NAME:____ DATE:________________________

REVIEW LOGS AND EXPONENTS

PROPERTIES

Evaluate

1. $\log_5 \frac{1}{125}$ $= \log_5 5^{-3}$ $= -3$

2. $\log_2 16$ $= \log_2 2^4$ $= 4$

3. $\log_4 \frac{1}{64}$ $= \log_4 4^{-3}$ $= -3$

4. $\log_7 343$ $= \log_7 7^3$ $= 3$

Express in the exponential form

5. $\log_3 9 = 2$

$3^2 = 9$

6. $\log_5 x = 2$

$5^2 = x$

Condense

7. $5\log_7 a + 10\log_7 b$

$= \log_7 a^5 + \log_7 b^{10}$

$= \log_7 a^5 b^{10}$

8. $2\log_6 x - 5\log_6 7$

$= \log_6 x^2 - \log_6 7^5$

$= \log_6 \frac{x^2}{16807}$

Expand

9. $\log_3 (8 \cdot 11^6)^2$

$= 2\log_3 (8 \cdot 11^6)$

$= 2\log_3 8 + 2\log_3 11^6$

$= 2\log_3 8 + 12\log_3 11$

10. $\log_5 \sqrt{xyz}$

$= \frac{1}{2}\log_5 xyz$

$= \frac{1}{2}\log_5 x + \frac{1}{2}\log_5 y + \frac{1}{2}\log_5 z$

Solve for the indicated variable. Round to three digits where applicable.

11. $(6^{2x})^{(x+5)} = 1$

$6^{2x(x+5)} = 6^0$

$2x(x+5) = 0$

$2x = 0$, $x+5$

$x = 0$, $x = -5$

12. $36^{-h} \cdot 6^3 = 36^2$

$6^{-2h} \cdot 6^3 = (6^2)^2$

$6^{-2h+3} = 6^4$

$-2h+3 = 4$

$-2h = 1$

$h = -\frac{1}{2}$

13. $5^x + 2 = 20$

$5^x = 18$

$\log 5^x = \log 18$

$x \log 5 = \log 18$

$x = \frac{\log 18}{\log 5}$

$x \approx 1.796$

14. $10\log_7 x = 21$

$\log_7 x = 2.1$

$7^{2.1} = x$

$59.526 \approx x$

15. $e^{2x} - 12 = 27$

$e^{2x} = 39$

$\ln 39 = 2x$

$\frac{1}{2}\ln 39 = x$

$1.832 \approx x$

16. $-7 \cdot 5^{-3R} = -76$

$5^{-3R} = \frac{76}{7}$

$\log 5^{-3R} = \log \frac{76}{7}$

$-3R \log 5 = \log \frac{76}{7}$

$R = \frac{\log \frac{76}{7}}{-3\log 5}$

$R \approx -.494$

17. ln x = ln (5x +1) – ln (x - 3)

$\ln x = \ln \frac{5x+1}{x-3}$

$x = \frac{5x+1}{x-3}$

$x^2 - 3x = 5x + 1$

$x^2 - 8x - 1 = 0$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-1)}}{2(1)}$

$x = \frac{8 \pm \sqrt{64+4}}{2}$

$x = \frac{8 \pm \sqrt{68}}{2}$

$x = \frac{8 \pm 2\sqrt{17}}{2}$

$x = 4 \pm \sqrt{17}$

$x \approx 8.123$, $x \not\approx -.123$

18. $10\log_7 (x-3) = 66$

$\log_7 (x-3) = 6.6$

$7^{6.6} = x - 3$

$7^{6.6} + 3 = x$

$378{,}138.163 \approx x$

Use change of base to evaluate the following to the nearest three decimal places!

19. $\log_{42} 160$ $= \frac{\log 160}{\log 42}$ ≈ 1.358

20. $\log_6 1$ $= 0$

21. $\log_2 2$ $= 1$

Find the inverse of the given function.

22. $f(x) = 8^{x-2}$

$x = 8^{y-2}$

$\log x = \log 8^{y-2}$

$\log x = (y-2)\log 8$

$\frac{\log x}{\log 8} = y-2$

$\frac{\log x}{\log 8} + 2 = y$

23. ln y = 5 ln (x – 4)

$\ln x = 5\ln(y-4)$

$\ln x = \ln(y-4)^5$

$x = (y-4)^5$

$\sqrt[5]{x} = y-4$

$\sqrt[5]{x} + 4 = y$

APPLICATIONS (You will be given the formulas on the test. All formulas are "fair game.")

24. How many years will it take for carbon-14 to diminish to 1% of its original amount after the death of a plant or animal?

$A = A_0 e^{-0.000124t}$ $\quad A = .01 \quad A_0 = 1$

$.01 = 1 \cdot e^{-0.000124t}$

$\ln .01 = -0.000124t$

$\frac{\ln .01}{-0.000124} = t$

37,138.469 years $\approx t$

25. The "New York Metzgerei" now offers choices for vegetarians: Black Bean Burgers! These delectable treats come from one organic bean plant and are bland enough for infants and the elderly alike! Brust throws a Black Bean Burger on the grill and cooks it to 350°F (T_0). After taking it off the grill, it takes 3 minutes ($=t$) to cool to a temperature of 200°F (T). Assume the temperature outside is 55°F (T_s).

$T = T_s + (T_0 - T_s)e^{-kt}$

a. Use Newton's Law of Cooling to find k.

b.

$200 = 55 + (350-55)e^{-k(3)}$

$145 = 295e^{-3k}$

$\frac{29}{59} = e^{-3k}$

$\ln\frac{29}{59} = -3k$

$-\frac{1}{3}\ln\frac{29}{59} = k$

$.237 \approx k$

b. How long will it take to reach a safe temperature to consume (120 °F)?

$T = T_s + (T_0 - T_s)e^{-kt}$

$120 = 55 + (350-55)e^{-.237t}$

$65 = 295e^{-.237t}$

$\frac{13}{59} = e^{-.237t}$

$\ln\frac{13}{59} = -.237t$

$\frac{\ln\frac{13}{59}}{-.237} = t$

6.382 minutes $\approx t$

26. It's the Monday after Christmas Break and Sully's class comes in and every student needs to watch a video indicating that nobody did any work over the break. Sully immediately yells "SULLY LAW‼‼‼!" at a level of 110 (D) decibels. Find the sound intensity of Sully's proclamation.

$D = 10\log\frac{I}{10^{-12}}$

$110 = 10\log\frac{I}{10^{-12}}$

$11 = \log\frac{I}{10^{-12}}$

$11 = \log I - \log 10^{-12}$

$11 = \log I - (-12)$

$11 = \log I + 12$

$-1 = \log I$

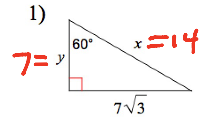
$10^{-1} = I$

$\frac{1}{10} = I$

$.1 = I$

Solve for the missing variables:

1)



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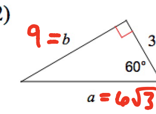

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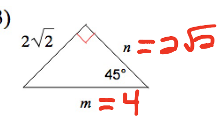

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