COLLEGE ALGEBRA EXAM 4 GG 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. $\log_3 81 = x$ **2.** $\log_4 x = -3/2$ **3.** $\log_b 8\sqrt{2} = \frac{7}{2}$

4. $\log_{27} 9 = x$ **5.** $\log_b 10 = 3$ **6.** $\log_{10} x = -3$

7. $\log_{10} 0 = x$ **8.** $\log_{25} 0.04 = x$ **9.** $\log_b 64 = \frac{2}{3}$

In 10 - 14, simplify completely:

10. $e^{\ln 3x}$ = _____ **11.** $\ln e^{3x}$ = _____ **12.** $\ln\left(\frac{1}{e^2}\right)$ = _____

13. $\log_b b^{10}$ = _____ **14.** $\log_{10} \sqrt[3]{10}$ = _____

In 15 - 20, use your calculator (round to nearest hundredth or give scientific notation):

15a) $\log_{10} 98{,}000$ = _____ **16a)** $\log_{10} 2.5\text{x}10^{-4}$ _____ **17a)** e^{25} = _____

b) $\ln 98{,}000$ = _____ **b)** $\ln 7.85\text{x}10^{-12}$ = _____ **b)** e^{-2} = _____

18. $\ln (e^7 + e^3)$ = **19.** $\log_5 \frac{125}{\sqrt{5}}$ **20.** $\log_7 100$ =

In 21 - 24, solve for X using the method of logarithms (you may use a graphing calculator to check!):

21. $3^x = 300$

22. $70^{(x-2)} = 10^x$

23. $\log_{10} x + \log_{10} (x - 15) = 2$

24. $\log_3 (x - 2) = \log_3 (x + 2) + 2$

25. The population of a rabbit farm is given by $y = 150\, e^{0.07t}$, where t is in *years*.

a) Estimate the population in 20 years.

b) How long will it take the population to double?

26. The population of a city in 1996 was 85,000. In 2000, the population was 125,000.

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 2008.

1. $\log_3 81 = x$

$3^x = 81$

$x = 4$

2. $\log_4 x = -3/2$

$4^{-3/2} = x$

$= (\sqrt{4})^{-3} = 2^{-3} = \frac{1}{8}$

3. $\log_6 8\sqrt{2} = \frac{7}{2}$

$6^{7/2} = 8\sqrt{2}$

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

$6 = 2^{7/2}$

4. $\log_{27} 9 = x$

$27^x = 9$

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

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

$3x = 2$ $\quad x = 2/3$

5. $\log_6 10 = 3$

$6^3 = 10$

$6 = \sqrt[3]{10}$

6. $\log_{10} x = -3$

$10^{-3} = x$

$x = \frac{1}{1000}$

7. $\log_{10} 0 = x$

Calculator — No Solution

8. $\log_{25} 0.04 = x$

$25^x = .04 = \frac{4}{100} = \frac{1}{25}$

$x = -1$

— OR —

$\frac{\ln .04}{\ln 25} = -1$

9. $\log_6 64 = 3/3$

$6^{3/3} = 64$

$(6^{2/3})^{3/2} = (64)^{3/2}$

$6 = (\sqrt{64})^3$

$6 = 8^3 = 512$

10. $3x$

11. $3x$

12. $\ln\left(\frac{1}{e^2}\right) = \ln e^{-2}$

$= -2$

13. 10

14. $\log_{10} \sqrt[3]{10} = \log_{10} 10^{1/3}$

$= 1/3$

15a) 4.99 b) 11.49

16a) −3.60 b) −25.57

17a) 7.2×10^{10} b) .14

18. 7.02

19. $\log_5 \frac{125}{\sqrt{5}} = \log_5 125 - \log_5 \sqrt{5}$

$= \log_5 5^3 - \log_5 5^{1/2}$

$= 3 - \frac{1}{2} = 2.5$ or $5/2$

20. $\log_7 100 = x$

$7^x = 100$

$\ln 7^x = \ln 100$

$x \ln 7 = \ln 100$

$x = \frac{\ln 100}{\ln 7} = 2.37$

— OR —

21. $3^x = 300$

$\ln 3^x = \ln 300$

$x \ln 3 = \ln 300$

$x = \frac{\ln 300}{\ln 3}$

$x = 5.19$

22. $70^{x-2} = 10^x$

$\ln 70^{x-2} = \ln 10^x$

$(x-2)\ln 70 = x \ln 10$

$x \ln 70 - 2 \ln 70 = x \ln 10$

$x \ln 70 - x \ln 10 = 2 \ln 70$

$x(\ln 70 - \ln 10) = 2 \ln 70$

$x = \frac{2 \ln 70}{(\ln 70 - \ln 10)} = 4.37$

23. $\log_{10} x + \log_{10}(x-15) = 2$

$\log_{10} x(x-15) = 2$

$10^2 = x^2 - 15x$

$0 = x^2 - 15x - 100$

$0 = (x-20)(x+5)$

$x = 20$ $\quad x = -5$ Reject.

24. $\log_3(x-2) - \log_3(x+2) = 2$

$\log_3 \frac{x-2}{x+2} = 2$

$3^2 = \frac{9}{1} = \frac{x-2}{x+2}$

$9x + 18 = x - 2$

$8x = -20$

$x = -2.5$ Reject

No Solution

25a) $y = 150 e^{0.07t}$

$= 150 e^{(.07)(20)}$

$= 150 e^{1.4}$

$= 608$ rabbits.

b) Doubles $\Rightarrow y = 2y_0$

$2y_0 = y_0 e^{.07t}$

$2 = e^{.07t}$

$\ln 2 = \ln e^{(.07t)} = .07t$

$t = \frac{\ln 2}{.07} = 9.9$ yrs.

26. $Y = Y_0 e^{kt}$

a) $125000 = 85000 e^{k(4)}$

$\ln \frac{125}{85} = \ln e^{4k}$

$4k = \ln \frac{125}{85}$

$k = .0964156202$

b) $y = y_0 e^{kt}$

$y = 85000 e^{(12k)}$

$= 270,329$