Write the Given exponential equation as a logarithmic equation. *(4-1a)*

1. $4^2 = 16$

2. $e^{17} = a$

3. $10^4 = 10,000$

4. $b^p = a$

Write the Given logarithmic equation as an exponential equation. *(4-1a)*

5. $\log_7 x = 10$

6. $\ln x = 32$

7. $\log 1000 = 3$

8. $\log_\Delta \Phi = \Psi$

Evaluate the following expressions by using properties of logarithms. *(4-2a)*

9. $\log_5 5 =$ _____

$\log_5 25 =$ _____

$\log_5 125 =$ _____

10. $e^{\ln 9} =$ _____

$e^{\ln 10} =$ _____

$10^{\log 16} =$ _____

Evaluate the following: *(4-2a)*

11. $\log_4 1$

12. $\ln e$

13. $\log_5 5$

14. $7^{\log_7 12}$

15. $\log_{12} 12^{15}$

16. $\ln e^{32}$

17. $10^{\log 14}$

17. $\log_5 \sqrt{5}$

Write each as a single logarithm. Assume that all variables are positive. *(4-2a)*

18. $3\log_4 2 + \log_4 6$

19. $3\log_7 y - 6\log_7 z$

20. $3\log_2 x + \log_2 y - 2\log(xz)$

Use the properties of logarithms to expand the following. Express all exponents as coefficients. *(4-2a)*

21. $\log_3 x^2 y^4$

22. $\log_{12} \dfrac{x}{y^2}$

23. $\log_4 \dfrac{xy}{w^2}$

Solve the following. Round your answer to the nearest hundredth. Check for extraneous solutions. *(4-3a)*
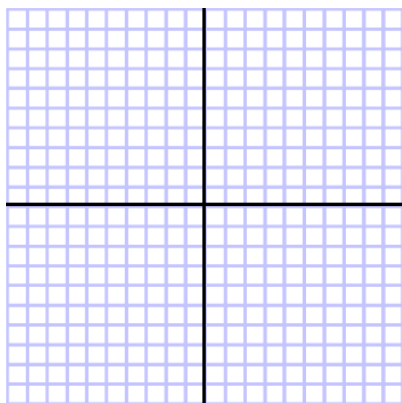
24. $4^{2x} + 6 = 262$
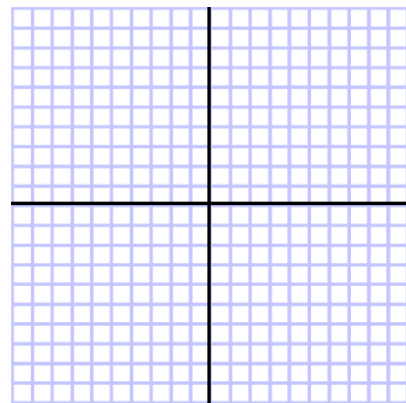
25. $7e^x = 500$

26. $\log_2 x - \log_2 3 = 4$
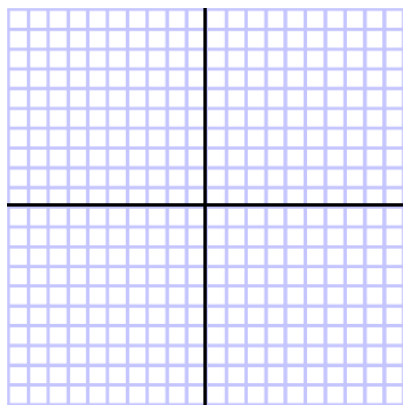
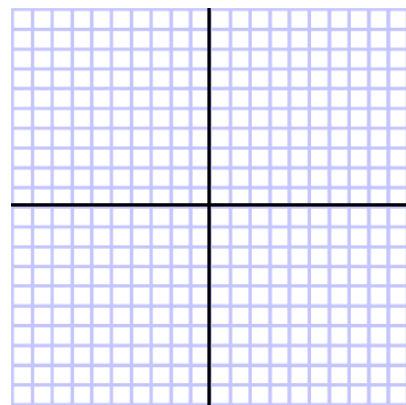27. $\ln(x+2) = \ln 30$

Graph the Following: *(4-4b)*

28. $f(x) = \ln(x) - 3$

29. $f(x) = \log(x+4)$

30. $f(x)=\log(x-3)-2$

31. $f(x)=\log(x+2)+2$

32. **(4-3a)** If Bob invests $5,000 with a 4% interest rate compounded monthly, how long will it take until his investment has grown to $7,000? $A=P\left(1+\dfrac{r}{n}\right)^{nt}$

33. **(4-3a)** Find the amount accumulated from an investment of $2,000 over 15 years at an interest rate of 6.2% compounded continuously. $A=Pe^{rt}$