COLLEGE ALGEBRA Exam 4A* **Name_____**

Show all work on this test or on separate paper! Calculators ARE allowed on this test!

In 1 - 9, solve for the unknown:

1. $\log_3 81 = X$ 2. $\log_5 X = -2$ 3. $\log_7 7\sqrt{7} = X$

4. $\log_{64} X = \frac{2}{3}$ 5. $\log_b 32 = 5$ 6. $\log_8 16 = X$

7. $\log_{10} 0.001 = X$ 8. $\log_2 X = 0$ 9. $\log_b 1000 = -3$

In 10 - 14, simplify completely:

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

13. $\ln e^{-1} =$ _____ 14. $\ln \sqrt[3]{e} =$ _____

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

15a) $\log_{10} 6.4 =$ _____ 16a) $\log_{10} 64{,}000 =$ _____ 17a) $e^8 =$ _____

b) $\ln 6.4 =$ _____ b) $\ln 64{,}000 =$ _____ b) $e^{-8} =$ _____

18. $\ln (e^3 + e^3) =$ 19. $\frac{\ln 100}{\ln 25} =$ 20. $\ln 100 - \ln 25 =$

In 21 - 24, solve for X:

21. $3^X = 100$

22. $7^{(X+2)} = 16^{(3X-4)}$

23. $\log_5 X - \log_5 (X+4) = -1$

24. $\log_2 (X+2) + \log_2 (X-1) = 2$

25. The population of a rabbit farm is given by $Y = 2500\, e^{0.03t}$, where t is in years.

a) Estimate the population in 12 years.

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

26. The population of a city in 1980 was 50,000. In 1984, the population was 62,000.

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 1998.

College Algebra Exam 4A Solutions

1. $\log_3 81 = x$
$3^x = 81$
$x = 4$

2. $\log_5 x = -2$
$5^{-2} = x$
$x = \frac{1}{25}$

3. $\log_7 7\sqrt{7} = x$
$7^x = 7^1 7^{1/2} = 7^{3/2}$
$x = 3/2$

4. $\log_{64} x = \frac{2}{3}$
$64^{2/3} = x$
$(\sqrt[3]{64})^2 = x = 16$

5. $\log_6 32 = 5$
$6^5 = 32$
$6 = 2$

6. $\log_8 16 = x$
$8^x = 16$
$(2^3)^x = 2^4$
$3x = 4$
$x = 4/3$

7. $\log_{10} 0.001 = x$
$10^x = 0.001 = \frac{1}{1000}$
$x = -3$

8. $\log_2 x = 0$
$2^0 = x$
$x = 1$

9. $\log_6 1000 = -3$
$6^{-3} = 1000$
$\frac{1}{6^3} = 1000$
$6^3 = \frac{1}{1000}$
$6 = \frac{1}{10}$

10. $\log_6 6^x = x$

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

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

13. $\ln e^{-1} = -1$

14. $\ln \sqrt[3]{e} = \ln e^{1/3} = \frac{1}{3}$

15a) $\log_{10} 6.4 = .81$
b) $\ln 64 = 1.86$

16a) $\log_{10} 64000 = 4.81$
b) $\ln 64000 = 11.07$

17a) $e^8 = 2980.96$
b) $e^{-8} = 3.35 \times 10^{-4}$

18. $\ln(e^3 + e^3) = 3.69$

19. $\frac{\ln 100}{\ln 25} = 1.43$

20. $\ln 100 - \ln 25 = \ln \frac{100}{25} = \ln 4 = 1.39$

21. $3^x = 100$
$\ln 3^x = \ln 100$
$x \ln 3 = \ln 100$
$x = \frac{\ln 100}{\ln 3} = 4.19$

22. $\ln 7^{x+2} = \ln 16^{3x-4}$
$(x+2)\ln 7 = (3x-4)\ln 16$
$x\ln 7 + 2\ln 7 = 3x\ln 16 - 4\ln 16$
$x\ln 7 - 3x\ln 16 = -2\ln 7 - 4\ln 16$
$x(\ln 7 - 3\ln 16) = -2\ln 7 - 4\ln 16$
$x = \frac{-2\ln 7 - 4\ln 16}{\ln 7 - 3\ln 16}$ or $\frac{2\ln 7 + 4\ln 16}{3\ln 16 - \ln 7}$
$= 2.35$

23. $\log_5 x - \log_5(x+4) = -1$
$\log_5 \frac{x}{x+4} = -1$
$5^{-1} = \frac{x}{x+4} = \frac{1}{5}$
$5x = x + 4$
$4x = 4$
$x = 1$

24. $\log_2(x+2) + \log_2(x-1) = 2$
$\log_2 (x+2)(x-1) = 2$
$2^2 = (x^2 + x - 2) = 4$
$x^2 + x - 6 = 0$
$(x+3)(x-2) = 0$
$x \neq -3$ $x = 2$

25. $y = 2500 e^{0.03t}$
a) $y = 2500 e^{(0.03)(12)}$
$= 3583$ rabbits

b) $10{,}000 = 2500 e^{0.03t}$
$4 = e^{0.03t}$
$\ln 4 = 0.03t$
$t = \frac{\ln 4}{0.03}$
$= 46.21$ yrs.

26. $y = 50{,}000 e^{kt}$
a) $62{,}000 = 50{,}000 e^{4k}$
$1.24 = e^{4k}$
$\ln 1.24 = 4k$
$k = \frac{\ln 1.24}{4} = .053778$

In 1998, $t = 18$ yrs.

b) $y = 50{,}000 e^{18k}$
$= 131{,}634$ people

BASIC ALGEBRA Exam 5B* **Name_____**

Show all work on this test or separate paper. Calculators are required on this test!

In 1–9, solve for the unknown: (3 each)

1. $\log_5 25 = x$ 2. $\log_4 1 = x$ 3. $\log_2 x = -3$

4. $\log_9 x = -\frac{1}{2}$ 5. $\log_b 16 = 4$ 6. $\log_9 27 = x$

7. $\log_4 4\sqrt{4} = x$ 8. $\log_e \frac{1}{e} = x$ 9. $\log_b 16 = \frac{1}{2}$

In 10–14, simplify completely: (3 each)

10. $\ln e^3 =$ ____ 11. $e^{\ln y} =$ ____ 12. $\log_b(b^{xy}) =$ ____

13. $\ln\left(\frac{1}{e}\right) =$ ____ 14. $\ln\left(\frac{1}{\sqrt{e}}\right) =$ ____

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

15. $\ln 35 =$ ____ 16. $e^{35} =$ ____ 17. $e^{-10} =$ ____

18. $5\ln 8 + 8\ln 5$ 19. $\ln(e^3 + e^7)$ 20. $\frac{\ln 12}{\ln 2}$

In 21–24, solve for x:

21. $4^{x-3} = 8^{x+2}$

22. $5^{x-4} = 12^{x}$

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

24. $\log_3 x = 2 - \log_3(x+8)$

25. A population of bacteria grows according to the equation $y = 80e^{0.07t}$, where t is in months.

a) Find the population in 3 years.

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

26. The population of a city in 1980 was 25,000. In 1984, the population was 40,000. $[y = y_0 e^{kt}]$

a) Find k.

b) Find the population in 1995.

c) In what year will population reach 100,000?

College Algebra Exam 4B Solutions

1. $\log_5 25 = x$
$5^x = 25$
$x = 2$

2. $\log_4 1 = x$
$4^x = 1$
$x = 0$

3. $\log_2 x = -3$
$2^{-3} = x$
$x = 1/8$

4. $\log_9 x = -1/2$
$9^{-1/2} = x$
$x = \frac{1}{\sqrt{9}} = \frac{1}{3}$

5. $\log_b 16 = 4$
$b^4 = 16$
$b = 2$

6. $\log_9 27 = x$
$9^x = 27$
$3^{2x} = 3^3$
$2x = 3$
$x = 3/2$

7. $\log_4 4\sqrt[3]{4} = x$
$4^x = 4\sqrt[3]{4}$
$4^x = 4^1 \cdot 4^{1/3}$
$4^x = 4^{4/3}$
$x = 4/3$

8. $\log_e \frac{1}{e} = x$
$e^x = \frac{1}{e}$
$e^x = e^{-1}$
$x = -1$

9. $\log_b 16 = 1/2$
$b^{1/2} = 16$
$b = 256$

10. $\ln e^3 = 3$

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

12. $\log_b(b^x) = x$

13. $\ln \frac{1}{e}$
$= \ln e^{-1}$
$= -1$ (see #8!)

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

15. $\ln 35 = 3.56$

16. $e^{35} = 1.59 \times 10^{15}$

17. $e^{-10} = 4.54 \times 10^{-5}$

18. $5\ln 8 + 8\ln 5$
$= 23.27$

19. $\ln(e^3 + e^7)$
$= 7.02$
(Not $\ln e^{10}$!)

20. $\frac{\ln 12}{\ln 2} = 3.58$
(Not $\ln 6$!)

21. $4^{x-3} = 8^{x+2}$
$(2^2)^{(x-3)} = (2^3)^{(x+2)}$
$2^{2x-6} = 2^{3x+6}$
$2x - 6 = 3x + 6$
$x = -12$

22. $\ln 5^{x-4} = \ln 12^x$
$(x-4)\ln 5 = x \ln 12$
$x\ln 5 - 4\ln 5 = x\ln 12$
$x\ln 5 - x\ln 12 = 4\ln 5$
$x(\ln 5 - \ln 12) = 4\ln 5$
$x = \frac{4\ln 5}{\ln 5 - \ln 12} = -7.35$

23. $\log_3 x - \log_3(x+2) = -2$
$\log_3 \frac{x}{x+2} = -2$
$3^{-2} = \frac{x}{x+2}$
$\frac{1}{9} = \frac{x}{x+2}$
$9x = x + 2$
$8x = 2$
$x = 1/4$

24. $\log_3 x = 2 - \log_3(x+8)$
$\log_3 x + \log_3(x+8) = 2$
$\log_3 x(x+8) = 2$
$3^2 = x^2 + 8x$
$x^2 + 8x - 9 = 0$
$(x+9)(x-1) = 0$
$x \neq -9$ $\quad x = 1$

25. a) $y = 80e^{0.07(2a)}$
$= 80e^{2.52}$
$= 994$

b) $10{,}000 = 80e^{0.07t}$
$\ln \frac{10{,}000}{80} = \ln e^{.07t}$
$t = \frac{1}{.07}\ln \frac{10{,}000}{80}$
$= 68.98$ mo. $= 5.75$ yrs

26. $40{,}000 = 25{,}000e^{4k}$
$8/5 = e^{4k}$
$k = \frac{1}{4}\ln 8/5 = .1175$

a) $y = 25{,}000e^{.15(10)}$
$= 145{,}676$

c) $10000 = 2500e^{kt}$
$\ln 4 = \ln e^{kt} = kt$
$t = \frac{\ln 4}{k} = 11.80$
$= 1992$