COLLEGE ALGEBRA EXAM 4 DR 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. $\log_2 16 = X$ 2. $\log_5 X = -3$ 3. $\log_2 8\sqrt{2} = X$

4. $\log_b 16 = 4$ 5. $\log_8 4 = X$ 6. $\log_{27} X = -\frac{2}{3}$

7. $\log_e X = 3$ 8. $\log_{10} 0.001 = X$ 9. $\log_b 3 = -\frac{1}{2}$

In 10 - 14, simplify completely:

10. $\log_b b^X =$ _____ 11. $e^{\ln(-3)} =$ _____ 12. $\ln(e^{-3}) =$ _____

13. $\ln e^{3X} =$ _____ 14. $\log_b \frac{1}{\sqrt{b}} =$ _____

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

15a) $\log_{10} 576{,}000 =$ _____ 16a) $\log_{10} 0 =$ _____ 17a) $e^{10} =$ _____

b) $\ln 576{,}000 =$ _____ b) $\ln 0.00004 =$ _____ b) $e^{-10} =$ _____

18. $\ln(e^5 + 100) =$ 19. $\frac{\ln 300}{\ln 100} =$ 20. $\log_5 35 =$

In 21 - 24, solve for X: Give exact form and decimal approximation.

21. $3^{(X+2)} = 100$

22. $3^{(X-2)} = 15^{(3X+4)}$

23. $\log_3 X - \log_3 (X-8) = 2$

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

25. The population of a rabbit farm is given by $Y = 25\, e^{0.05t}$, where t is in years. Show all work!

a) Estimate the population in 15 years.

b) How long will it take the population to reach 10,000?

26. The population of a city in 2000 was 42,000. In 2003, the population was 62,000. Show all work!

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 year 2010.

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

COLLEGE ALGEBRA EXAM 4 DR Solutions

1. $\log_2 16 = x$

$2^x = 16$

$x = 4$

2. $\log_5 x = -3$

$5^{-3} = x$

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

3. $\log_2 8\sqrt{2} = x$

$2^x = 8 \cdot \sqrt{2} = 2^3 \cdot 2^{\frac{1}{2}}$

$2^x = 2^{7/2}$

$x = 7/2$

4. $\log_6 16 = 4$

$6^4 = 16$

$6 = 2$

5. $\log_8 4 = x$

$8^x = 4$

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

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

$x = 2/3$

6. $\log_{27} x = -2/3$

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

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

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

7. $\log_e x = 3$

$e^3 = x$

$x \approx 20.09$

8. $\log_{10} 0.001 = x$

$10^x = 0.001 = \frac{1}{1000}$

$x = -3$

9. $\log_6 3 = -\frac{1}{2}$

$6^{-1/2} = 3$

$\frac{1}{6^{1/2}} = \frac{3}{1}$

$3 \cdot 6^{1/2} = 1$

$\left(6^{1/2}\right)^2 = \left(\frac{1}{3}\right)^2$

$6 = \frac{1}{9}$

10. $\log_6 6^x = x$

11. $e^{\ln(-3)} =$ No solution ($\ln(-3)$ = Undefined)

12. $\ln(e^{-3}) = -3$

13. $\ln e^{3x} = 3x$

14. $\log_6 \frac{1}{\sqrt{6}} = \log_6 6^{-1/2} = -1/2$

15a) $\log_{10} 576{,}000 = 5.76$

b) $\ln 576{,}000 = 13.26$

16a) $\log_{10} 0 =$ undefined

b) $\ln 0.00004 = -10.13$

17a) $e^{10} = 22026.47$

b) $e^{-10} = 4.54 \times 10^{-5}$

18. $\ln(e^5 + 100) = 5.52$

19. $\frac{\ln 300}{\ln 100} = 1.24$

20. $\log_5 35 = \frac{\ln 35}{\ln 5} = 2.21$

21. $\ln 3^{x+2} = \ln 100$

$(x+2)\ln 3 = \ln 100$

$x \ln 3 + 2\ln 3 = \ln 100$

$x \ln 3 = \ln 100 - 2\ln 3$

$x = \frac{\ln 100 - 2\ln 3}{\ln 3} = 2.19$

22. $\ln 3^{x-2} = \ln 15^{3x+4}$

$(x-2)\ln 3 = (3x+4)\ln 15$

$x \ln 3 - 2\ln 3 = 3x \ln 15 + 4\ln 15$

$x \ln 3 - 3x \ln 15 = 2\ln 3 + 4\ln 15$

$x = \frac{2\ln 3 + 4\ln 15}{\ln 3 - 3\ln 15} = -1.85$

23. $\log_3 x - \log_3 (x-8) = 2$

$\log_3 \frac{x}{x-8} = 2$

$3^2 = \frac{9}{1} = \frac{x}{x-8}$

$9x - 72 = x$

$8x = 72$

$x = 9$

24. $\log_2 (x-2) = 3 - \log_2 x$

$\log_2 (x-2) + \log_2 x = 3$

$\log_2 x(x-2) = 3$

$2^3 = x^2 - 2x$

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

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

$x = 4$ ~~$x = -2$~~ Reject

25. $y = 25e^{0.05t}$

a) $y = 25e^{0.05(15)}$

$= 25e^{.75} = 52.93$

b) $10000 = 25e^{0.05t}$

$400 = e^{0.05t}$

$\ln 400 = \ln e^{0.05t} = .05t$

$t = \frac{\ln 400}{.05} = 119.83$ yrs

26a) $y = 42{,}000\, e^{kt}$ $t = 0$ in

$62{,}000 = 42{,}000\, e^{k(3)}$

$\frac{31}{21} = \frac{62000}{50{,}000} = e^{3k}$

$\ln \frac{31}{21} = \ln e^{3k} = 3k$

$\rightarrow k = \frac{\ln\left(\frac{31}{21}\right)}{3} = .12982158892\ldots$

b) $y = 42{,}000\, e^{k(10)}$

$= 153{,}835.75$ or $153{,}836$