Advanced Algebra – EXAM REVIEW
Ch. 8 Exponential Functions and Logarithms

Name Key hr

Write an equation that meets the specified conditions.

$y = 5614(1.052)^x$ **1.** An exponential function that represents an initial population of 5614 which increases at 5.2% per year.

$y = 2000(0.97)^x$ **2.** An exponential function that represents an initial purchase of $2000 which depreciates at 3% per year.

$y = -2(5)^{x-5} + 2$ **3.** An exponential function that reflects over the x-axis, translates 5 units to the right and 2 units up of the parent function $y = 2(5)^x$

$y = 3^{x+6} - 1$ **4.** An exponential function that translates 6 units to the left and 1 unit down of the parent function $y = 3^x$

5. An exponential function, $y = a \cdot b^x$, that contains the points (-4, 81) and (-1, 24).

$24 = a \cdot b^{-1}$
$\div \quad 81 = a \cdot b^{-4}$
$\sqrt[3]{\frac{8}{27} = b^3}$
$\frac{2}{3} = b$

$24 = a(2/3)^{-1}$
$24 = a(1.5)$
$16 = a$
$y = 16(2/3)^x$

6. An exponential function, $y = a \cdot b^x$, that contains the points (3, 4) and (6, 32).

$32 = a \cdot b^6$
$\div \quad 4 = a \cdot b^3$
$\sqrt[3]{8 = b^3}$
$2 = b$

$32 = a \cdot 2^6$
$32 = a \cdot 64$
$1/2 = a$
$y = \frac{1}{2}(2)^x$

Write in logarithmic form.

7. $3^5 = 243$ $\log_3 243 = 5$

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

9. $7^2 = 49$ $\log_7 49 = 2$

10. $2^{-1} = \frac{1}{2}$ $\log_2 1/2 = -1$

Write in exponential form.

11. $\log_6 216 = 3$ $6^3 = 216$

12. $\log 0.1 = -1$ $10^{-1} = 0.1$

13. $\log_9 81 = 2$ $9^2 = 81$

14. $\log 1000 = 3$ $10^3 = 1000$

Evaluate each logarithm. Round to the nearest ten-thousandth if needed.

15. $\log_7 31 = x$
$7^x = 31$
$x \log 7 = \log 31$
$\frac{x \log 7}{\log 7} = \frac{\log 31}{\log 7}$
$x = 1.7647$

16. $\log_{1/6} 42 = x$
$(\frac{1}{6})^x = 42$
$x \cdot \frac{\log 1/6}{\log 1/6} = \frac{\log 42}{\log 1/6}$
$x = -2.0860$

17. $\log_4 48 = x$
$4^x = 48$
$x \cdot \frac{\log 4}{\log 4} = \frac{\log 48}{\log 4}$
$x = 2.7925$

18. $\log_{1/2} 32 = x$
$(\frac{1}{2})^x = 32$
$x \cdot \frac{\log 1/2}{\log 1/2} = \frac{\log 32}{\log 1/2}$
$x = -5$

Solve each equation. Round solutions to the nearest ten-thousandth if needed.

19. $5^x = 25$

$5^x = 5^2$

$x = 2$

20. $2^{3x+1} = 4^x$

$2^{3x+1} = (2^2)^x$

$3x+1 = 2x$

$1 = -x$

$-1 = x$

21. $4^{3x-1} = 8^{x+2}$

$(2^2)^{3x-1} = (2^3)^{x+2}$

$6x-2 = 3x+6$

$3x-2 = 6$

$3x = 8$

$x = 8/3$

22. $3^{2x-5} = \frac{1}{27}$

$3^{2x-5} = 3^{-3}$

$2x-5 = -3$

$2x = 2$

$x = 1$

23. $4^x = 64$

$4^x = 4^3$

$x = 3$

24. $5^{4x} = 25^{x+3}$

$5^{4x} = (5^2)^{x+3}$

$4x = 2x+6$

$2x = 6$

$x = 3$

25. $1000^{2x+3} = 100^{5x+2}$

$(10^3)^{2x+3} = (10^2)^{5x+2}$

$6x+9 = 10x+4$

$6x+5 = 10x$

$5 = 4x$

$1.25 = x$

26. $2^{x-3} = \frac{1}{16}$

$2^{x-3} = 2^{-4}$

$x-3 = -4$

$x = -1$

27. $4^x = 26$

$x \cdot \log 4 = \log 26$

$x = \frac{\log 26}{\log 4}$

$x = 2.3502$

28. $6^{2x} = 27$

$2x \cdot \log 6 = \log 27$

$2x = \frac{\log 27}{\log 6}$

$2x = 1.8394$

$x = .9467$

29. $7^{x-9} = 16$

$(x-9) \cdot \frac{\log 7}{\log 7} = \frac{\log 16}{\log 7}$

$x-9 = 1.4248$

$x = 10.4248$

30. $-12 + 2^x = 3$

$+12 \quad +12$

$2^x = 15$

$x \cdot \frac{\log 2}{\log 2} = \frac{\log 15}{\log 2}$

$x = 3.9069$

31. $5^x = 75$

$x \cdot \frac{\log 5}{\log 5} = \frac{\log 75}{\log 5}$

$x = 2.6826$

32. $8^{2x} = 81$

$2x \cdot \frac{\log 8}{\log 8} = \frac{\log 81}{\log 8}$

$2x = 2.1133$

$x = 1.0567$

33. $5^{x+1} = 17$

$(x+1)\frac{\log 5}{\log 5} = \frac{\log 17}{\log 5}$

$x+1 = 1.7604$

$x = 0.7604$

34. $5 + 3^x = 40$

$-5 \quad -5$

$3^x = 35$

$x \cdot \frac{\log 3}{\log 3} = \frac{\log 35}{\log 3}$

$x = 3.2362$

35. $\log_{1000} 100 = x$

$1000^x = 100$

$(10^3)^x = 10^2$

$3x = 2$

$x = 2/3$

36. $\log_x 32 = 5$

$x^5 = 32$

$\sqrt[5]{x^5} = \sqrt[5]{32}$

$x = 2$

37. $\log (x-5) = 2$

10 is base

$10^2 = x-5$

$100 = x-5$

$105 = x$

38. $\log_{125} x = \frac{2}{3}$

$125^{2/3} = x$

$25 = x$

39. $\log_8 2 = x$

$8^x = 2$

$(2^3)^x = 2^1$

$3x = 1$

$x = 1/3$

40. $\log_x 256 = 4$

$x^4 = 256$

$\sqrt[4]{x^4} = \sqrt[4]{256}$

$x = 4$

41. $\log_4 (x-3) = 2$

$4^2 = x-3$

$16 = x-3$

$19 = x$

42. $\log_{10} x = 5$

base is 10

$10^5 = x$

$100{,}000 = x$

Solve each question below.

43. $10,000 is deposited into an account that pays 4.75% interest compounded monthly. What is the balance on the account after 3 years?

$A = P(1+\frac{r}{n})^{nt}$

$A = 10000\left(1+\frac{.0475}{12}\right)^{12\cdot 3}$

$A = \$11528.29$

P = Principle
r = rate (dec)
n = # times compounded in 1 yr
t = time (yrs)
A = Final amt

44. $5000 is deposited into an account that pays 3% interest compounded quarterly. What is the balance on the account after 2 years?

$A = P(1+\frac{r}{n})^{nt}$

$A = 5000\left(1+\frac{0.03}{4}\right)^{4\cdot 2}$

$A = \$5307.99$

45. A car that sells for $32,000 depreciates 10% each year? A) Write a function that models the value of the car. B) Find the value of the car after 4 years.

a) $y = 32000(0.9)^x$

b) $\$20,995.20$

$(1-0.1)$

$y = 32000(0.9)^4$

$y = 20,995.20$

46. A college has an enrollment of 7000 students. The college is predicting that their enrollment will increase by 3.5% each year. A) Write a function that models the enrollment of the college. B) Find the enrollment of the school in 5 years.

a) $y = 7000(1.035)^x$

b) ≈ 8314 students

$(1+0.035)$

$y = 7000(1.035)^5$

$y = 8313.80$

47. The population of a high school decreases by 12% each year. If there are 125 students now when will there be 75 students?

$75 = 125(0.88)^x$ $(1-0.12)$

$\frac{75}{125} = \frac{125}{125}$

$0.6 = 0.88^x$

$\log 0.6 = x \cdot \log 0.88$

$\frac{\log 0.6}{\log 0.88} = \frac{x \cdot \log 0.88}{\log 0.88}$

$3.9960 \approx x$

3.9960 years

48. A parent raises a child's allowance by 20% each year. If the allowance is $8 now, when will it reach $20?

$20 = 8(1.2)^x$ $(1+0.2)$

$\frac{20}{8} = \frac{8}{8}$

$2.5 = 1.2^x$

$\log 2.5 = x \cdot \log 1.2$

$\frac{\log 2.5}{\log 1.2} = \frac{x \cdot \log 1.2}{\log 1.2}$

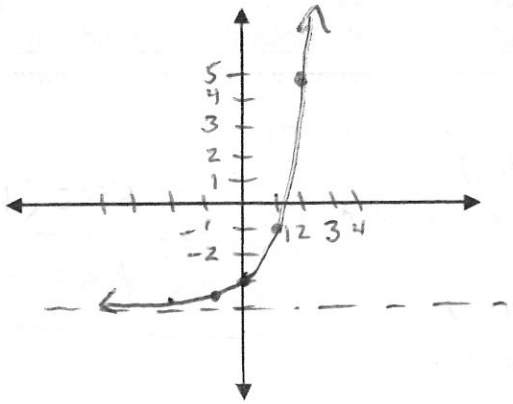
$5.0257 \approx x$

5.0257 yrs

Make a t-chart & graph the functions below. Identify the desired characteristics of the graph. Label axis intervals.

49. $y = 3^x - 4$

x	y
-2	$-3\frac{8}{9}$
-1	$-3\frac{2}{3}$
0	-3
1	-1
2	5



Growth or Decay (circle one)

Domain: $\mathbb{R}$

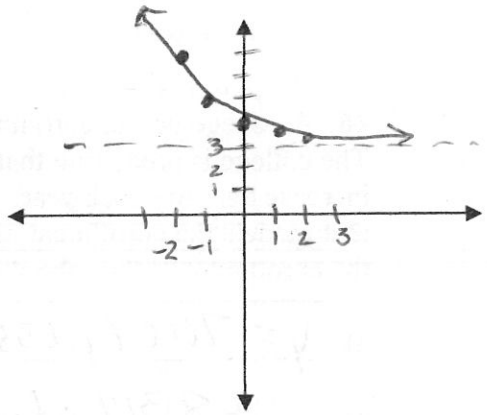
Range: $y > -4$

y-intercept: $(0, -3)$

equation for asymptote: $y = -4$

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

x	y
-2	7
-1	5
0	4
1	3.5
2	3.25



Growth or Decay (circle one)

Domain: $\mathbb{R}$

Range: $y > 3$

y-intercept: $(0, 4)$

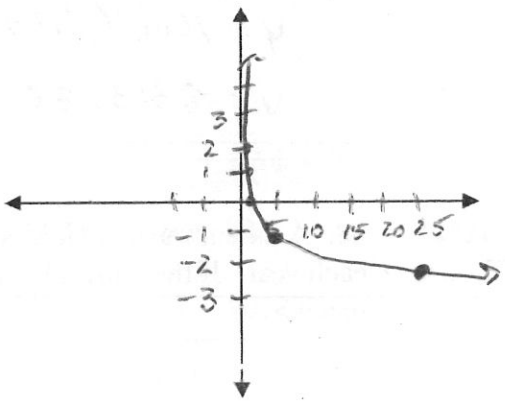
equation for asymptote: $y = 3$

51. $y = \log_{1/5} x$

$\left(\frac{1}{5}\right)^x$

-2	25
-1	5
0	1
1	$\frac{1}{5}$
2	$\frac{1}{25}$

x	y
25	-2
5	-1
1	0
$\frac{1}{5}$	1
$\frac{1}{25}$	2



Domain: $x > 0$

Range: $\mathbb{R}$

y-intercept: None x int $(1, 0)$

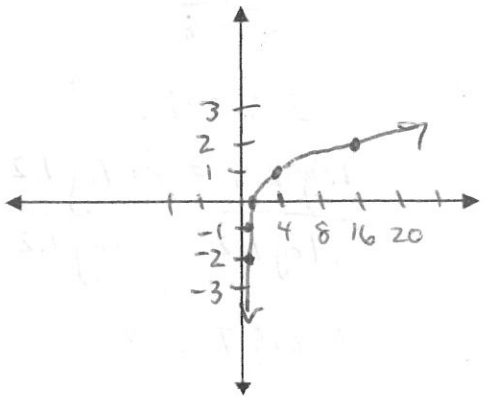
equation for asymptote: $x = 0$

52. $y = \log_4 x$

4^x

-2	$\frac{1}{16}$
-1	$\frac{1}{4}$
0	1
1	4
2	16

x	y
$\frac{1}{16}$	-2
$\frac{1}{4}$	-1
1	0
4	1
16	2



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$24 = a \cdot b^{-1}$
$81 = a \cdot b^{-4}$
$\sqrt[3]{\frac{8}{27} = b^3}$
$b = \frac{2}{3}$

$24 = a\left(\frac{2}{3}\right)^{-1}$
$24 = a(1.5)$
$a = 16$

$y = 16\left(\frac{2}{3}\right)^x$

6. An exponential function, $y = a \cdot b^x$, that contains the points (3, 4) and (6, 32).

$32 = a \cdot b^6$
$4 = a \cdot b^3$
$\sqrt[3]{8 = b^3}$
$2 = b$

$32 = a \cdot 2^6$
$32 = a \cdot 64$
$a = \frac{1}{2}$

$y = \frac{1}{2}(2)^x$

Write in logarithmic form.

7. $3^5 = 243$ $\log_3 243 = 5$

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

9. $7^2 = 49$ $\log_7 49 = 2$

10. $2^{-1} = \frac{1}{2}$ $\log_2 \frac{1}{2} = -1$

Write in exponential form.

11. $\log_6 216 = 3$ $6^3 = 216$

12. $\log_{10} 0.1 = -1$ $10^{-1} = 0.1$

13. $\log_9 81 = 2$ $9^2 = 81$

14. $\log_{10} 1000 = 3$ $10^3 = 1000$

Evaluate each logarithm. Round to the nearest ten-thousandth if needed.

15. $\log_7 31$ $\frac{\log 31}{\log 7} = 1.7647$

16. $\log_{1/6} 42$ $\frac{\log 42}{\log(1/6)} = -2.0860$

17. $\log_4 48$ $\frac{\log 48}{\log 4} = 2.7925$

18. $\log_{1/2} 32$ $\frac{\log 32}{\log(1/2)} = -5$

Solve each equation. Round solutions to the nearest ten-thousandth if needed.

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$5^x = 5^2$

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$(2^2)^{3x-1} = (2^3)^{x+2}$

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$3x = 8$

$x = 8/3$

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$x = 3$

24. $5^{4x} = 25^{x+3}$

$5^{4x} = (5^2)^{x+3}$

$4x = 2x + 6$

$2x = 6$

$x = 3$

25. $1000^{2x+3} = 100^{5x+2}$

$(10^3)^{2x+3} = (10^2)^{5x+2}$

$6x+9 = 10x+4$

$5 = 4x$

$x = 1.25$

26. $2^{x-3} = \frac{1}{16}$

$2^{x-3} = 2^{-4}$

$x-3 = -4$

$x = -1$

27. $4^x = 26$

$\log_4 26 = x$

$\frac{\log 26}{\log 4} = 2.3502$

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$\frac{\log 100}{\log 1000} = x$

$2/3 = x$

36. $\log_x 32 = 5$

$\sqrt[5]{x^5} = 32$

$x = 2$

37. $\log_{10}(x-5) = 2$

$10^2 = x-5$

$100 = x-5$

$105 = x$

38. $\log_{125} x = \frac{2}{3}$

$125^{2/3} = x$

$25 = x$

39. $\log_8 2 = x$

$\frac{\log 2}{\log 8} = x$

$x = 1/3$

40. $\log_x 256 = 4$

$\sqrt[4]{x^4} = 256$

$x = 4$

41. $\log_4(x-3) = 2$

$4^2 = x-3$

$16 = x-3$

$19 = x$

42. $\log x = 5$

10

$10^5 = x$

$100{,}000 = x$

Solve each question below.

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b) $(1-.1)$

$y = 32000(.9)^4$

$\$20,995.20$

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a) $y = 7000(1.035)^x$

b) 8314 students

$(1+.035)$

$y = 7000(1.035)^5$

$= 8313.80$

47. The population of a high school decreases by 12% each year. If there are 125 students now when will there be 75 students? $(1-.12)$

$\frac{75}{125} = \frac{125(.88)^x}{125}$

$.6 = .88^x$

$\log_{.88} .6 = x$

$\frac{\log .6}{\log .88} = x$

$x = 3.9960$

$x \approx 4$ yrs

48. A parent raises a child's allowance by 20% each year. If the allowance is $8 now, when will it reach $20? $(1+.2)$

$\frac{20}{8} = \frac{8(1.2)^x}{8}$

$2.5 = 1.2^x$

$\log_{1.2} 2.5 = x$

$\frac{\log 2.5}{\log 1.2} = x$

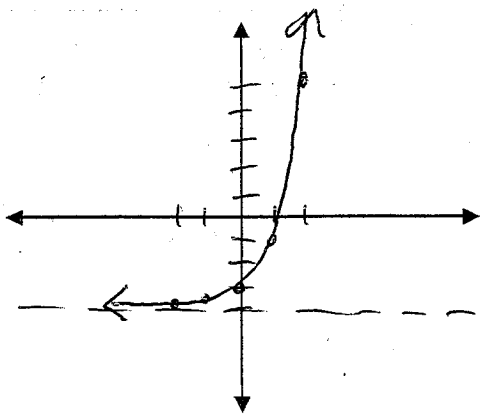
$x = 5.0257$

$x \approx 5.02$ yrs

Make a t-chart & graph the functions below. Identify the desired characteristics of the graph. Label axis intervals.

49
AA. $y = 3^x - 4$

x	y
-2	$-3\frac{8}{9}$
-1	$-3\frac{2}{3}$
0	-3
1	-1
2	5



Growth or Decay (circle one)

Domain: All Reals (ℝ)

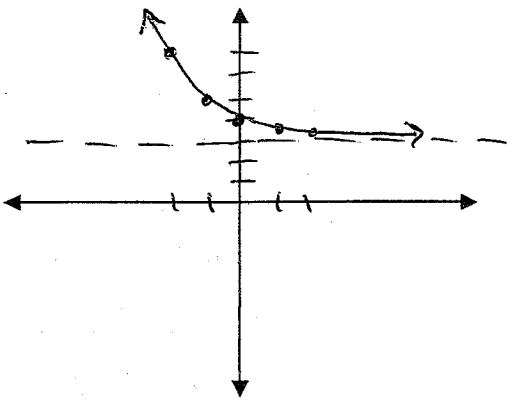
Range: $y > -4$

y-intercept: $(0, -3)$

equation for asymptote: $y = -4$

50
AA. $y = \left(\frac{1}{2}\right)^x + 3$

x	y
-2	7
-1	5
0	4
1	3.5
2	3.25



Growth or Decay (circle one)

Domain: All Reals (ℝ)

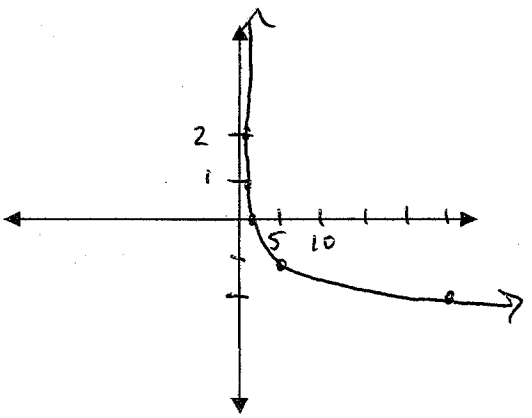
Range: $y > 3$

y-intercept: $(0, 4)$

equation for asymptote: $y = 3$

51
AA. $y = \log_{1/5} x$

x	y
25	-2
5	-1
1	0
1/5	1
1/25	2



Domain: $x > 0$

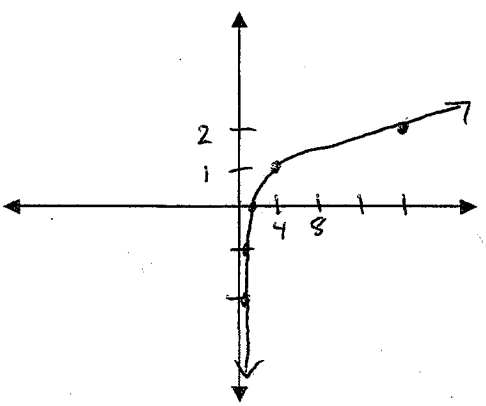
Range: ℝ

y-intercept: None

equation for asymptote: $x = 0$

52
AA. $y = \log_4 x$

x	y
1/16	-2
1/4	-1
1	0
4	1
16	2



Domain: $x > 0$

Range: ℝ

y-intercept: None

equation for asymptote: $x = 0$