Chapter 6.4 Notes
Logarithmic Functions

* Logarithms is just another way of thinking about exponents.

* $2^x = 16 \longrightarrow x = 4$
  * This asks "2 raised to what power = 16"

*Logarithms say the same thing just written a little different.
  * $\log_2 16 = x$

what power do we raise 2 to to get 16

ex.) $\log_2 64 \rightarrow \underbrace{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}_{6} = 64$ so $2^6 = 64$

or

$\log_2 64 = 6$

$$\log_b(a) = c \longleftrightarrow b^c = a$$

- b = base
- c = exponent
- a = argument

1. Evaluate the expression without using a calculator.

$\log_8 1$

- This asks: 8 to what power = 1

$8^x = 1$

$8^0 = 1$

So... $\boxed{0}$

$\log_b(a) = c \rightarrow b^c = a$

b to the c power = a

2. Find the exact value of the logarithm without using a calculator.

$\log_8 64$

- This asks: 8 to what power = 64

$8^x = 64$

$8 \cdot 8 = 64$

8^2

$\underline{8}^x = \underline{8}^2$

$x = \boxed{2}$

* want to get bases the same on both sides of =, so that exponents will = each other.

3. Find the value of the logarithmic expression.

$\log_2\left(\frac{1}{16}\right)$

- This asks: 2 to what power = $\frac{1}{16}$

$2^x = \frac{1}{16}$

$2 \cdot 2 \cdot 2 \cdot 2 = 16$

$2^4 = 16$

$2^{-4} = \frac{1}{16}$

Bases are the same so exponents = each other.

$\underline{2}^x = \underline{2}^{-4}$

$x = \boxed{-4}$

* If going from a whole number to a fraction, the exponent will be negative.

4. Find the exact value of the logarithm without using a calculator.

$$\log_6 \sqrt{6}$$

This asks 6 raised to what power $= \sqrt{6}$.

$$6^x = \sqrt{6} \longrightarrow \sqrt[2]{6^1} = 6^{\frac{1}{2}}$$

$$6^x = 6^{\frac{1}{2}}$$

$$x = \boxed{\frac{1}{2}}$$

5. Change the exponential statement to an equivalent statement involving a logarithm.

$$16 = 4^2$$

$$\underset{a}{16} = \underset{b}{4}^{\overset{c}{2}}$$

$$\log_b(a) = c$$

$$\boxed{\log_4(16) = 2}$$

$$a = b^c \longrightarrow \log_b(a) = c$$

* Just replace the letters with your numbers.

6. Change the exponential statement to an equivalent statement involving a logarithm.

$$\underset{a}{1.3} = \underset{b}{a}^{\overset{c}{3}}$$

$$\log_b(a) = c$$

$$\boxed{\log_a(1.3) = 3}$$

$$a = b^c \longrightarrow \log_b(a) = c$$

* Just replace the letters with your numbers.

7. Change the logarithmic statement to an equivalent statement involving a exponent.

$$\text{Log}_{\underset{b}{4}}\, \underset{a}{16} = \underset{c}{2}$$

$$b^c = a$$

$$\boxed{4^2 = 16}$$

$$\text{Log}_b(a) = c \longrightarrow b^c = a$$

* Just replace the letters with your numbers.

8. Change the logarithmic statement to an equivalent statement involving a exponent.

$$\log_3 81 = x$$

$$b^c = a$$

$$\boxed{3^x = 81}$$

$$\text{Log}_b(a) = c \longrightarrow b^c = a$$

* Just replace the letters with your numbers.

9. Solve the following equation. Write the answer in terms of the natural logarithm.

$$e^{6x} = 5$$

b, c, a

$$\log_b(a) = c$$

$$b^c = a \longrightarrow \log_b(a) = c$$

$$\log_e(5) = 6x$$

* Replace $\log_e$ with Ln

$$\frac{\ln 5}{6} = \frac{\cancel{6}x}{\cancel{6}}$$

← solve for x.

$$\boxed{\frac{\ln 5}{6} = x}$$

10. Solve the following equation. Write the answer in terms of the natural logarithm.

$$e^{5x+9} = 6$$

b, c, a

$$\log_b(a) = c$$

$$b^c = a \longrightarrow \log_b(a) = c$$

$$\log_e(6) = 5x+9$$

* Replace $\log_e$ with Ln

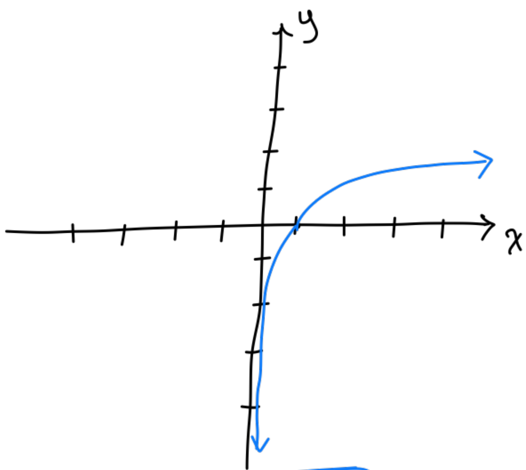
$$\ln 6 = 5x + \cancel{9}$$

$$-9 \qquad \cancel{-9}$$

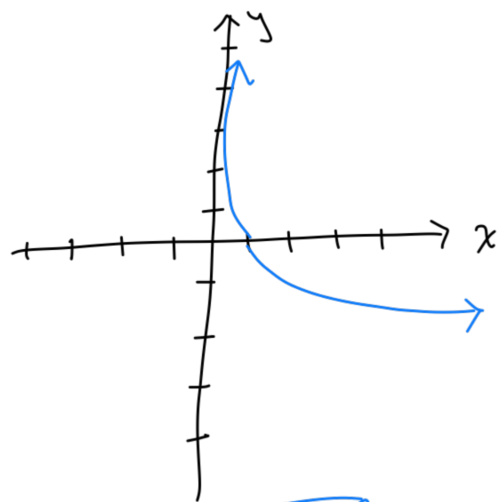
$$\frac{\ln 6 - 9}{5} = \frac{\cancel{5}x}{\cancel{5}}$$

$$\boxed{\frac{\ln 6 - 9}{5}} = x$$

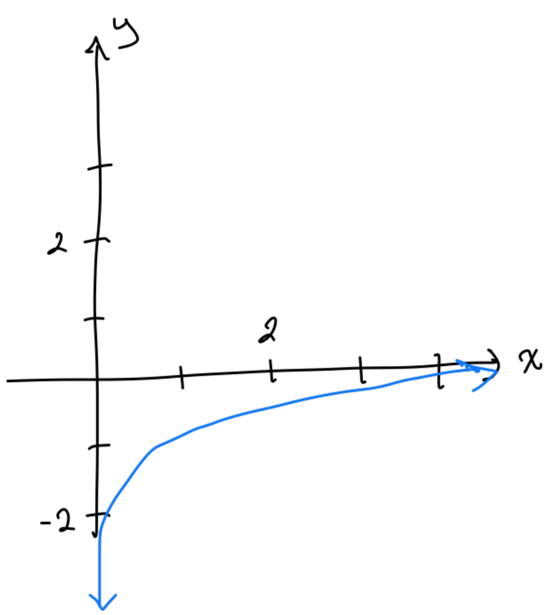
11. The graph of a logarithmic function is given. Select the function for each graph from the given options.



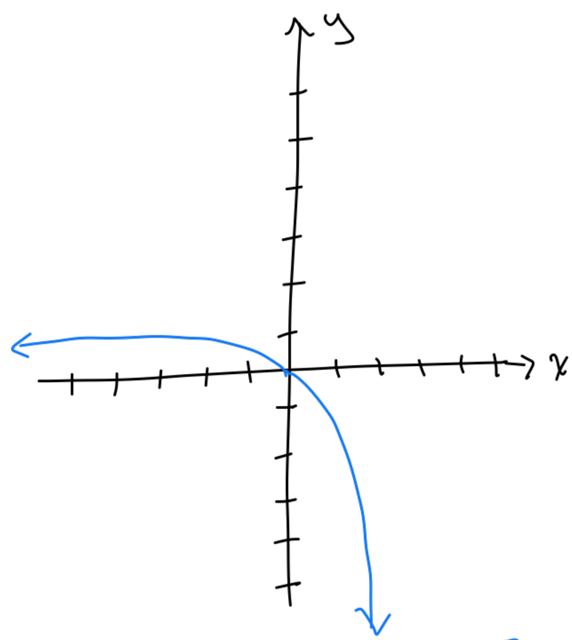
$\boxed{\log_8 x}$



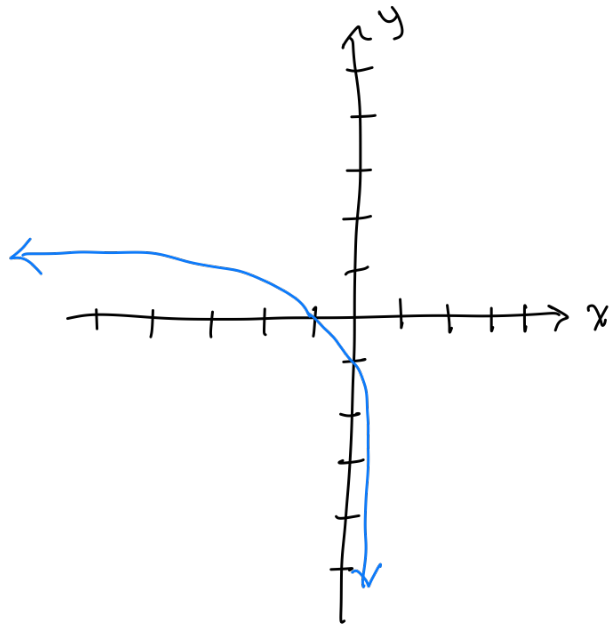
$\boxed{-\log_8 x}$



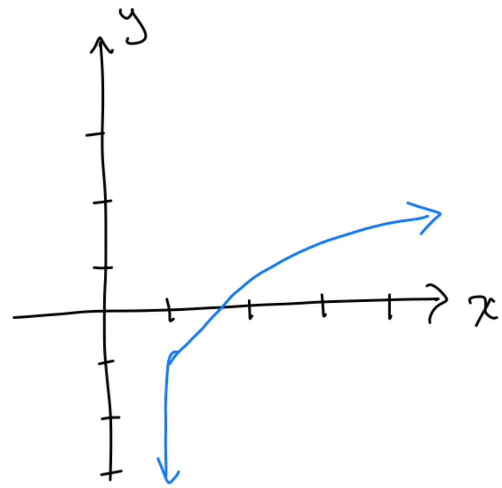
$\boxed{\log_8 x - 1}$



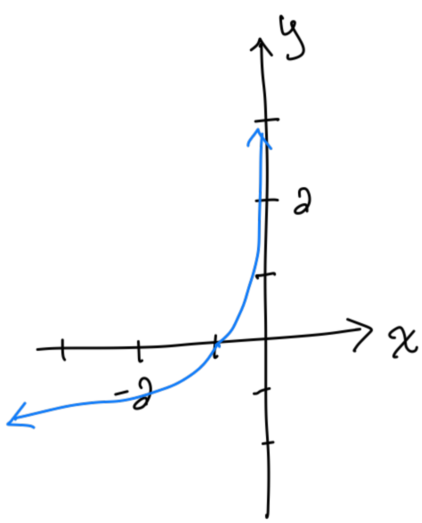
$\boxed{\log_8 (1-x)}$



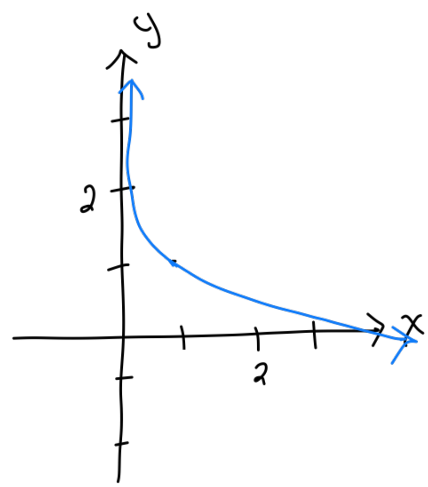
$\boxed{\log_8(-x)}$



$\boxed{\log_8(x-1)}$



$\boxed{-\log_8(-x)}$



$\boxed{1-\log_8 x}$