COLLEGE ALGEBRA EXAM 4 HR1 NAME _____

SHOW ALL WORK ON THIS TEST OR ON SEPARATE PAPER. Circle answers.
TURN IN ALL WORKSHEETS. CALCULATORS ARE REQUIRED ON THIS TEST.

In 1 - 9, solve for the unknown:

1. $\log_5 125 = x$ **2.** $\log_3 \frac{1}{81} = x$ **3.** $\log_5 1 = x$

4. $\log_5 5\sqrt{5} = x$ **5.** $\log_9 x = \frac{3}{2}$ **6.** $\log_5 x = -1$

7. $\log_b 16 = 2$ **8.** $\log_8 4 = x$ **9.** $\log_b 8 = -3$

In 10 - 14, simplify completely:

10. $e^{\ln x} =$ _____ **11.** $\ln e^{2y} =$ _____ **12.** $\ln\left(\frac{1}{e}\right) =$ _____

13. $\log_b \sqrt{b} =$ _____ **14.** $\log_3 9\sqrt{3} =$ _____ **15.** $\log_b \frac{1}{\sqrt[3]{b}} =$ _____

In 16 - 21, use your calculator (round to nearest hundredth or give scientific notation):

16. $e^{-7} =$ _____ **17.** $\ln 6 + \ln 100$ **18.** $\ln (e^5 + e^7)$

19. $6e^{20} + 9e^{30}$ **20.** $\log_3 75$ **21.** $-2 \ln 8 + 6 \ln 75$

In 22 - 25, solve for x (Give exact values--you may use "ROOT" to check!):

22. $27^{x+4} = 9^{x-2}$

23. $12^{x} = 8^{x+4}$

24. $\log_5 x = \log_5 (x + 4) - 2$

25. $\log_2 x + \log_2 (x + 2) = 3$

26. The population of a rabbit farm is given by $y = 50\, e^{0.035t}$, where t is in *years*.

a) Estimate the population in 24 years.

b) How long will it take the population to reach 1000?

27. The population of a city in 1975 was 30,000. In 1978, the population was 39,000.

a) Assuming that $y = y_0 e^{kt}$, find the value of k.

b) Use this value of k to predict the population of the city in 2005.

c) How many years does it take the population to double?

1. $\log_5 125 = x$

$5^x = 125$

$x = 3$

2. $\log_3 \frac{1}{81} = x$

$3^x = \frac{1}{81}$

$x = -4$

3. $\log_5 1 = x$

$5^x = 1$

$x = 0$

4. $\log_5 5\sqrt{5} = x$

$5^x = 5\sqrt{5} = 5^1 \cdot 5^{1/2}$

$5^x = 5^{3/2}$

$x = 3/2$

5. $\log_9 x = 3/2$

$9^{3/2} = x$

$x = (\sqrt{9})^3 = 27$

6. $\log_5 x = -1$

$5^{-1} = x$

$x = 1/5$ or .2

7. $\log_6 16 = 2$

$6^2 = 16$

$6 = 4$

$(6 \neq -4)$

8. $\log_8 4 = x$

$8^x = 4$

$(2^3)^x = 2^2$

$2^{3x} = 2^2$

$3x = 2$

$x = 2/3$

9. $\log_6 8 = -3$

$6^{-3} = 8$

$\frac{1}{6^3} = \frac{8}{1}$

$6^3 = 1/8$ $\quad 6 = 1/2$

10. $e^{\ln x} = x$

11. $\ln e^{2y} = 2y$

12. $\ln \frac{1}{e} = \ln e^{-1} = -1$

13. $\log_6 \sqrt{6} = \log_6 6^{1/2} = 1/2$

14. $\log_3 9\sqrt{3}$

$= \log_3 3^2 \cdot 3^{1/2}$

$= \log_3 3^{5/2} = 5/2$

15. $\log_6 \frac{1}{\sqrt[3]{6}}$

$= \log_6 6^{-1/3}$

$= -1/3$

16. $e^{-7} = 9.12 \times 10^{-4}$ or .000912

17. $\ln 6 + \ln 100$ (or $\ln 600$)

$= 6.40$

18. $\ln(e^5 + e^7) = 7.13$

(No shortcuts!)

19. $6e^{20} + 9e^{30} = 9.62 \times 10^{13}$

20. $\frac{\ln 75}{\ln 3} = 3.93$ (Not $\ln 25$)

21. $-2\ln 8 + 6\ln 75 = 21.75$

22. $27^{x+4} = 9^{x-2}$

$(3^3)^{x+4} = (3^2)^{x-2}$

$3x + 12 = 2x - 4$

$x = -16$

23. $12^x = 7^{x+4}$

$\ln 12^x = \ln 7^{(x+4)}$

$x \ln 12 = (x+4) \ln 7$

$x \ln 12 = x \ln 7 + 4 \ln 7$

$x \ln 12 - x \ln 7 = 4 \ln 7$

$x(\ln 12 - \ln 7) = 4 \ln 7$

$x = \frac{4 \ln 7}{(\ln 12 - \ln 7)} \approx 14.44$

24. $\log_5 x - \log_5 (x+4) = -2$

$\log_5 \frac{x}{x+4} = -2$

$5^{-2} = \frac{x}{x+4}$ so $\frac{1}{25} = \frac{x}{x+4}$

$x + 4 = 25x$

$-x \quad -x$

$\frac{4}{24} = \frac{24x}{24}$

$\frac{1}{6} = x$

25. $\log_2 x(x+2) = 3$

$2^3 = x^2 + 2x$

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

$0 = (x+4)(x-2)$

$x = -4$ (Reject! makes log of negative!) $\quad x = 2$

26a) $y = 50e^{(.035)(24)}$

$= 50e^{.84} = 115.82$

b) $\frac{1000}{50} = \frac{50e^{.035t}}{50}$

$20 = e^{.035t}$

$\ln 20 = \ln e^{.035t} = .035t$

$t = \frac{\ln 20}{.035} = 85.59$ yrs

27. $y = y_0 e^{kt}$

a) $39000 = 30{,}000e^{3k}$

$1.3 = e^{3k}$

$\ln 1.3 = \ln e^{3k} = 3k$

$k = \frac{\ln 1.3}{3} \approx .087454\ldots$

b) $y = 30000e^{.35(\downarrow)}$

$= 413575.5$

c) $y = \text{Double pop.} = 2y_0 = y_0 e^{kt}$

$2 = e^{kt}$

$\ln 2 = \ln e^{kt}$

$\ln 2 = kt$

$t = \frac{\ln 2}{k} = 7.93$ yrs