Algebra 2 – Chapter 8 Review: Exponentials and Logarithms

Name: Key Hour: _____

For the following functions, state their parent functions, then state their transformations, the draw a sketch of the function.

1. $y = -2^x + 4$

Parent: $y = 2^x$ Transformation: Reflx, ↑4

2. $y = \frac{1}{2}\left(\frac{1}{3}\right)^{x+2} + 1$

Parent: $y = \left(\frac{1}{3}\right)^x$ Transformation: V. shrink by $\frac{1}{2}$, ←2, ↑1

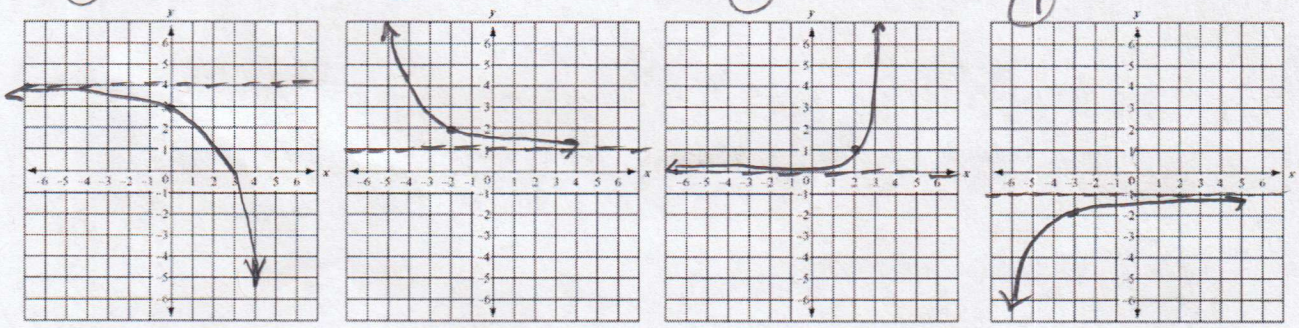
3. $y = 5 * 3^{x-2}$

Parent: $y = 3^x$ Transformation: V stretch by 5, →2

4. $y = -\left(\frac{1}{4}\right)^{x+3} - 1$

Parent: $y = \left(\frac{1}{4}\right)^x$ Transformation: Reflx, ←3, ↓1

(1) (2) (3) (4)



Use the following formulas to answer the questions below. $A = P\left(1 \pm \frac{r}{n}\right)^{nt}$, & $A = Pe^{rt}$.

5. Stacie has $11,340 in an investment bank that offers 3.5% growth per year. How much money will Stacie have after 6 years? $A = 11340\left(1 + \frac{0.035}{1}\right)^{1 \cdot 6} = \$13939.76$ or $13,939.75

6. You drink a beverage with 120mg of caffeine. Each hour *h*, the amount of caffeine in your system decreases by about 12%. How many milligrams of caffeine will be left in your system after 8 hours?

$A = 120(1 - 0.12)^8 = 43.16$ mg

7. You get a loan of $110,000 to buy a house. The loan has an interest rate of 1.2% compounded every 2 months. How much money will you owe after 10 years? (assuming you make no payments)

$110,000\left(1 + \frac{0.012}{6}\right)^{6(10)} = \$124,009.79$

8. You buy a car for $7,499.99. The cars value will depreciate at a rate of 1.9% per year. How much will the car be worth after 6 years? $7499.99\left(1 - \frac{0.019}{1}\right)^{1 \cdot 6} \approx \$6,684.59$ or $6,6845 8

9. You invest $52,600 into an account which grows at a rate of 3.5% compounded continuously. How much money will you have after 11 years?

$A = 52600(e)^{0.035 \cdot 11} \approx 77301.71$

Convert the following expressions to either Logarithms or Exponentials. Do not solve.

10. $\log_4 x = -2$ $4^{-2} = x$

11. $\log_{\frac{1}{2}} \frac{1}{8} = 3$ $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$

12. $\ln(x+1) = 3$ $e^3 = (x+1)$

13. $e^{6x} = 120$ $\ln 120 = 6x$

14. $\left(\frac{1}{2}\right)^{-x} = 8$ $\log_{1/2} 8 = -x$

15. $10^3 = 100$ $\log_{10} 100 = 3$

typo, should be 1000

Evaluate the expressions without a calculator.

16. $\log_4 64 =$ 3

17. $\log_2 \frac{1}{8} =$ −3

18. $\log_3 \frac{1}{9} =$ −2

19. $\log_6 1 =$ 0

20. $16^{\log_{16} 3} =$ 3

21. $\log_x x =$ 1

For the following logarithm functions, state the parent function & any transformations. Then sketch a graph.

22. $y = \log(x+3) - 1$

Parent: $y = \log x$ Transformation: ← 3, ↓ 1

23. $y = -\ln x + 2$

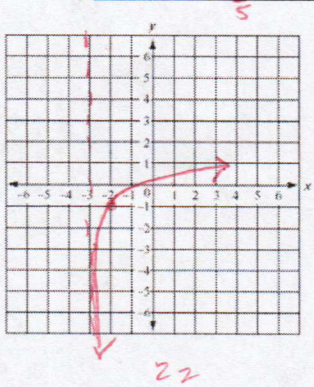
Parent: $y = \ln x$ Transformation: Rxa, ↑ 2

24. $f(x) = \log_{0.5}(x-4)$

Parent: $y = \log_{0.5} x$ Transformation: → 4

25. $g(x) = -\log_{\frac{1}{5}}(x+1) - 3$

Parent: $y = \log_{\frac{1}{5}} x$ Transformation: Rxa, ← 1, ↓ 3



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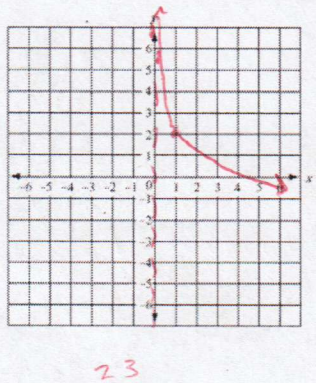

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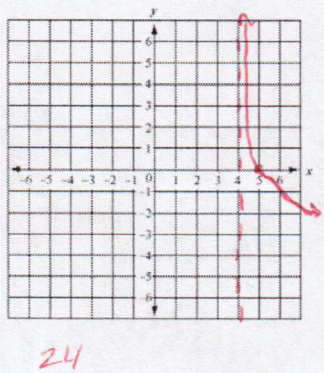

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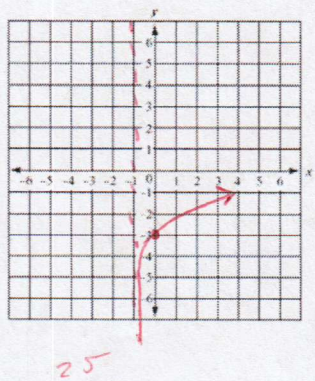

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Expand the Expression. For #31. Remember how the $\sqrt{\ }$ sign can be written as an exponent.

26. $\log_3 6xy =$ $\log_3 6 + \log_3 x + \log_3 y$

27. $\ln \frac{7x}{3} =$ $\ln 7 + \ln x - \ln 3$

28. $\log 5x^3 =$ $\log 5 + 3\log x$

29. $\ln x^{\frac{1}{2}} y^3 =$ $\frac{1}{2}\ln x + 3\ln y$

30. $\ln \frac{3y^4}{x^3} =$ $\ln 3 + 4\ln y - 3\ln x$

31. $\log_2 \sqrt{4x} =$ $\frac{1}{2}\log_2 4 + \frac{1}{2}\log_2 x$ or ... $1 + \frac{1}{2}\log_2 x$

$\log_2 (4x)^{1/2}$

Condense the Expression.

32. $\log_5 8 - \log_5 12 =$ $\log_5 \frac{8}{12}$

33. $3\ln x + 5\ln y =$ $\ln x^3 y^5$

34. $\log_3 2 + \frac{1}{2}\log_3 y =$ $\log_3 2y^{1/2}$

35. $3\log_4(2x) + \log_4 x - 2\log_4 y^2 =$ $\log_4 (2x)^3 + \log_4 x - \log_4 (y^2)^2 = \log_4 \frac{8x^3 \cdot x}{y^4} = \log_4 \frac{8x^4}{y^4}$ ($8x^3$, y^4)

Solve the following equations. Round to the nearest 2 decimal places if necessary.

36. $10^{x-3} = 100^{4x-5}$ $\Rightarrow 10^{x-3} = (10^2)^{4x-5} \Rightarrow 10^{x-3} = 10^{8x-10} \Rightarrow x - 3 = 8x - 10 \Rightarrow x = 1$ (+10, −x, +10)

37. $e^{-x} = 6$ $\log_e 6 = -x \Rightarrow x = -\ln 6$

38. $8^{5x} = 4^{3x+4}$ $\Rightarrow (2^3)^{5x} = (2^2)^{3x+4} \Rightarrow 15x = 6x + 8 \Rightarrow x = \frac{8}{9}$

39. $-5e^{-x} + 9 = 6$ $\Rightarrow -5e^{-x} = -3 \Rightarrow e^{-x} = \frac{3}{5} \Rightarrow \log_e \frac{3}{5} = -x \Rightarrow x = -\ln \frac{3}{5}$

40. $10^{-12x} + 6 = 100$ $\Rightarrow 10^{-12x} = 94 \Rightarrow \log_{10} 94 = -12x \Rightarrow x = -\frac{\log 94}{12}$

41. $\log_2 x = -1$ $\Rightarrow e^{-1} = x$

42. $4\log_3 x = 28$ $\Rightarrow \log_3 x = 7 \Rightarrow 3^7 = x$

43. $2\ln(-x) + 7 = 14$ $\Rightarrow 2\ln(-x) = 7 \Rightarrow \ln(-x) = 7/2 \Rightarrow e^{7/2} = -x \Rightarrow x = -e^{7/2}$

44. $\ln x + \ln(x+3) = 1$ This one will need to be solved like a quadratic eventually.

45. $15 + 2\log_2 x = 31$ $\Rightarrow 2\log_2 x = 16 \Rightarrow \log_2 x = 8 \Rightarrow 2^8 = x$

44. $\ln[x(x+3)] = 1$

$\ln(x^2 + 3x) = 1$

$e^1 = x^2 + 3x$

$x^2 + 3x - e = 0$

$x = \frac{-3 \pm \sqrt{9 - 4(1)(-e)}}{2} = \frac{-3 \pm \sqrt{9 + 4e}}{2}$ so $x \approx 0.729$ & -3.729