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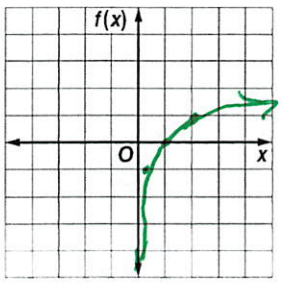
Mid-Chapter Review Chapter 6

Identify the **Domain and Range** of each. Then sketch the graph.

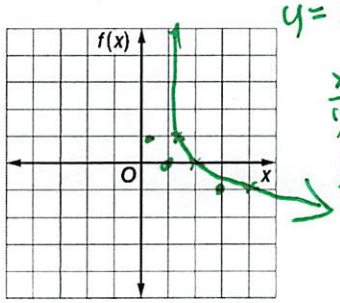
1. $f(x) = \log_2 x$



x	y
1/2	-1
1	0
2	1

D: (0,∞)
R: ℝ

2. $f(x) = -\log_3 (x-1)$



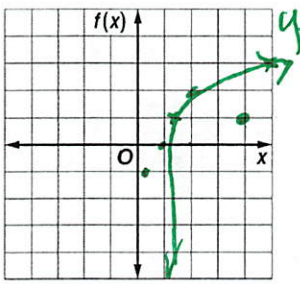
y = log₃x

x	y	-y
1/3	-1	1
1	0	0
3	1	-1

1 →

D: (1,∞)
R: ℝ

3. $f(x) = \log_4(x-1) + 2$



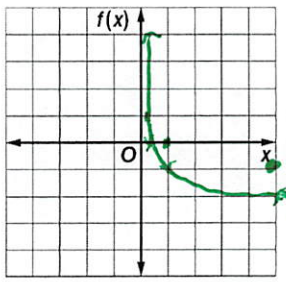
y = log₄x

x	y
1/4	-1
1	0
4	1

1 →
↑2

D: (1,∞)
R: ℝ

4. $f(x) = -2\log_5 x - 1$



y = log₅x

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

↓1

D: (0,∞)
R: ℝ

Rewrite each equation in exponential form.

5. $\log_6 36 = 2$

$6^2 = 36$

6. $\log_{289} 17 = \frac{1}{2}$

$289^{1/2} = 17$

Rewrite each equation in logarithmic form.

7. $64^{\frac{1}{2}} = 8$

$\log_{64} 8 = \frac{1}{2}$

8. $12^2 = 144$

$\log_{12} 144 = 2$

Evaluate each expression.

9. $\log_5 125$

$5^x = 125 \quad x = 3$

10. $\log_3 \frac{1}{243}$

$3^x = \frac{1}{243} \quad x = -5$

11. $\log_{343} 7$

$343^x = 7$

$x = 1/3$

12. $\log_{64} 4$

$64^x = 4$

$x = 1/3$

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Expand each logarithm. Don't evaluate
(All logarithms are common logs, base 10)

13. $\log(3 \cdot 5)$

$\log 3 + \log 5$

14. $\log(3 \cdot 2^3)$

$\log 3 + \log 2^3 \neq \log 3 + 3\log 2$

15. $\log\left(\frac{2^4}{5}\right)$

$\log 2^4 - \log 5$

$4\log 2 - \log 5$

16. $\log\left(\frac{6}{5}\right)^6$

$6\log\frac{6}{5} = 6(\log 6 - \log 5)$

$(6\log 6 - 6\log 5)$

Condense each expression to a single logarithm.

17. $\log 3 - 2\log 8$

$\log 3 - \log 8^2$

$\log \frac{3}{64}$

18. $6\log_3 u + 2\log_3 v$

$\log_3 u^6 + \log_3 v^2$

$\log_3 \frac{u^6}{v^2}$

19. $4\log_4 5 - \frac{1}{2}\log_4 9$

$\log_4 5^4 - \log_4 9^{1/2}$

$\log_4 625 - \log_4 3$

$= \log_4 \frac{625}{3}$

20. $20\log_6 x + 5\log_6 y$

$\log_6 x^{20} + \log_6 y^5$

$\log_6 \frac{x^{20}}{y^5}$

Change of Base Formula
Use a calculator to approximate each to the nearest thousandth.

21. $\log_2 30$

$\frac{\log 30}{\log 2} \approx 4.907$

22. $\log_4 5^3$

$3\left(\frac{\log 5}{\log 4}\right)$

≈ 3.483

23. $\log_3 3^8$

$8\log_3 3$

$= 8$

Solve each equation. Check your solutions.

24. $\log_4 4 + \log_4 x = \log_4 72$

$\log_4 4x = \log_4 72$

$4x = 72$

$x = 18$

25. $\log_6 6c + \log_6 3 = \log_6 126$

$\log_6 18c = \log_6 126$

$18c = 126$

$c = 7$

26. $\log_5 2y - \log_5 4 = \log_5 3$

$\log_5 \frac{2y}{4} = \log_5 3$

$\frac{2y}{4} = 3$

$2y = 12$

$y = 6$

27. $\log_2(q+2) - \log_2 3 = \log_2 7$

$\log_2 \frac{q+2}{3} = \log_2 7$

$\frac{q+2}{3} = 7$

$q+2 = 21$

$q = 19$

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28. $\log_9 4 + 2\log_9 5 = \log_9 w$

$\log_9 4 + \log_9 5^2 = \log_9 w$

$\log_9 100 = \log_9 w$ $\quad w = 100$

29. $\log_{10} x + \log_{10}(3x - 5) = \log_{10} 2$

$\log_{10} x(3x-5) = \log_{10} 2$

$3x^2 - 5x = 2$

$3x^2 - 5x - 2 = 0$

$(3x+1)(x-2)$ $\quad x = 2$, $x = -\frac{1}{3}$

30. $\log_3 d + \log_3 3 = 3$

$\log_3 3d = 3$

$3d = 3^3$

$d = 9$

31. $\log_{10} y - \log_{10}(2 - y) = 0$

$\log_{10} \frac{y}{2-y} = 0$

$\frac{y}{2-y} = 1$ $\quad y = 1$

$y = 2 - y$

32. $\log_2 r + 2\log_2 5 = 0$

$\log_2 25r = 0$

$25r = 1$

$r = \frac{1}{25}$

33. $\log_2(x+4) - \log_2(x-3) = 3$

$\log_2 \frac{x+4}{x-3} = 3$

$\frac{x+4}{x-3} = 8$

$x + 4 = 8(x-3)$

$x + 4 = 8x - 24$

$28 = 7x$

$x = 4$

Solve each equation or inequality. Round your answers to the nearest thousandth.

34. $3^b = 17$

$\log_3 3^b = \log_3 17$

$b = \frac{\log 17}{\log 3} \approx 2.579$

35. $16^v = 67$

$v = \log_{16} 67$

≈ 1.517

36. $5(18)^x = 26$

$18^x = \frac{26}{5}$

$x = \log_{18} \frac{26}{5} \approx .571$

37. $3^y - 6 = 5$

$3^y = 11$

$y = \log_3 11 \approx 2.183$

38. $9^{n+10} + 3 = 81$

$9^{n+10} = 78$

$n + 10 = \log_9 78$

$n = \frac{\log 78}{\log 9} - 10 \approx -8.017$

39. $11^{n-8} - 5 = 54$

$11^{n-8} = 59$

$n - 8 = \log_{11} 59$

$n = \frac{\log 59}{\log 11} + 8 \approx 9.700$

40. $-6(2)^{8r+8} + 5 = -19$

$-6(2)^{8r+8} = -24$

$2^{8r+8} = 4$

$8r + 8 = \log_2 4$

$r = -\frac{3}{4}$

41. $36^p = 216^{5-p}$

$(6^2)^p = (6^3)^{(5-p)}$

$2p = 15 - 3p$

$p = 3$

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42. $(13)^{x^2} = 33.3$

$x^2 = \log_{13} 33.3$

$x \approx \pm 1.169$

43. $9^{b+2} = 27^b$

$(3^2)^{(b+2)} = (3^3)^b$

$3^{2b+4} = 3^{3b}$

$2b + 4 = 3b$

$b = 4$

44. $5^x \geq 42$

$x \geq \log_5 42$

$x \geq 2.322$

45. $9^{2a} < 120$

$2a < \log_9 120$

$2a < \frac{\log 120}{\log 9}$

$a < 1.089$

46. $3^{4x} \leq 72$

$4x \leq \log_3 72$

$4x \leq \frac{\log 72}{\log 3}$

$x \leq 0.973$

47. $7^{6n} > 49^{2n+3}$

$7^{6n} > (7^2)^{(2n+3)}$

$7^{6n} > 7^{4n+6}$

$6n > 4n + 6$

$2n > 3$

48. $3^{y-1} \leq 9^y$

$3^{y-1} < 3^{2y}$

$y - 1 < 2y$

$-y < 1$

$y > -1$

49. $125^p \geq 25^{p-2}$

$(5^3)^p \geq (5^2)^{(p-2)}$

$5^{3p} \geq 5^{2p-4}$

$3p \geq 2p - 4$

$p \geq -4$

50. Find the values of $log_3\ 27$ and $log_{27}\ 3$
Find the values of $log_2\ 32$ and $log_{32}\ 2$
Make and prove a conjecture about the relationship between $log_a\ b$ *and* $log_b\ a$

$\log_3 27 = 3$

$\log_{27} 3 = 1/3$

$\log_2 32 = 5$

$\log_{32} 2 = \frac{1}{5}$

$\log_a b = \frac{1}{\log_b a}$

$\log_a b = \frac{\log b}{\log a}$

(they're reciprocals)

$\frac{1}{\log_b a} = \frac{1}{\frac{\log b}{\log a}} = \frac{\log b}{a}$