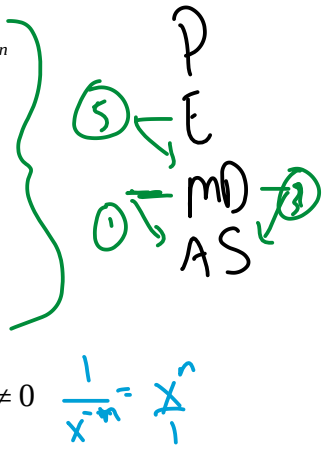
Solving Equations Using Exponent Rules

Rules for Exponents:

1. $x^m \cdot x^n = x^{m+n}$
2. $(xy)^m = x^m y^m$
3. $\frac{x^m}{x^n} = x^{m-n}$
4. $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$
5. $\left(x^m\right)^n = x^{mn}$
6. $x^0 = 1$ for $x \neq 0$
7. $x^{-n} = \frac{1}{x^n}, x \neq 0$
8. $x^{1/n} = \sqrt[n]{x}$ if n is even $x \geq 0$



Property of exponentials: If $a^x = a^y$ then $x = y$.

Examples: Solve the exponential equations by inspection or trial and error.

a) $5^x = 125$

$5^x = 5^3$ $x = 3$

$125 = 5^3$

b) $4^x = 16384$

$4^x = 4^7$ $x = 7$

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

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

$\frac{1}{100} = \frac{1}{10^2} = 10^{-2}$

d) $3^a = \frac{1}{27}$

$3^a = 3^{-3}$ so $a = -3$

$\frac{1}{27} = \frac{1}{3^3} = 3^{-3}$

Similar to solving absolute value equations, we want to isolate the exponential part to solve exponential equations.

$3y = 192$, $\div 3$, $y = \frac{192}{3}$

e) $3(4)^x = 192$

$\frac{3(4)^x}{3} = \frac{192}{3}$

$4^x = 64$

$4^x = 4^3$

so $x = 3$

P
E
MD
AS

f) $12(3)^x - 240 = 2676$

$+240 \quad +240$

$\frac{12(3)^x}{12} = \frac{2916}{12}$

$3^x = 243$

$3^x = 3^5$

so $x = 5$

g) $81(3)^t + 12 = 15$

$-12 \quad -12$

$\frac{81(3)^t}{81} = \frac{3}{81}$

$3^t = \frac{3^1}{3^4}$

$3^t = 3^{-3}$

$t = -3$