

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: (2.5 points each) SHOW ALL WORK!

1. $\log_5 25 = x$

2. $\log_2 x = -3$

3. $\log_3 9\sqrt{3} = x$

4. $\log_4 8 = x$

5. $\log_b 4 = -2$

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

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

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

9. $\log_b 3 = 3$

10. $\log_b 3 = \frac{1}{2}$

11. $\log_2 0.25 = x$

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

In 13 - 14, simplify completely: (2.5 points each)

13. $\log_{10} 10^{3y} = \underline{\hspace{2cm}}$

14. $e^{\ln 10} = \underline{\hspace{2cm}}$

15. $\ln(\sqrt{e}) = \underline{\hspace{2cm}}$

16. $\ln e^{-5} = \underline{\hspace{2cm}}$

17. $\log_5 25\sqrt[3]{5} = \underline{\hspace{2cm}}$

18. $\log_b \frac{1}{b^3} = \underline{\hspace{2cm}}$

In 19 - 24, use your calculator (round to nearest hundredth or give scientific notation): (2.5 each)

19. $e^{30} = \underline{\hspace{2cm}}$

20. $e^{-2} = \underline{\hspace{2cm}}$

21. $\ln(e^3 + 100)$

22. $\frac{\ln 30 + 5\ln 2}{\ln 6 - \ln 2}$

23. $\log_3 75$

24. $-6\ln 3 - 8\ln 7$

In 25 - 28, solve for x (Give exact values as well as decimal approximations!):
SHOW ALL WORK (6 points each)

25. $5^x = 100$

26. $4^{(x+2)} = 12^{(3x-4)}$

27. $\log_3 x + \log_3 (x + 8) = 2$

28. $\log_5 (x + 4) - \log_5 x = -2$

In 29-30, 3 points each part: SHOW ALL WORK!

29. The population of a rabbit farm is given by $y = 250 e^{0.04t}$, where t is in years.
- a) Estimate the population in 20 years. b) How long will it take the population to reach 10,000?

30. The population of a city in 1990 was 13,000. In 1996, the population was 22,000.
- 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 2010.

- c) How many years (nearest tenth of a year) does it take the population to double?

COLLEGE ALGEBRA EXAM 4 CR Solutions

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

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

3. $\log_3 9\sqrt{3} = x$
 $3^x = 9\sqrt{3}$
 $3^x = 3^2 \cdot 3^{\frac{1}{2}} = 3^{\frac{5}{2}}$
 $x = \frac{5}{2}$

4. $\log_4 8 = x$
 $4^x = 8$ - OR -
 $(2^2)^x = 2^3$ $\frac{\ln 8}{\ln 4}$
 $2^{2x} = 2^3$ $\frac{\ln 8}{\ln 4}$
 $2x = 3$ $\frac{\ln 8}{\ln 4}$
 $x = \frac{3}{2}$ or \uparrow

5. $\log_6 4 = -2$
 $6^{-2} = 4$
 $\frac{1}{6^2} = \frac{4}{1}$
 $6^2 = \frac{1}{4}$
 $6 = \pm \frac{1}{2}$
 $6 = \frac{1}{2}$

6. $\log_{27} x = \frac{2}{3}$
 $27^{\frac{2}{3}} = x$
 $(\sqrt[3]{27})^2 = x$
 $3^2 = 9 = x$

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

9. $\log_6 3 = 3$
 $6^3 = 3$
 $\sqrt[3]{6^3} = \sqrt[3]{3}$
 $6 = \sqrt[3]{3}$

8. $\log_{10} 0 = x$
 Undefined

10. $\log_6 3 = \frac{1}{2}$
 $6^{\frac{1}{2}} = 3$
 $(6^{\frac{1}{2}})^2 = (3)^2$
 $6 = 9$

11. $\log_2 0.25 = x$
 $2^x = \frac{1}{4} = 2^{-2}$
 $x = -2$
 - OR -
 $\frac{\ln 0.25}{\ln 2} = -2$

12. $\log_{10} 0.001 = x$
 Use Calculator
 $\log(0.001) = -3$

13. 39
 14. 10
 15. $\frac{1}{2}$
 16. -5

17. $\log_5 25\sqrt[3]{5} = x$
 $5^x = 25\sqrt[3]{5}$
 $5^x = 5^2 \cdot 5^{\frac{1}{3}} = 5^{\frac{7}{3}}$
 $x = \frac{7}{3}$

18. $\log_6 6^{-3} = -3$
 19. 1.07×10^{13}
 20. 0.14
 21. 4.79

22. 6.25
 23. 3.93
 24. -22.16

25. $5^x = 100$
 $\ln 5^x = \ln 100$
 $x \ln 5 = \frac{\ln 100}{\ln 5}$
 $x \approx 2.86$

26. $4^{(x+2)} = 12^{(3x-4)}$
 $\ln 4^{(x+2)} = \ln 12^{(3x-4)}$
 $(x+2) \ln 4 = (3x-4) \ln 12$
 $x \ln 4 + 2 \ln 4 = 3x \ln 12 - 4 \ln 12$
 $-3x \ln 12$
 $x \ln 4 - 3x \ln 12 = -2 \ln 4 - 4 \ln 12$
 $x(\ln 4 - 3 \ln 12) = \frac{-2 \ln 4 - 4 \ln 12}{\ln 4 - 3 \ln 12}$
 $x = \frac{-2 \ln 4 - 4 \ln 12}{\ln 4 - 3 \ln 12}$ or $\frac{2 \ln 4 + 4 \ln 12}{3 \ln 12 - \ln 4} \approx 2.09$

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

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

29a) $y = 250e^{(.04 \times 20)}$
 ≈ 556.4 Rabbits

a) $10,000 = 250e^{.04t}$
 $40 = e^{.04t}$
 $\ln 40 = \ln e^{.04t} = .04t$
 $\ln 40 = .04t$

30a) $y = y_0 e^{kt}$
 $22000 = 13000 e^{6k}$
 $\frac{22}{13} = e^{6k}$
 $\ln \frac{22}{13} = \ln e^{6k} = 6k$
 $k = \frac{\ln(\frac{22}{13})}{6} \approx .08768$

b) $y = 13000 e^{(.08768 \times 20)}$
 $\approx 44,367.18$
 15,083
 c) $y = y_0 e^{kt}$
 $24 = y_0 e^{kt}$
 $90 = y_0 e^{kt}$
 $2 = e^{kt}$
 $\ln 2 = \ln e^{kt} = kt$
 $\ln 2 = k \cdot 20$