Name: Key

Date: _____

Math 433—Pulford

Lesson 61

4 1. The solution set of $2^{x^2+2x} = 2^{-1}$ is

(1) { }
(2) {-1, 1}
(3) {1}
(4) {-1}

$x^2+2x=-1$

$x^2+2x+1=0$

$(x+1)(x+1)$

$x=-1$

4 2. What is the value of b in the equation $4^{2b-3} = 8^{1-b}$?

(1) $-\frac{3}{7}$
(2) $\frac{10}{7}$
(3) $\frac{7}{9}$
(4) $\frac{9}{7}$

$(2^2)^{2b-3}$ $(2^3)^{1-b}$

$4b-6=3-3b$

$7b=9$ $b=\frac{9}{7}$

2 3. Solve for x: $64^{x-2} = 256^{2x}$

(1) 0
(2) $-\frac{6}{5}$
(3) $-\frac{1}{5}$
(4) $-\frac{6}{11}$

$(2^6)^{x-2}=(2^8)^{2x}$

$6x-12=16x$

$-12=10x$

$x=\frac{-12}{10}$

4 4. The magnitude (R) of an earthquake is related to its intensity (I) by $R = \log\left(\frac{I}{T}\right)$, where T is the threshold below which the earthquake is not noticed. If the intensity is doubled, its magnitude can be represented by

(1) 2(log I - log T)
(2) log I - log T
(3) 2 log I - log T
(4) log 2 + log I - log T

$\log\frac{2I}{T}$

$\log 2+\log I-\log T$

2 5. The expression $\log_3 a^5 b$ is equivalent to:

(1) 5 $\log_3$ ab
(2) 5 $\log_3$ a + $\log_3$ b
(3) $\log_3$ 5ab
(4) $\log_3$ 5a + $\log_3$ b

3 6. Which expression is *not* equivalent to $\log_b 36$?

(1) $2\log_b 6$
(2) $\log_b 72 - \log_b 2$
(3) $6\log_b 2$
(4) $\log_b 9 + \log_b 4$

1 7. If log 5 = a, then log 250 can be expressed as

$\log 5^2 \cdot 10$

$2\log 5 + \log 10$

(1) 2a + 1 (3) 50a

(2) 10 + 2a (4) 25a

2 8. For which value of x is y = log x undefined?

(1) ~~1~~ ~~10~~

(2) 0 (3) 1.483

(4) π

1 9. If log x = a, log y = b, and log z = c, then $\log \frac{x^2y}{\sqrt{z}}$ is equivalent to

$2a + b - \frac{1}{2}c$

(1) $2a + b - \frac{1}{2}c$ (3) $2ab - \frac{1}{2}c$

(2) $a^2 + b - \frac{1}{2}c$ (4) $42a + b + \frac{1}{2}c$

3 10. If x = -2 and y = 3, what is the value of the expression $\frac{y^{-2}}{x^{-3}}$?

(1) $-\frac{9}{8}$ (3) $\frac{8}{9}$ $\frac{3^{-2}}{(-2)^{-3}}$ $\frac{(-2)^3}{9}$

(2) -1 (4) $\frac{8}{9}$

1 11. The expression $(2y)^{\frac{2}{5}}$ is equivalent to

$\sqrt[5]{4y^2}$

(1) $\sqrt[5]{4y^2}$ (3) $\sqrt[5]{2y^2}$

(2) $\sqrt{32y^5}$ (4) $\sqrt{2y^5}$

2 12. The graph $y = 3^x$

(1) intersects the x-axis only.

(2) intersects the y-axis only.

(3) intersects both coordinates axes.

(4) does not intersect either axis.

1 13. The expression $3 \log A - \frac{1}{2} \log B$ is equivalent to

(1) $\log \frac{A^3}{\sqrt{B}}$ (3) $\log \frac{3A}{\sqrt{B}}$

(2) $\log \frac{A^3}{B^2}$ (4) $\log \frac{3A}{2B}$

$\log \frac{A^3}{\sqrt{B}}$

1 14. Find the equation of the inverse of $y = 2^x$.

(1) $y = \log_2 x$ (3) $y = x^2$

(2) $y = \log_x 2$ (4) $y = (\frac{1}{2})^x$

1 15. If $M = 10a^2$, then $\log M =$

(1) $1 + 2\log a$ (3) $10 + 2\log a$

(2) $1 + 2a$ (4) $20 \log a$

$\log 10a^2$

$\log 10 + 2 \log a$

$1 + 2 \log a$

16. The common logarithm of $x = -1.2142$, then which number is closest to x?

(1) -0.0843 (3) 0.0843

(2) 0.0611 (4) 16.3757

17. Solve for x: $\left(x^{-3}\right)^{-\frac{1}{3}}=\left(\frac{27}{64}\right)^{-\frac{1}{3}}$

$x=\frac{4}{3}$

18. Simplify the following expressions:

(a) $\left(\frac{m^{-4}}{m^{-6}}\right)^{-\frac{1}{2}}$

$\frac{m^2}{m^3}=\frac{1}{m}$

(b) $\frac{c^2d^{-3}}{c^{-4}d^2}$

$\frac{c^6}{d^5}$

19. Solve for x: $\log_b 36-\log_b 2=\log_b x$

$\log_b \frac{36}{2}=\log_b x$

$\log_b 18=\log_b x$

$x=18$

20. If $\log_5 x=2$, what is the value of $\sqrt{x}$?

$5^2=x$

$25=x$

$\sqrt{x}=5$

21. Solve for x: $\log_8(x+1)=\frac{2}{3}$

$8^{\frac{2}{3}}=x+1$

$4=x+1$

$x=3$

22. If $\log_x 9=-2$, what is the value of x?

$\left(x^{-2}\right)^{\frac{1}{-2}}=(9)^{\frac{1}{-2}}$

$x=\frac{1}{3}$

23. Solve for x: $\log_2(x+1)=3$

$2^3 = x+1$

$8 = x+1$

$7 = x$

24. Solve for x: $3^{x+1} - 5 = 22$

$3^{x+1} = 27$

$3^{x+1} = 3^3$

$x+1 = 3$

$x=2$

25. Solve algebraically for x: $27^{2x+1} = 9^{4x}$

$(3^3)^{2x+1} = (3^2)^{4x}$

$6x+3 = 8x$

$2x = 3$

$x = \frac{3}{2}$

26. Solve the following equation: $\log_4(x^2 + 3x) - \log_4(x + 5) = 1$

$\log_4 \frac{x^2+3x}{x+5} = 1$

$4 = \frac{x^2+3x}{x+5}$

27. Solve algebraically for x: $27^x = 9^{x+2}$

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

$3x = 2x+4$

$x = 4$

28. Solve algebraically for x: $8^{2x} = 4^6$

$(2^3)^{2x} = (2^2)^6$

$2^{6x} = 2^{12}$

$6x = 12$

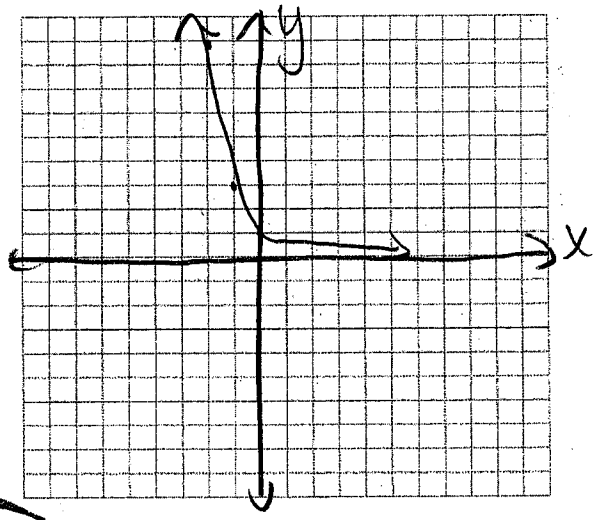
$x=2$

29. The graph of $y = (\frac{1}{3})^x$ has an asymptote.

On the grid, sketch the graph of

$y = (\frac{1}{3})^x$ and write the equation

of the asymptote.



x	y
-2	9
-1	3
0	1
1	1/3
2	1/9

$y = 0$

For questions #30 - #33: Solve for x:

30. $\log (x + 2) - \log x = \log 12$

$$\log \frac{x+2}{x} = \log 12$$

$$\frac{x+2}{x} = 12$$

$$x + 2 = 12x$$

$$2 = 11x$$

$$x = \frac{2}{11}$$

31. $\log_x 4 + \log_x 9 = 2$

$$\log_x 36 = 2$$

$$x^2 = 36$$

$$x = \pm 6$$

reject neg

$x = 6$

32. $x = \log_5 29.5$

$5^x = 29.5$

33. $\log_{(x+1)} 27 = 3$

$$((x+1)^3)^{\frac{1}{3}} = (27)^{\frac{1}{3}}$$

$$x + 1 = 3$$

$x = 2$

34. Match the expression in column 1 with those in Column 2.

Column 1

d 1. $\log xy$

h 2. $\log \frac{x}{y}$

a 3. $\log xy^2$

l 4. $\log x^2y$

f 5. $\log (xy)^2$

b 6. $\log \sqrt{xy}$

j 7. $\log \sqrt{\frac{x}{y}}$

i 8. $\log \sqrt{\frac{y}{x}}$

n 9. $\log \frac{x}{\sqrt{y}}$

c 10. $\log \frac{\sqrt{x}}{y}$

m 11. $\log x\sqrt{y}$

e 12. $\log y\sqrt{x}$

g 13. $\log \sqrt{xy^2}$

k 14. $\log \sqrt{\frac{x}{y^2}}$

Column 2

a. $\log x + 2 \log y$

b. $\frac{\log x + \log y}{2}$

c. $\frac{1}{2}\log x - \log y$

d. $\log x + \log y$

e. $\log y + \frac{1}{2}\log x$

f. $2(\log x + \log y)$

g. $\frac{\log x + 2\log y}{2}$

h. $\log x - \log y$

i. $\frac{\log y - \log x}{2}$

j. $\frac{\log x - \log y}{2}$

k. $\frac{\log x - 2\log y}{2}$

l. $2\log x + \log y$

m. $\log x + \frac{1}{2}\log y$

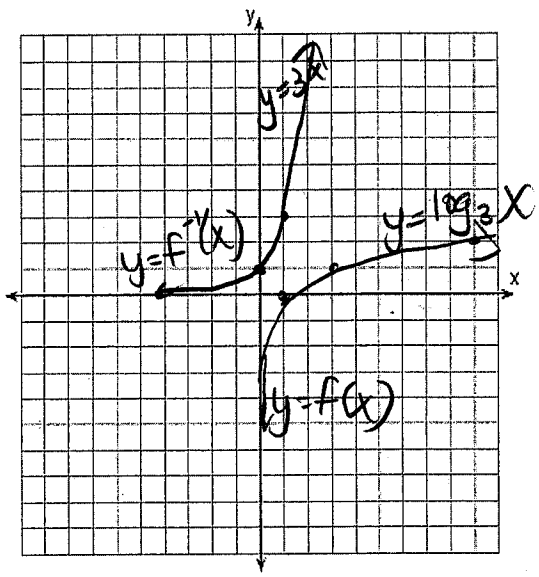
n. $\log x - \frac{1}{2}\log y$

15. (a) Sketch the graph of $f(x) = \log_3 x$.
(b) What is the domain of f(x)?
(c) What is the range of f(x)?
(d) Sketch the graph of $f^{-1}(x)$.
(e) Write an equation for $f^{-1}(x)$.

inverse of $y = 3^x$

$y = 3^x$

x	y
-2	1/9
-1	1/3
0	1
1	3
2	9



$y = \log_3 x$

x	y
1/9	-2
1/3	-1
1	0

b) $x > 0$

c) $\mathbb{R}$

d) graph

e) $f^{-1}(x) = 3^x$

36. Solve each equation for y in terms of x.

(a) $x = \log_6 y$

$6^x = y$

(b) $x = 82^y$

$y = \log_{82} x$

5 5 5 5

37. Evaluate each logarithmic expression. Show all work.

(a) $3\log_2 8$

$3 \cdot 3 = 9$

(b) $\frac{14}{9}\log_5 625$

$\frac{14}{9}(4) = \frac{56}{9}$

38. If $f(x) = \log_3 x$, find f(27).

$f(27) = \log_3 27 = 3$

39. Solve for x: $\log_6 x = -2$

$6^{-2} = x$

$x = \frac{1}{36}$

40. Solve for b: $\log_b 27 = \frac{3}{2}$

$(b^{\frac{3}{2}})^{\frac{2}{3}} = (27)^{\frac{2}{3}}$

$3^2 = 9$

41. Expand $\log \frac{x^4(x-2)^3}{\sqrt{x+3}}$ using the rules for logarithms.

$[4\log x + 3\log(x-2)] - \frac{1}{2}\log(x+3)$

If $\log 3 = x$ and $\log 5 = y$, write each in terms of x and y.

42. log 75

$\log 25 \cdot 3$

$\log 5^2 \cdot 3$

$2\log 5 + \log 3$

$2y + x$

43. log 0.04

$\log .04 = \log \frac{1}{25} = \log \frac{1}{5^2}$

$\log 1 - 2\log 5$

$0 - 2y = -2y$

Write each exponential equation in logarithmic form.

44. $2^4 = 16$ $\quad \log_2 16 = 4$

45. $12^0 = 1$ $\quad \log_{12} 1 = 0$

46. $5^{-3} = 0.008$ $\quad \log_5 .008 = -3$

47. $64^{\frac{1}{3}} = 4$ $\quad \log_{64} 4 = \frac{1}{3}$

Write each logarithmic equation in exponential form.

48. $\log_{10} 100 = 2$ $\quad 10^2 = 100$

49. $7 = \log_2 128$ $\quad 2^7 = 128$

50. $\log_{10} 0.001 = -3$ $\quad 10^{-3} = .001$

51. $\log_8 2 = \frac{1}{3}$ $\quad 8^{\frac{1}{3}} = 2$

Evaluate each logarithmic expression.

$4^y = \frac{1}{64}$

52. $\log_8 8$ — 1

53. $4\log_6 216$ — $4 \cdot 3$, 12

54. $\log_3 81$ — 4

55. $16\log_4 \frac{1}{64}$ — $16 \cdot -3$, -48

Solve each equation for the variable.

56. $\log_{10} x = 3$ — $10^3 = x$, $x = 1000$

57. $A = \log_4 16$ — $4^A = 16$, $A = 2$

58. $\log_5 y = -2$ — $5^{-2} = y$, $y = \frac{1}{25}$

59. $\log_8 x = \frac{1}{2}$ — $8^{\frac{1}{2}} = x$, $x = \sqrt{8} = 2\sqrt{2}$

$3^{\frac{9}{3}}\ 3^{\frac{9}{3}}\ 3^{\frac{9}{3}}\ 3^{\frac{9}{3}}$

Write each expression as a single logarithm. Find the value of the expression.

60. $\log_3 1 + \log_3 9$ — $\log_3 9$, 2

61. $\log_3 243 - \log_3 729$ — $\log_3 \frac{243}{729}$, $\log_3 \frac{1}{3}$, -1

62. $\frac{1}{3}\log_3 2{,}187 + \frac{1}{6}\log_3 81$ — $\log_3 \sqrt[3]{2187} \cdot \sqrt[6]{81}$, $\log_3 \sqrt[3]{3^7} \cdot \sqrt[6]{3^4}$, $\log_3 3^{\frac{7}{3}} \cdot 3^{\frac{2}{3}}$, $\log_3 3^{\frac{25}{6}}$

729, 3, 81, 3, 3, 3

$3^{\frac{3}{3}\frac{7}{2}+\frac{2}{3}\frac{2}{2}}$, $\frac{21}{6}+\frac{4}{6}$, $\frac{25}{6}$, $3^x = 3^{\frac{25}{6}}$, $x = \frac{25}{6}$

Expand each expression using the properties of logarithms.

63. $\log_2 2ab$ — $\log_2 2 + \log_2 a + \log_2 b$

64. $\log_3 (\frac{10}{x})$ — $\log_3 10 - \log_3 x$

65. $\log_5 a^{-5}$ — $-5\log_5 a$

66. $\log_{10} (x+1)^2$ — $2\log_{10}(x+1)$

67. $\log_4 (\frac{x^6}{y^3})$ — $6\log_4 x - 3\log_4 y$

68. $\log_{10}(3x)^2$ — $2(\log_{10} 3 + \log_{10} x)$

2 2 2 2 2

Solve each equation for the variable.

69. $\log_2 2^3 + \log_2 2^2 = \log_2 x$

$\log_2 2^5 = \log_2 X$

$X = 2^5 = 32$

70. $\log_5 x + \log_5 x = \log_5 625$

$\log_5 X^2 = \log_5 625$

$X^2 = 625$

$X = \pm 25$ reject neg

$X = 25$

71. $\log_b 64 - \log_b 16 = \log_4 16$

$\log_b \frac{64}{16} = \log_4 16$

$\log_b 4 = 2$

$\sqrt{b^2} = \sqrt{4}$

$b = \pm 2$

reject neg

$b = 2$

72. $\log_2 8 + \log_3 9 = \log_b 100{,}000$

$3 + 2 = \log_b 100{,}000$

$5 = \log_b 100{,}000$

$b^5 = 100{,}000$

$10 = b$