Warm up

- Solve for x. $2^x = 32$

  Write 32 as 2 to the power of something

  $2^x = 32$

  $2^x = 2^5 \Rightarrow x = 5$

Exponentials, a^x, has a unique solution, assuming $a > 0$ & $a \neq 1$

$$2^a = 2^b \Rightarrow a = b$$

- $3^{7x} = 27$

  $3^{7x} = 3^3 \Rightarrow 7x = 3$

  $\Rightarrow x = \frac{3}{7}$

- $4^{3x-5} = 16$

  $4^{3x-5} = 4^2 \Rightarrow 3x - 5 = 2$

  $\Rightarrow 3x = 7$

  $\Rightarrow x = \frac{7}{3}$

- $3^{x^2+4x} = \frac{1}{27}$

  Hint: $3^{-1} = \frac{1}{3}$

  $3^{x^2+4x} = \frac{1}{3^3} = 3^{-3} \Rightarrow x^2 + 4x = -3$

  $\Rightarrow x^2 + 4x + 3 = 0$

  $(x+3)(x+1) = 0$

  $x = -3$

  $x = -1$

Recall logarithms:

$$a^x = y \qquad \log_a y = x$$

We can go back and forth between the two. Can be helpful when trying to solve some equations.

Ex

① $\log_3 9$

$\log_3 9 = x \Rightarrow 3^x = 9$

$3^x = 3^2$

$x = 2$

② $\log_8 2$

$\log_8 2 = x \Rightarrow 8^x = 2$

$8^x = 8^{1/3}$

$x = \frac{1}{3}$

$2^3 = 8 \Rightarrow \sqrt[3]{8} = 2 \Rightarrow 8^{1/3} = 2$

③ $\log_{49} 7$

$\log_{49} 7 = x \Rightarrow 49^x = 7$

$49^x = 49^{1/2}$

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

Recall: log & exponentials are "inverse functions" of each other.

In general, inverses "cancel" each other out

$$\log_a b = c \qquad a^c = b$$

$$\log_a(a^b) = c \qquad a^c = a^b \Rightarrow c = b$$

$$\Rightarrow \log_a(a^b) = b$$

$$\log_2 2^8 = x \Rightarrow 2^x = 2^8 \Rightarrow x = 8$$

Similarly, $a^{\log_a b} = c \Rightarrow \log_a c = \log_a b \Rightarrow c = b$

$$\Rightarrow a^{\log_a b} = b$$

$$2^{\log_2 8} = x \Rightarrow \log_2 x = \log_2 8 \Rightarrow x = 8$$

Ex

① $\log_5 5^4 = x$

Cancels out $\Rightarrow x = 4$

② $\ln \sqrt{e} = x$ $\qquad e = 2.7182818\ldots$

$= \log_e e^{1/2} \Rightarrow x = 1/2$

③ $e^{\ln \sqrt{e}} = x$

$e^{\log_e \sqrt{e}} \Rightarrow x = \sqrt{e}$