~~8.1~~ Supplement 1.8

Ex $x^2 \cdot x^5 = ?$

memorize rules

$x^2 \cdot x^5 = x^{2+5}$

$x^2 \cdot x^5 = x^7$

understand rules

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

7 x's multiplied

$= x^7$

$x^2 + x^5 = ?$

not like terms! So you can't simplify

$= x^2 + x^5$

Quick Check:

If $x^2 \cdot x^5 = x^7$,

then should still be true no matter what number we use for x.

$1^2 \cdot 1^5 \stackrel{?}{=} 1^7$

$1 \cdot 1 \stackrel{?}{=} 1$

$1 \stackrel{\checkmark}{=} 1$

what about

$x^2 + x^5 \stackrel{?}{=} x^7$

$1^2 + 1^5 \stackrel{?}{=} 1^7$

$1 + 1 \stackrel{?}{=} 1$

No!

~~$x^2 + x^5 = x^7$~~

Exponent Rule #1

Product of Powers Rule

$$x^a \cdot x^b = x^{a+b}$$

Ex $(x^2)^3 = ?$

shortcut to memorize

$(x^2)^3 = x^{2 \cdot 3}$

$(x^2)^3 = x^6$

means $(x^2)^3$

means $(x \cdot x)^3$

which means $(x \cdot x) \cdot (x \cdot x) \cdot (x \cdot x)$

$= x \cdot x \cdot x \cdot x \cdot x \cdot x$

$= x^6$

$(x^2)(x^2)(x^2)$

$= (x^4)(x^2)$

$= x^6$

Exponent Rule #2
Power to Power Rule

$(x^a)^b = x^{a \cdot b}$

Uncertainty?

⇓

Substitute in 3.

$(x^2)^3 = x^6$

$(3^2)^3 \stackrel{?}{=} 3^6$

$9^3 \stackrel{?}{=} 3^6$

$729 \stackrel{?}{=} 729$ ✓

~~$(x^2)^3 = x^5$~~

$(3^2)^3 \stackrel{?}{=} 3^5$

$(9)^3 \stackrel{?}{=} 3^5$

$729 \stackrel{?}{=} 243$

No!

Ex $(xy)^3 = ?$

understanding...

$(xy)^3 = x^3 \cdot y^3$

$= (xy)(xy)(xy)$

$= xyxyxy$

$= x \cdot x \cdot x \cdot y \cdot y \cdot y$

$(xy)^3 = x^3 \cdot y^3$

Exponent Rule #3
Product to Power Rule

$(xy)^a = x^a \cdot y^a$

$(xy)^2 \overset{?}{=} x^2y^2$ ~~$\neq$~~ M E

$(x+y)^2 \overset{?}{=} x^2 + y^2$ ~~$\neq$~~

$(xy)^2 \overset{?}{=} x^2y^2$

Uncertainty?

TM $x=3$
$y=5$

$(3+5)^2 = 3^2 + 5^2$

$8^2 = 9 + 25$

$64 = 34$

No!

$(3 \cdot 5)^2 \overset{?}{=} 3^2 \cdot 5^2$

$15^2 \overset{?}{=} 9 \cdot 25$

$225 = 225$ ✓

$(3 \cdot 5)^2 \overset{?}{=} 3 \cdot 5^2$

$15^2 \overset{?}{=} 3 \cdot 25$

$225 \overset{?}{=} 75$

No!

Ex Simplify $-2 \cdot t^3 \cdot 4t^5$

factors: things/pieces that get multiplied.

$= -2 \cdot 4 \cdot t^3 \cdot t^5$

$= -8 \cdot t^8$ ← Use Product of Powers

Simplify

Ex $5(v^4)^2$ ← E, applies to (v^4), not 5

$= 5(v^8)$

$= 5v^8$ ← use power-to-power rule multiply exponents

Ex Simplify $4(3u)^2$ ← Use Product-to-Power Rule

$= 4 \cdot 3^2 \cdot u^2$

$= 4 \cdot 9 \cdot u^2$

$= 36u^2$

Ex Simplify $x^3 \cdot y^2$

Is already simplified!

Rule #1: Needs same base.

Rule #2: Power to a Power $((\ )^{(\ )})^{(\ )}$

Rule #3: $((x)^{(\ )})^{(\ )}$

$x^3 y^2 \stackrel{?}{=} (xy)^5$

$3^3 \cdot 5^2 \stackrel{?}{=} (3 \cdot 5)^5$

$27 \cdot 25 \stackrel{?}{=} (15)^5$

$675 \stackrel{?}{=} 759375$ (No!)

$x = 3$

$y = 5$

2.1 Intro to Equations & Solving

Equation: When two algebraic expressions are equal to each other

$$x^2 + 1 = 3x + 11$$

Some numbers make equation false:
Some numbers make equation true:

- $x = 1$ is no good.
- $x = 5$ makes it true.

2 14

$1^2 + 1 \neq 3 \cdot 1 + 11$

$5^2 + 1 \overset{?}{=} 3 \cdot 5 + 11$

$26 \quad \checkmark \quad 26$

Ex $x + 1 = 4$

Solve this ... Find any and all x-values that the equation true

Imagine what to plug in, so adding 1 makes 4.

$x = 3$ is the solution.

$\{3\}$ is the solution set.

Ex $2 - x = -2$

Imagine what to subtract from 2, to get -2...

$x = 4$ is the solution

Ex Solve $3\left(x-\frac{8}{5}\right) = (x+1)\cdot 10 - 15$

Too hard to imagine the solution..

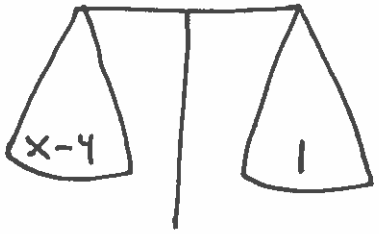
Ex Solve $x^2 - 18x + 22 = 0$

Addition Property of Equality

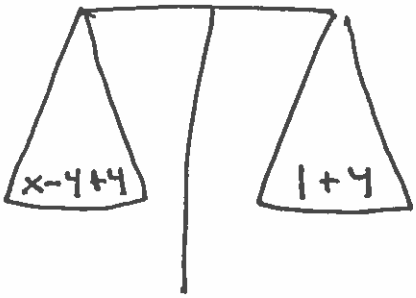
need to attack

opposite action

Ex $x - 4 = 1 \longrightarrow x - 4 + 4 = 1 + 4$



allowed to throw more weight, as long as its the same for both sides



$$x - 4 = 1$$
$$x - 4 + 4 = 1 + 4$$
$$x = 5$$

Crystal clear Solution!

Ex Solve $6 = x - 8$

Solve for...
Isolate this...
$x =$ ___

attack!

$$6 + 8 = x - 8 + 8$$
$$14 = x$$
$$x = 14$$

Be skeptical

$z - 2 \stackrel{?}{=} -7$

$(-5) - 2 \stackrel{?}{=} -7$

$-7 \stackrel{\checkmark}{=} -7$

Ex $z - 2 = -7$

$z - 2 + 2 = -7 + 2$

$z = -5$

Ex $-\frac{1}{2} = x - \frac{3}{4}$

Attack this

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

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

$+\frac{3}{4} \quad +\frac{3}{4}$

$\frac{1}{4} = x$ ← found the answer!

this is not viewed as clear writing for a next reader.

Ex Solve $y+1=10$ (Can imagine $y=9$.)

attack this

$$y+1-1=10-1$$

$$y=9$$

Ex Solve $x+7=10$

scratch this itch!

$$x+7-7=10-7$$

$$x=3$$

Ex Solve $z+12=5$

opposite of adding 12 is subtracting 12

$$z+12-12=5-12$$

$$z=-7$$

Check!

$$z+12=5$$

$$-7+12 \stackrel{?}{=} 5$$

$$5 \stackrel{\checkmark}{=} 5$$

Ex $t+\frac{2}{3}=\frac{-7}{6}$

$$t+\frac{2}{3}-\frac{2}{3}=\frac{-7}{6}-\frac{2}{3}$$

$$t=\frac{-7}{6}-\frac{2}{3}$$

$$t=\frac{-7}{6}-\frac{4}{6}$$

$$t=\frac{-11}{6}$$

(Check!)

Ex Solve $7x = 12 + 6x$

(split: x is over the two sides...)

↑ thing to attack

obstacle to $x =$ ~~~

subtract $6x$

$7x - 6x = 12 + 6x - 6x$

$x = 12$

Let's check!

$7x = 12 + 6x$

$7(12) \stackrel{?}{=} 12 + 6(12)$

$84 \stackrel{?}{=} 12 + 72$

✓

Ex Solve $7x+3 = 6(x-1) + 9$

simplified each side first.

$7x+3 = 6x - 6 + 9$

$7x+3 = 6x + (-6) + 9$

$7x+3 = 6x + 3$

thing to attack!

$7x + 3 - 6x = 6x + 3 - 6x$

$x + 3 = 3$

$x + 3 - 3 = 3 - 3$

$x = 0$

Check

$7(0)+3 \stackrel{?}{=} 6(0-1)+9$

$0+3 \stackrel{?}{=} 6(-1)+9$

$3 \stackrel{?}{=} -6+9$

$3 \stackrel{?}{=} 3$

✓

Ex Formula purchasing a phone

$$S = C + M$$

- S: selling price
- C: wholesale price
- M: markup (profit, paying salespeople, overhead)

You bought a phone for $250. But you know that Samsung's cost to produce is $108.50. (What's the markup?)

$$S = C + M$$

Solve for M

$$250 = 108.50 + M$$

attack!

$$250 - 108.50 = 108.50 + M - 108.50$$

$$141.50 = M$$

$M = 141.50 \longrightarrow$ The markup is $141.50.