

Solving Exponential and Logarithmic Functions Worksheet

Simplify.

$$1. 27^{2/3}$$

$$= (3^3)^{2/3}$$

$$= 3^2$$

$$= 9$$

$$2. \sqrt[4]{81}$$

$$= (81)^{1/4}$$

$$= (3^4)^{1/4}$$

$$= 3$$

$$3. \log_4 32 = x$$

$$4^x = 32$$

$$(2^2)^x = 2^5$$

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

$$2x = 5$$

$$x = \frac{5}{2}$$

$$4. \log_2 \left(\frac{1}{16}\right)$$

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

$$2^x = \frac{1}{2^4}$$

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

$$x = -4$$

$$5. \log .01$$

$$10^x = .01$$

$$10^x = \frac{1}{100}$$

$$10^x = 10^{-2}$$

$$x = -2$$

Solving Exponential Equations

Type 1: can make bases equal

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

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

$$2^{9x-3} = 2^{-x-2}$$

$$9x-3 = -x-2$$

$$10x = 1$$

$$x = \frac{1}{10}$$

Type 2: cannot make bases equal

$$\frac{3\pi^{x+1}}{3} = \frac{9}{3}$$

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

$$\log \pi^{x+1} = \log 3$$

$$(x+1) \log \pi = \log 3$$

$$x+1 = \frac{\log 3}{\log \pi}$$

$$x = \frac{\log 3}{\log \pi} - 1$$

Solve: $5e^{2x-1} + 4 = 14$

$$\frac{5e^{2x-1}}{5} = \frac{10}{5}$$

$$e^{2x-1} = 2$$

$$\ln e^{2x-1} = \ln 2$$

$$(2x-1)(1) = \ln 2$$

$$2x-1 = \ln 2$$

$$2x = \ln 2 + 1$$

$$x = \frac{\ln 2 + 1}{2}$$

Estimate the value without a calculator.

$$1. \frac{6 + \sqrt{20}}{2}$$

$$\approx \frac{6 + 4.5}{2}$$

$$\approx \frac{10.5}{2}$$

$$\approx 5.25$$

$$2. \frac{7 - \sqrt{27}}{2}$$

$$\approx \frac{7 - 5.3}{2}$$

$$\approx \frac{1.7}{2}$$

$$\approx .8$$

Rules for Logarithms

$$\log x^b = b \cdot \log x$$

$$\log(AB) = \log A + \log B$$

$$\log\left(\frac{A}{B}\right) = \log A - \log B$$

$$\log_a a = 1$$

$$\log_b X = \frac{\log X}{\log b}$$

Solving Log Equations

Type 1: every term has a log

$$\log_3(x+1) + \log_3(x-5) = \log_3 4$$

$$\begin{array}{l} x+1 > 0 & x-5 > 0 \\ x > -1 & x > 5 \end{array}$$

Domain: $x > 5$

$$\log_3[(x+1)(x-5)] = \log_3 4$$

$$(x+1)(x-5) = 4$$

$$x^2 - 4x - 5 = 4$$

$$x^2 - 4x - 9 = 0$$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(1)(-9)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{52}}{2}$$

$$x = \frac{4 + \sqrt{52}}{2}$$

Type 2: not every term has a log

log = number
then rewrite as an exponent

$$\log_2(x+1) + \log_2(x-1) = 3$$

D: $x > 1$

$$\log_2(x+1)(x-1) = 3$$

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

$$8 = x^2 - 1$$

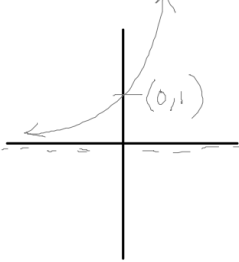
$$\sqrt{9} = \sqrt{x^2}$$

$$\pm 3 = x$$

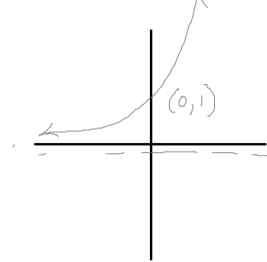
$$x = 3$$

Graphs

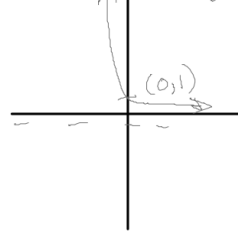
1. $y = 2^x$



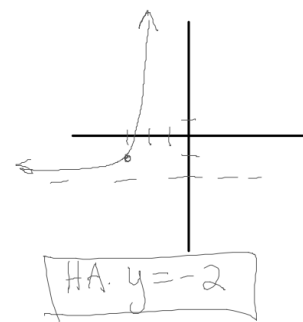
2. $y = e^x$



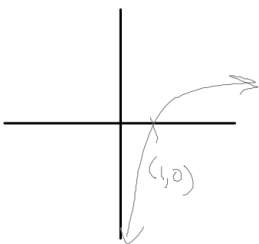
3. $y = \left(\frac{1}{2}\right)^x = \left(2^{-1}\right)^x = 2^{-x}$



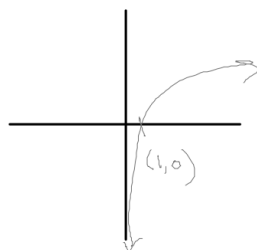
4. $y = \pi^{(x+3)} - 2$



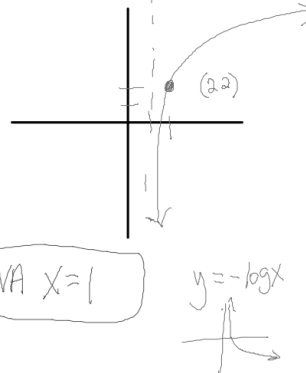
5. $y = \log_2 x$



6. $y = \ln x$



7. $y = \log(x-1) + 2$



8. $y = 3 - \log(x+4)$

