PRINCIPLES - LESSON 3A
SOLVING ONE & TWO STEP EQUATIONS

EQUATION: 2 algebraic expressions separated by an equal sign

Equations are like balance scales with each side of the equal sign perfectly balanced at all times.

Usually, equations have an unknown value which we have to discover. Remember that we use **variables** to represent unknown values.

Examples of equations:

$x + 3 = 25$

$34 - r = 30$

THE ADDITION & SUBTRACTION PROPERTIES OF EQUALITY

$$50 = 50$$ ← Start with a true statement.

Add the same number to both sides. Still true? (yes) →

$$+8 \quad +8$$

$$58 = 58$$

$$-10 \quad -10$$ ← Subtract the same number from both sides. Still true? (yes)

$$48 = 48$$

THE ADDITION PROPERTY OF EQUALITY

We can add the same number to BOTH sides of an equation and the equation will remain true.

THE SUBTRACTION PROPERTY OF EQUALITY

We can subtract the same number from BOTH sides of an equation and the equation will remain true.

THE RELATIONSHIP BETWEEN ADDITION & SUBTRACTION

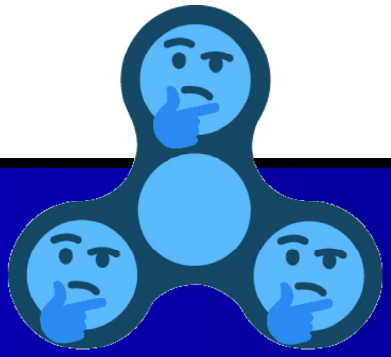
5 ← Start with any number.

Add some number. → + 20

25 ← What can I do now to get back to the number I started with?

Subtract that same number. → − 20

5 ← We're back to the number we started with. Magic!



What is the relationship between addition and subtraction?

Addition and Subtraction are INVERSE OPERATIONS. This means that one UNDOES the other.

SOLVING EQUATIONS

We simplify algebraic expressions. We SOLVE equations.

What does it mean to SOLVE?

SOLVE: to find the values of the variable that make the equation true

How to solve an equation:

1. Whatever we do to one side of an equation, we must do exactly the same thing to the other side of the equation.
2. Isolate the variable by using inverse operations to UNDO whatever has been done to it.

Remember that an equation begins perfectly balanced, and we must always keep it that way.

SOLVING ONE-STEP EQUATIONS

Solve each equation. Show all work.

ex1) $n + 10 = 14$

$-10 \quad -10$

$n = 4$

ex2) $x + 4 = -6$

$-4 \quad -4$

$x = -10$

ex3) $12 = -10 + m$

$+10 \quad +10$

$22 = m$ or $m = 22$

Always work from the side that has the variable.

ex4) $\frac{3}{2} = \frac{1}{2} + (+y)$

Always fix double signs

$\frac{3}{2} = \frac{1}{2} + y \rightarrow \frac{2}{2} = y$

$-\frac{1}{2} \quad -\frac{1}{2}$

$1 = y$ or $y = 1$

THE RELATIONSHIP BETWEEN MULTIPLICATION & DIVISION

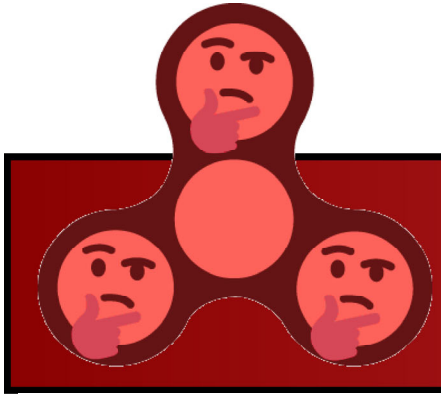
36 ← Start with any number.

Divide by some number. → ÷ 9

4 ← What can I do now to get back to the number I started with?

Multiply by that same number. → · 9

36 ← We're back to the number we started with. Amazing!



What is the relationship between multiplication and division?

Multiplication and division are INVERSE OPERATIONS. This means that one UNDOES the other.

SOLVING ONE-STEP EQUATIONS

Solve each equation. Show all work.

ex5) $\frac{3n}{3} = \frac{-27}{3}$

$n = -9$

ex6) $\frac{-2x}{-2} = \frac{-22}{-2}$

$x = 11$

ex7) $\frac{w}{3} \cdot 3 = 12 \cdot 3$

$w = 36$

ex8) $\frac{5}{-1} = \frac{-1x}{-1}$

$-5 = x$ or $x = -5$

Remember:
There is ALWAYS a coefficient.

SOLVING TWO-STEP EQUATIONS

ex9) **Suppose that you buy a plasma TV and 12 DVDs. The cost of the TV is $2500 and the total charge without tax is $2662. What is the cost of each DVD assuming that they are all the same price?**

Create a let statement:

let x = the cost of one DVD
(Does anyone still buy DVDs?)

Cost of plasma TV + Cost of 12 DVDs = Total charge

$2500 + 12x = 2662$

$-2500 \quad -2500$

$\frac{12x}{12} = \frac{162}{12}$

$x = 13.5$

The cost of each DVD is $13.50.

SOLVING TWO-STEP EQUATIONS

Remember:

1. Always work on the side of the equation that contains the variable.
2. Use inverse operations to isolate the variable.
3. In a two-step equation, it is easier to undo addition and subtraction first.

Solve each equation. Show all work.

ex10) $4a - 5 = 11$

$+5 \quad +5$

$\frac{4a}{4} = \frac{16}{4}$

$a = 4$

ex11) $2 = 2m + 6$

$-6 \quad -6$

$\frac{-4}{2} = \frac{2m}{2}$

$-2 = m$ or $m = -2$

SOLVING EQUATIONS

Solve each equation. Show all work.

Combine like terms on the same side of the equation whenever possible.

ex13) $-8 - 2n = 3$

$+8 \quad +8$

$\frac{-2n}{-2} = \frac{11}{-2}$

$n = -\frac{11}{2}$

No need to convert to a mixed number or to a decimal

ex14) $7x - 4x - 5 = -32$

$3x - 5 = -32$

$+5 \quad +5$

$\frac{3x}{3} = \frac{-27}{3}$

$x = -9$

SOLVING EQUATIONS

Solve each equation. Show all work.

ex15) $\frac{r}{2} + \frac{r}{3} = \frac{3}{4}$ $\cdot 12$ $\cdot 12$ $\cdot 12$

$6r + 4r = 9$

$\frac{10r}{10} = \frac{9}{10}$

$r = \frac{9}{10}$

To clear fractions in an equation:
Multiply every term in the equation by the common denominator of all the fractions.