x + 9$

$\boxed{5 = x}$

18. $49^{x+4} = 7^{18-x}$

19. $\left(\frac{9}{16}\right)^{3x-2} = \left(\frac{3}{4}\right)^{5x+4}$

$\left(\frac{3}{4}\right)^{2(3x-2)} = \left(\frac{3}{4}\right)^{5x+4}$

$6x - 4 = 5x + 4$

$\boxed{x = 8}$

20. $25^{\frac{x}{3}} = 5^{x-4}$

$\boxed{x = 12}$

Evaluate with the **CALCULATOR**. Round to 3 decimal places.

21. $\log 170 = x$

$x \approx 2.230$

22. $\log x = -2.1$

23. $\ln 16 = x$

$x \approx 2.773$

24. $\ln x = \frac{3}{4}$

Use the change of base formula to evaluate to 3 decimal places with a **CALCULATOR**.
SHOW YOUR WORK.

25. $\log_3 5$

$\frac{\log 5}{\log 3} \approx 1.465$

26. $\log_7 4$

27. $\log_{\frac{1}{2}} 15$

$\frac{\log 15}{\log \frac{1}{2}} \approx -3.907$

28.. $\log_{20} 0.125$

Write an equation for each and solve.

29. Uranium-235 is used to fuel a commercial power plant. It has a half-life of 704 million years.

A) How many grams of Uranium-235 will remain after 1 million years if you start with 200 grams?

$A = P\left(\frac{1}{2}\right)^{\frac{x}{704}}$

$A = 200\left(\frac{1}{2}\right)^{\frac{1}{704}}$

$A \approx 199.8$

B) How many grams of Uranium-235 will remain after 4540 million years if you start with 200 grams?

30. A certain bacterium used to treat oil spills has a doubling time of 15 minutes. Suppose a colony begins with 1 bacterium.

A) Write an equation to model this and use it to predict the population of bacteria after 55 minutes.

$A = P(2)^{\frac{x}{15}}$

$A = 1(2)^{\frac{55}{15}}$

$A \approx 12.700$

B). A population of 8192 bacteria is sufficient to clean a small oil spill. Use your model to predict how long it will take the colony to grow to this size.

31. The chance of having an automobile accident increases exponentially if the driver has consumed alcohol. The relationship can be modeled by $A(c) = 6e^{12.8c}$, where A is the percent chance of an accident and c is the driver's blood alcohol concentration (BAC).

A) The legal BAC is 0.08. What is the percent chance of having a car accident at this concentration?

$A(.08) = 6e^{12.8(.08)}$

$A(.08) = 16.\%$

B) What BAC would correspond to a 50% chance of having a car accident?