COLLEGE ALGEBRA EXAM 4 YG 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. $\log_2 8 = x$ **2.** $\log_4 \frac{1}{16} = x$ **3.** $\log_3 3\sqrt{3} = x$

4. $\log_5 x = -3$ **5.** $\log_{27} x = -\frac{2}{3}$ **6.** $\log_8 4 = x$

7. $\log_b 81 = -4$ **8.** $\log_b 3 = 3$ **9.** $\log_{10} 0 = x$

In 10 - 14, simplify completely:

10. $\log_{10} 10^{5x}$ = _____ **11.** $\ln \sqrt{e}$ = _____ **12.** $e^{\ln 5x}$ = _____

13. $\log_4 \frac{1}{4^3}$ = _____ **14.** $\log_{10} \sqrt[3]{10}$ = _____

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

15a) $\log_{10} 70{,}000$ = _____ **16a)** $\log_{10} 3.5\text{x}10^{25}$ = _____ **17a)** e^{65} = _____

b) $\ln 70{,}000$ = _____ **b)** $\ln 3.5\text{x}10^{25}$ = _____ **b)** e^{-6} = _____

18. $\frac{3\ln 5 + 2\ln 8}{3\ln 5 - 2\ln 8}$ = **19.** $\log_2 \frac{32}{\sqrt{2}}$ **20.** $\log_7 500$ =

In 21 - 24, solve for *x* using the method of logarithms (you may use your graphing calculator to check your answer!):

21. $7^{3x} = 200$

22. $40^{x-5} = 5^{3x+6}$

23. $\log_4 x + \log_4 (x + 6) = 2$

24. $\log_2 (x - 5) = \log_2 (x + 5) - 3$

NOTE: YOU MUST SHOW ALL WORK!!

25. The population of a rabbit farm is given by $y = 350\, e^{0.065t}$, 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 1998 was 92,000. In 2002, the population was 135,000.

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 2020.

c) How long will it take the population to reach 500,000?

COLLEGE ALGEBRA EXAM 4 YG Solutions

1. $\log_2 8 = x$

$2^x = 8$

$x = 3$

2. $\log_4 \frac{1}{16} = x$

$4^x = \frac{1}{16}$

$x = -2$

3. $\log_3 3\sqrt{3} = x$

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

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

$x = 3/2$

4. $\log_5 x = -3$

$5^{-3} = x$

$x = \frac{1}{125}$

5. $\log_{27} x = -\frac{2}{3}$

$27^{-2/3} = x$

$\left(\sqrt[3]{27}\right)^{-2} = x$

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

6. $\log_8 4 = x$

$8^x = 4$

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

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

$3x = 2$ $x = 2/3$

7. $\log_b 81 = -4$

$b^{-4} = 81$

$\frac{1}{b^4} = \frac{81}{1}$

$b^4 = \frac{1}{81}$

$b = 1/3$

8. $\log_b 3 = 3$

$b^3 = 3$

$b = \sqrt[3]{3}$

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

Undefined

No way!

10. $\log_{10} 10^{5x} = 5x$

11. $\ln \sqrt{e} = \ln e^{1/2} = 1/2$

12. $e^{\ln 5x} = 5x$

13. $\log_4 \frac{1}{43} = \log_4 4^{-3} = -3$

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

15a) $\log_{10} 70{,}000 = 4.85$

b) $\ln 70000 = 11.16$

16a) $\log_{10} 3.5 \times 10^{25} = 25.54$

b) $\ln 3.5 \times 10^{25} = 58.82$

17a) $e^{65} = 1.69 \times 10^{28}$

b) $e^{-6} = 0.002$ or 0.00

18. $\frac{(3\ln(5) + 2\ln(8))}{(3\ln(5) - 2\ln(8))} = 13.43$

19. $\log_2 \frac{32}{\sqrt{2}} = x$

$2^x = \frac{32}{\sqrt{2}}$

$2^x = \frac{2^5}{2^{1/2}} = 2^{5-1/2}$

$2^x = 2^{9/2}$

$x = 9/2$

20. $\log_7 500 = \frac{\ln 500}{\ln 7}$

≈ 3.19

21. $7^{3x} = 200$

$\ln 7^{3x} = \ln 200$

$3x \cdot \ln 7 = \ln 200$

$x = \frac{\ln(200)}{(3\ln(7))} \approx 0.91$

22. $40^{x-5} = 5^{3x+6}$

$\ln 40^{(x-5)} = \ln 5^{(3x+6)}$

$(x-5)\ln 40 = (3x+6)\ln 5$

$x\ln 40 - 5\ln 40 = 3x\ln 5 + 6\ln 5$

$x\ln 40 - 3x\ln 5 = 6\ln 5 + 5\ln 40$

$x(\ln 40 - 3\ln 5) = 6\ln 5 + 5\ln 40$

$x = \frac{(6\ln(5) + 5\ln(40))}{(\ln(40) - 3\ln(5))} \approx -24.66$

23. $\log_4 x + \log_4 (x+6) = 2$

$\log_4 x(x+6) = 2$

$4^2 = x^2 + 6x$

$0 = x^2 + 6x - 16$

$0 = (x+8)(x-2)$

$x = 2$

~~$x = -8$~~ Reject

24. $\log_2 (x-5) - \log_2 (x+5) = -3$

$\log_2 \frac{(x-5)}{(x+5)} = -3$

$2^{-3} = \frac{x-5}{x+5}$ $\frac{1}{8} = \frac{x-5}{x+5}$

$8(x-5) = x+5$

$8x - 40 = x + 5$

$7x = 45$

$x = 45/7$

25. $y = y_0 e^{0.065 \cdot t}$

a) $y = 350 e^{(0.065 \times 20)}$

≈ 1284.25 or 1284

b) Doubled population $\Rightarrow y = 2y_0$

$2y_0 = y_0 e^{0.065t}$

$2 = e^{0.065t}$

$\ln 2 = \ln e^{.065t} = .065t$

$t = \frac{\ln 2}{.065} = 10.66$ yrs

26a) $y = 92{,}000 e^{kt}$ $t = 0$ in 1998

$\frac{135{,}000}{92000} = \frac{92000 e^{4k}}{92000}$ $t = 4$ in 2002

$\frac{135}{92} = e^{4k}$

$\ln\left(\frac{135}{92}\right) = \ln e^{4k} = 4k$ $k \approx 0.0458$

$4k = \ln(135/92)$

$k = \frac{\ln(135/92)}{4}$

b) $y = 92{,}000 e^{(22k)}$ 2020, $t = 22$

$y = 758{,}211.74$

c) $y = 500{,}000$

$\frac{500{,}000}{92{,}000} = \frac{92000 e^{kt}}{92000}$

$e^{kt} = \frac{500}{92}$

$kt = \ln\left(\frac{500}{92}\right)$

$t = \frac{\ln(500/92)}{k} \approx 17.64$ yrs