Every math operation has it's inverse.

Inverse operations "undo" each other.

We solve equations by using inverses to get the variable by itself.

Given Operation	Inverse Operation
Addition	Subtraction
Division	Multiplication
Squaring	Square Root
Cube Root	Cubing

Find the equation of the inverse for this function:

$$y = \sqrt{\frac{4x^3 - 7}{8}} + 1$$

$$x = \sqrt{\frac{4y^3 - 7}{8}} + 1$$

Switch the x and y.

$$y = \sqrt[3]{\frac{8(x-1)^2 + 7}{4}}$$

Then solve for y.

Find the equation of the inverse.

$$y = 10^x$$

At this point you don't know how to do this!!!

To solve for x in an exponential equation: $y = 10^x$
we use the inverse operation called:

Logarithm

Sec 8-3: Logarithms
(the inverse of exponential functions)

Exponential Function

$y = b^x$

The base of the Exponential Function

The exponent

Logarithmic Function

$\log_b y = x$

The base of the Logarithmic Function

How do you say this?

$\text{Log}_b y = x$

Log base b of y equals x

Exponential Function:

$y = b^x$

Logarithmic Function:

"Log, base b, of y equals x"

$\log_b y = x$

Rewriting an equation into Logarithmic form.

Exponential Function: $y = b^x$

Logarithmic Function: "Log, base b, of y equals x" $\log_b y = x$

The base is the base

"The exponent is the answer"

Another way to remember how to write an Exponential Equation in Logarithmic Form:

Exponential Form:	becomes	Lograrithmic Form:
$x = y^z$		$z = \text{Log}_y x$

Exponential Equation

$y = b^x$

Range: $y>0$

Domain: Any real number

$b>0, b\neq 1$

Logarithmic Equation

$\log_b y = x$

Range: Any real number

Domain: $x > 0$

$b: \quad b>0, b\neq 1$

You can only input positive numbers to a logarithm and you can get anything out of a logarithm.

Get a small white board, marker, and rag.

1. Rewrite each into logarithmic form.

a. $5^x = 40$ ⟶ $\log_5 40 = x$

b. $6^2 = x$ ⟶ $\log_6 x = 2$

c. $x^2 = 20$ ⟶ $\log_x 20 = 2$

2. Write each in exponential form.

a) $\log_x 169 = 2$ ↓ $x^2 = 169$

b) $\log_8 x = 1$ ↓ $8 = x$

c) $\log_4 3 = x$ ↓ $4^x = 3$

Write in Logarithmic Form: $10^x = 125$

$\log_{10} 125 = x$

$LOG_{10}125$ → "LOG base 10 of 125" → LOG125

LOG_{10} is called the Common Logarithm and is written without the 10.

The button on the calculator [LOG] is for Common Logarithms LOG_{10}

Evaluate each: (hint: think of each as an exponential)

1. $\log_4 1 = 0$ $4^x = 1 \rightarrow x = 0$

2. $\log_3 9 = 2$ $3^x = 9 \rightarrow x = 2$

3. $\log_7(7)$ $7^x = 7 \rightarrow x = 1$

4. $\log_{25} 5 = 1/2$ $25^x = 5 \rightarrow \sqrt{25} = 5$, $x = 1/2$

5. [ ]

6. [ ]

7. [ ]