Springboard 24.1,24.2

Exponential Equations

Warm-up

*1)* $2^{log_2 x} =$

*2)* $4^{log_4 5} =$

3) $log_2 2^x =$

4) $log_3 3^{6x} =$

There are two methods for solving exponential equations:

1. Try writing them so that the bases are all the same.
2. Take the logarithm of both sides.

I Try:

Example #1: Solve using both methods. Check your answer.

$3^x = 27$

Finding common base.

| | |
|---|---|
| Find common base | $3^x = 3^3$ |
| Cancel out bases | x=3 |

Taking Log to both sides.

$3^x = 27$

| | |
|---|---|
| Take log of the base to both sides | $log_3 3^x = log_3 27$<br>$log_3 3^x = log_3 3^3$ |
| Cancel out the log to simplify | $x = 3$ |

Example #2: Solve.

$$\left(\frac{1}{3}\right)^{2x} = \left(\frac{1}{9}\right)^{4-x}$$

We Try:

Example #3: Solve by creating the same base. Check.

$9^{8-x} = 27^{x-3}$

We Try:

Example #3: Solve by taking log to both sides.

$$5^{x-2} = 200$$

You try with your partner on whiteboards:

Solve $4^{3x-1} = 8^{x+1}$

I try:

Solve for x by writing both sides of the equation in terms of the same base.

$3 \cdot 2^x = 384$

| | |
|---|---|
| Isolate the exponent | $2^x = 128$ |
| Solve for x | $2^x = 2^7$ |
| | x=7 |

We Try:

$6 \cdot 4^{x+1} = 96$

You Try:

$5^{4x} = 125^{x-1}$

try:

Solve for x by taking log to both sides

$3^x - 2 = 30$

| | |
|---|---|
| Isolate exponent | $3^x = 32$ |
| Take log of the base on both sides | $log_3 3^x = log_3 32$ |
| Simplify | $x = log_3 32$ |
| Use calculator to solve | $x = \frac{log32}{log3}$=3.15 |

We Try:

$2 \cdot 4^x + 3 = 36$

| | |
|---|---|
| Isolate exponent | |
| Take log of the base on both sides | |
| Simplify | |
| Use calculator to solve | |

We Try:

$5 + e^{2x} = 20$

| | |
|---|---|
| Isolate exponent | |
| Take log of the base on both sides | |
| Simplify | |

CW

Pg. 372 #7-14

Pg. 375 1-5

A logarithmic equation is an equation with a logarithmic expression that contains a variable.

- If $\log_b x = \log_b y$, what can we say about x and y?

I Try:

Example #4:

$\log_6(2x - 1) = -1$

I Try:

Example #5:

$\log_{12} x + \log_{12}(x + 1) = 1$

We Try:

Solve

$\log_3(x-5)=2$

We Try:

$\text{Log}\,45x - \log 3 = 1$

You try with your partner:

$\log_4 100 - \log_4(x+1) = 1$

Exit Ticket

Solve for x

*1)* $5 + e^{2x} = 10$

*2)* $\left(\frac{1}{3}\right)^{2x} = \left(\frac{1}{9}\right)^{4-x}$