Logarithmic Functions

Name: KEY

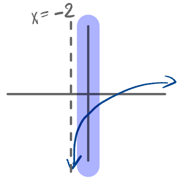
Date: ____________ Period: ______

1. Find the domain and range of the function. Use interval notation.

$$f(x) = 4\log(x+2) - 5$$

Domain $(-2, \infty)$

Range : $(-\infty, \infty)$

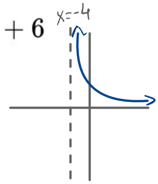


2. Find the domain and range of the function. Use inequality notation.

$$f(x) = -2\log(x+4) + 6$$

Domain $-4 < x < \infty$

Range $-\infty < y < \infty$



Rewrite each equation in exponential form.

1) $\log_{16} 256 = 2$

$16^2 = 256$

2) $\log_9 81 = 2$

$9^2 = 81$

3) $\log_2 \frac{1}{8} = -3$

$2^{-3} = 1/8$

4) $\log_5 25 = 2$

$5^2 = 25$

5) $\log_{20} 400 = 2$

$20^2 = 400$

6) $\log_{17} 289 = 2$

$17^2 = 289$

7) $\log_{13} 169 = 2$

$13^2 = 169$

8) $\log_5 125 = 3$

$5^3 = 125$

9) $\log_9 \frac{1}{81} = -2$

$9^{-2} = 1/81$

10) $\log_{169} 13 = \frac{1}{2}$

$169^{1/2} = 13$

11) $\log_y x = \frac{2}{3}$

$y^{2/3} = x$

12) $\log_y 76 = x$

$y^x = 76$

13) $\log_n 117 = 11$

$n^{11} = 117$

14) $\log_5 a = b$

$5^b = a$

Rewrite each equation in logarithmic form.

21) $4^{\frac{1}{2}} = 2$

$\log_4 2 = \frac{1}{2}$

22) $3^5 = 243$

$\log_3 243 = 5$

23) $14^{-2} = \frac{1}{196}$

$\log_{14} \frac{1}{196} = -2$

24) $18^2 = 324$

$\log_{18} 324 = 2$

25) $3^3 = 27$

$\log_3 27 = 3$

26) $\left(\frac{1}{6}\right)^3 = \frac{1}{216}$

$\log_{1/6} \frac{1}{216} = 3$

27) $14^2 = 196$

$\log_{14} 196 = 2$

28) $36^{-\frac{1}{2}} = \frac{1}{6}$

$\log_{36} \frac{1}{6} = -\frac{1}{2}$

29) $6^3 = 216$

$\log_6 216 = 2$

30) $17^2 = 289$

$\log_{17} 289 = 2$

31) $x^y = 101$

$\log_x 101 = y$

32) $v^u = 74$

$\log_v 74 = u$

33) $3^n = 125$

$\log_3 125 = n$

34) $x^y = 130$

$\log_x 130 = y$

Solve each equation. Give an exact solution.

1. $\log_{49} x = -\frac{1}{2}$

$49^{-1/2} = x$

$x = \frac{1}{\sqrt{49}} = \frac{1}{7}$

2. $3^{4x+1} - 5 = 22$

$+5 \quad +5$

$3^{4x+1} = 27 \qquad 3^3 = 27$

$4x + 1 = 3 \qquad x = \frac{1}{2}$

$4x = 2$

3. $\log_5 (x+1) - \log_5 x = 2$

$\log_5 \left(\frac{x+1}{x}\right) = 2$

$\frac{x+1}{x} = 5^2 = 25 \qquad x = \frac{1}{24}$

$x + 1 = 25x$

$1 = 24x$

~~4. $8^{x+2} = 16$~~

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

$3x - 2 = 4^2$

$3x - 2 = 16$

$3x = 18$

$x = 6$

~~6. $\log(2x - 1) + \log x = 1$~~

Expand each logarithm.

1) $\log (6 \cdot 11)$

$\log 6 + \log 11$

2) $\log (5 \cdot 3)$

$\log 5 + \log 3$

3) $\log \left(\frac{6}{11}\right)^5$ ← 5 "attached" to 6 and 11

$5 \log 6 - 5 \log 11$

4) $\log (3 \cdot 2^3)$

$\log 3 + 3 \log 2$

5) $\log \frac{2^4}{5}$ ← 4 is "attached" to 2

$4 \log 2 - \log 5$

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

$6 \log 6 - 6 \log 5$

7) $\log \frac{x}{y^6}$

$\log x - 6 \log y$

8) $\log (a \cdot b)^2$

$2 \log a + 2 \log b$

Property Name	Property
Log of 1	$\log_a 1 = 0$
Log of the same number as base	$\log_a a = 1$
Product Rule	$\log_a(mn) = \log_a m + \log_a n$
Quotient Rule	$\log_a\left(\frac{m}{n}\right) = \log_a m - \log_a n$
Power Rule	$\log_a m^n = n \log_a m$
Change of Base Rule	$\log_b a = \frac{\log_c a}{\log_c b}$ (OR) $\log_b a \cdot \log_c b = \log_c a$
Equality Rule	$\log_b a = \log_b c \Rightarrow a = c$
Number Raised to Log	$a^{\log_a x} = x$
Other Rules	$\log_{b^n} a^m = \frac{m}{n} \log_b a$ $-\log_b a = \log_b \frac{1}{a}$ (OR) $= \log_{\frac{1}{b}} a$

9) $\log \frac{u^4}{v}$

$4 \log u - \log v$

10) $\log \frac{x}{y^5}$

$\log x - 5 \log y$

Solve each equation.

$\log A = \log B$

1) $\log 5x = \log (2x + 9)$

$5x = 2x + 9$
$-2x \quad -2x$

$\frac{3x = 9}{3}$

$x = 3$

2) $\log (10 - 4x) = \log (10 - 3x)$

$10 - 4x = 10 - 3x$
$+4x \quad +4x$

$10 = 10 + x$

$x = 0$

3) $\log (4p - 2) = \log (-5p + 5)$

$4p - 2 = -5p + 5$
$+5p \ +2 \quad +5p \ +2$

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

$p = 7/9$

4) $\log (4k - 5) = \log (2k - 1)$

$4k - 5 = 2k - 1$
$-2k \ +5 \quad -2k \ +5$

$\frac{2k = 4}{2}$

$k = 2$

5) $\log (-2a + 9) = \log (7 - 4a)$

$-2a + 9 = 7 - 4a$
$+2a \ -7 \quad -7 \ +2a$

$\frac{2 = -2a}{-2}$

$a = -1$

6) $\frac{2\log_7 -2r = 0}{2}$

$\log_7 (-2r) = 0$

$-2r = 7^0$

$-2r = 1$

$r = 1/2$