5.5 Exponential Equations (Not same Base)

Recall: you can solve $5^{x+10} = 25$ by writing both sides with the same base.

What to Do when: $2^x = 61$
same base is not possible?

USE LOGARITHMS: $2^x = 61$ in log form is $\log_2(61) = x$

NOTE
use the calculator
round to 2 decimal places

$x \approx 5.93$

Steps:

1. Isolate the "power" (base & exponent)
2. Change to log form. $b^x = a \Leftrightarrow \log_b a = x$
3. Solve and check for extraneous solutions.

Ex1: solve $8^{m-7} = 92$

$$\log_8 92 = m - 7$$
$$+7 \qquad\qquad +7$$
$$7 + \log_8 92 = m$$
$$\boxed{m \approx 9.17}$$

check
$8^{9.17-7} = 92$ ✓

Ex. 2: solve $4^{3w} - 5 = 3$

$$4^{3w} - 5 = 3$$
$$+5 \quad +5$$
$$4^{3w} = 8$$

$$\frac{\log_4(8)}{3} = \frac{3w}{3}$$

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

YT1: solve $9^{m-6} = 78$

$$\log_9 78 = m - 6$$
$$+6 \quad +6$$
$$6 + \log_9 78 = m$$

$$\boxed{m \approx 7.98}$$

YT2: solve $15^{3x} + 7 = 67$

$$-7 \quad -7$$
$$15^{3x} = 60$$

$$\frac{\log_{15}(60)}{3} = \frac{3x}{3}$$

$$\boxed{x \approx 0.50}$$

Ex. 3: solve $8 \cdot 11^{7k} - 3 = 213$

$$+3 \quad +3$$
$$\frac{8 \cdot 11^{7k}}{8} = \frac{216}{8}$$
$$11^{7k} = 27$$

$$\frac{\log_{11}(27)}{7} = \frac{7k}{7}$$

$$\boxed{k \approx 0.20}$$

YT3: Solve $5 \cdot 9^{x-1} + 1 = 181$

$x \approx 2.63$

YT4: Solve $10 \cdot 5^{3k-3} = 40$

$k \approx 1.29$

YT5: Solve $8 \cdot 3^{n-1} - 21 = 51$

$n = 3$