COLLEGE ALGEBRA EXAM 4 XG 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.** $\log_3 X = -1$ **3.** $\log_{10} 0.001 = X$

4. $\log_b 8 = -2$ **5.** $\log_6 6\sqrt{6} = X$ **6.** $\log_5 X = 1/2$

7. $\log_{10} X = 0$ **8.** $\log_{10} 0 = X$ **9.** $\log_b 3 = 3$

In 10 - 14, simplify completely:

10. $\ln(e^{10x}) =$ _____ **11.** $\log_3 \frac{1}{3^5} =$ _____ **12.** $e^{\ln x} =$ _____

13. $\log_{10} \sqrt{10} =$ _____ **14.** $\log_b \sqrt[5]{b} =$ _____

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

15a) $\log_{10} 29{,}800 =$ _____ **16a)** $\log_{10} 2.85 \times 10^{-6}$ _____ **17a)** $e^{32} =$ _____

b) $\ln 29{,}800 =$ _____ **b)** $\ln 2.85 \times 10^{-6} =$ _____ **b)** $e^{-2} =$ _____

18. $\ln (e^7 + e^7) =$ **19.** $\frac{\ln 8 + \ln 6}{\ln 8 - \ln 6} =$ **20.** $\log_4 24 =$

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

21. $8^X = 4000$

22. $9^{(X-3)} = 4^{(5-X)}$

23. $\log_3 15 + \log_3 X - \log_3 (X+4) = 2$

24. $\log_2 (X) + \log_2 (X+2) = 3$

25. The population of a city is given by $Y = 5000\, e^{0.04t}$, where t is in ***years***.

a) Estimate the population in 15 years.

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

26. The population of a city in 1995 was 24,000. In 1998, the population was 70,000.

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 2003.

COLLEGE ALGEBRA EXAM 4X Solutions

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

2. $\log_3 x = -3$
$3^{-3} = x$
$x = \frac{1}{27}$

3. $\log_8 4 = x$
$8^x = 4$
$2^{3x} = 2^2$
$3x = 2$
$x = \frac{2}{3}$

4. $\log_6 9 = -2$
$6^{-2} = 9$
$\frac{1}{6^2} = \frac{9}{1}$
$\frac{6^2}{1} = \frac{1}{9}$
$6 = \pm\frac{1}{3}$
$6 = 1/3$

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

6. $\log_3 x = \frac{1}{2}$
$3^{1/2} = x$
$x = \sqrt{3}$

7. $\log_{10} x = 0$
$10^0 = x$
$1 = x$

8. $\log_{10} 0 = x$
(use calculator)
Undefined

9. $\log_6 64 = \frac{2}{3}$
$6^{2/3} = 64$
$(6^{2/3})^{3/2} = (64)^{3/2}$
$6 = (\sqrt{64})^3$
$6 = 8^3 = 512$

10. $e^{\ln 74} = 74$

11. $\log_5 \sqrt[5]{5}$
$= \log_5 5^{1/5} = 1/5$

12. $\ln e^1 = 1$

13. $\log_{10} 10^{-12}$
$= -12$

14. $\log_6 \frac{1}{\sqrt[3]{6}} = \log_6 6^{-1/3}$
$= -1/3$

15a) 4.30 b) 9.89

16a) −5.60 b) −16.36

17a) 1.59×10^{15} b) 0.05

18. 12.86

19. $\log_5 125\sqrt[3]{5}$
$= \log_5 5^3 \cdot 5^{1/3}$
$= \log_5 5^{10/3} = 10/3$

20. $\log_8 12 = \frac{\ln 12}{\ln 8}$
$= 1.19$
or $\log_8 12 = x$
$8^x = 12$
$\ln 8^x = \ln 12$
$x \ln 8 = \ln 12$
$x = \frac{\ln 12}{\ln 8} = 1.19$

21. $10^x = 500$
$\ln 10^x = \ln 500$
$x \ln 10 = \ln 500$
$x = \frac{\ln 500}{\ln 10}$
$= 2.70$

22. $7^{x-5} = 21^x$
$\ln 7^{x-5} = \ln 21^x$
$(x-5)\ln 7 = x \ln 21$
$x \ln 7 - 5\ln 7 = x \ln 21$
$x \ln 7 - x \ln 21 = 5 \ln 7$
$x(\ln 7 - \ln 21) = 5 \ln 7$
$x = \frac{5 \ln 7}{\ln 7 - \ln 21} = -8.86$

23. $\log_3 x + \log_3 (x+8) = 2$
$\log_3 x(x+8) = 2$
$3^2 = x^2 + 8x$
$0 = x^2 + 8x - 9$
$0 = (x+9)(x-1)$
$x = -9$ Rej. $x = 1$

24. $\log_5 x = \log_5 (x+4) + 2$
$\log_5 x - \log_5 (x+4) = 2$
$\log_5 \frac{x}{x+4} = 2$
$\frac{5^2}{1} = \frac{x}{x+4}$
$25x + 100 = x$
$24x = -100$
$x = -\frac{25}{6}$ Reject
No Solution

25a) $y = 50e^{0.05t}$
$y = 50e^{0.05(20)}$
$= 50e^1 = 136$

b) Triple: $y = 150$
$150 = 50e^{0.05t}$
$3 = e^{0.05t}$
$\ln 3 = \ln e^{0.05t}$
$\ln 3 = 0.05t$
$t = \frac{\ln 3}{0.05} \approx 21.97$ yrs.

26a) $y = y_0 e^{kt}$
$\frac{80,000}{50,000} = \frac{50000e^{k(3)}}{50000}$
$1.6 = e^{3k}$
$\ln 1.6 = \ln e^{3k} = 3k$
$k = \frac{\ln 1.6}{3}$
$= 0.15666787\ldots$

b) $y = 50,000e^{(k}$
$y = 50,000e^{8(k}$
$= 175,102$