6.0 Solving One Step Equations KEY

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6.0 INTRODUCTION TO LINEAR EQUATIONS

Name: Key Block____

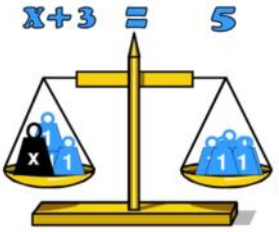
A) BALANCING EQUATIONS

What does it mean to ***solve an equation?***

- find the numbered value the variable represents
- have both sides of the = sign have the same #

In algebra, an e**quals** sign is considered a b**alance** sign.

It tells us that the expression on either side of the equal sign represents the same number.



To balance the scales, the x must represent 1 1 = 2

Replacing the variable in the equation $x + 3 = 5$ with a constant that makes the equation true is said to be a **solution** to the equation.

a number on its own, not attached to a variable

"solve for x"

PRACTICE

Like algebra tiles...but fancy!

Write an equation and use "algebra stones" to solve the equation.

Let ◊= x, ♦=-x, o=1 and •=-1

38. = x= 8

must be: oooo oooo to balance $x+6 = 14$

39. -6 zero pair x= 11

$x-6 = 5$

40. How many x's? 5 groups so each x must represent: ooo x= 3

$5x = 15$

1

When solving an equation, you want to isolate the variable on one side of the equation. This can be done by applying ***inverse operations***.

"Do the opposite, in the reverse order"

Inverse operations undo one another.

Warm Up #1: Write the ***inverse*** of each scenario.

a) Put your socks on, then your shoes.

Take off your shoes, then take off socks.

b) Put the key in the engine and turn the car on.

Turn the car off, then take the key out.

c) Multiply a number by two then add one.

Subtract 1, then divide by 2.

d) Subtract 3 then divide by 5.

Multiply by 5, then add 3

*** List the inverse operations:**

Add & Subtract

Multiply & Divide

PRACTICE

We apply these inverse operations when we solve equations.

Definition: Inverse Operations

29. The inverse of adding 5 is subtracting 5.
30. The inverse of subtracting 7 is adding 7.
31. The inverse of multiplying by 2 is dividing by 2.
32. The inverse of dividing by 2 is multiplying by 2.

33. Additive inverses, $(+,-)$, add to $\emptyset$ and multiplicative inverses, $(\times,\div)$, multiply to, 1.

Perform the inverse operation to isolate x.

have x on one side, by itself.

Remember! what you do to one side, you must do to the other!

34. $x + 5 = 10$

$-5 \quad -5$

$x = 5$

35. $x - 7 = 10$

$+7 \quad +7$

$x = 3$

36. $2x = 10$

$\frac{2 \cdot x}{2} = \frac{10}{2}$ cancel

$x = 10 \div 2$

$x = 5$

37. $\frac{x}{3} = 10$

$x \div 3 = 10$ cancel

$\times 3 \quad \times 3$

$x = 10 \times 3$

$x = 30$

2

B) ONE-STEP EQUATIONS

These types of algebraic equations require you to do one operation (on both sides) in order to isolate the variable "x"

Example #1: Solve each equation

By substituting in your solved * for x to see if both sides are =

	Solution	Check your Work!
a.	$x + 7 = 21$ $-7 \quad -7$ $x = 21 - 7$ $x = \boxed{14}$	$x + 7 = 21$ $(14) + 7 = 21$ $21 = 21$ ✓ True statement.
b.	$x - 3.1 = -7.9$ $+3.1 \quad +3.1$ $x = (-7.9) + 3.1$ $x = \boxed{-4.8}$	$x - 3.1 = -7.9$ $(-4.8) - 3.1 = -7.9$ $-7.9 = -7.9$ ✓ correct
c.	$3x = 27$ $\frac{3 \cdot x}{3} = \frac{27}{3}$ (cancel) $x = 27 \div 3$ $x = \boxed{9}$ remember: means ÷	$3x = 27$ $3 \cdot (9) = 27$ $27 = 27$ ✓
d.	$-4x = -24$ $\frac{-4x}{-4} = \frac{-24}{-4}$ $x = (-24) \div (-4)$ $x = \boxed{6}$ # and +/- signs both cancel!	$-4x = -24$ $-4(6) = -24$ $-24 = -24$ ✓
e.	$\frac{x}{5} = 6$ $x \div 5 = 6$ $\times 5 \quad \times 5$ $x = 6 \times 5$ $x = \boxed{30}$ inverse operations will cancel!	$\frac{x}{5} = 6$ $\frac{(30)}{5} = 6$ $30 \div 5 = 6$ $6 = 6$ ✓
f.	$\left(\frac{3}{1}\right)\left(-\frac{1}{3}\right)x = \frac{6}{1} \times \left(\frac{-3}{1}\right)$ $\frac{+3 \cdot 1}{1 \cdot 3}x = \frac{-18}{1}$ $\frac{3}{3}x = -18$ $1x = -18$ $x = -18$ multiply by the reciprocal fraction	$-\frac{1}{3}x = 6$ $-\frac{1}{3}(-18) = 6$ $\frac{-1 \cdot (-18)}{3} = 6$ $\frac{18}{3} = 6$ $6 = 6$ ✓

PRACTICE

What specific operation must be performed to isolate x?

41. $x+3=14$	42. $x-6=10$	43. $3x=15$	44. $\frac{x}{4}=20$
$-3\ \ -3$	$+6\ \ +6$	$\frac{3x}{3}=\frac{15}{3}$	$\times 4\ \ \times 4$
$x=11$	$x=16$	$x=5$	$x=80$
45. $-5x=30$	46. $7+x=16$	47. $\frac{x}{-3}=-9$	48. $-18=-3x$
$\frac{-5x}{-5}=\frac{30}{-5}$	$-7\ \ -7$	$\times -3\ \ \times -3$	$\frac{-18}{-3}=\frac{-3x}{-3}$
$x=-6$	$x=9$	$x=27$	$6=x$

ONE-STEP EQUATION SUMMARY

We have found that to solve equations of the form

$x+a=b$ $\quad -a\ \ -a$ $\qquad x-a=b$ $\quad +a\ \ +a$

we subtract (or add) a to both sides of the equation.

We have found that to solve an equation of the form

$ax=b$ $\quad \div a\ \ \div a$

we divide both sides of the equation by a.

We have found that to solve equations of the form

$\times b\ \frac{a}{b}x=c$ $\qquad \times b\ \frac{ax}{b}=c$

we multiply both sides by b, then divide both sides of the equation by a.

Homework

Complete the following questions to SOLVE FOR X.

TRY the challenge questions…I bet you'll surprise yourself!

2. Determine the solution of each equation.

a) $x+3=7$
$-3\ \ -3$
$x=4$

b) $x-3=7$
$+3\ \ +3$
$x=10$

c) $x+3=-7$
$-3\ \ -3$
$x=-10$

d) $x-3=-7$
$+3\ \ +3$
$x=-4$

e) $-x+3=7$
$-3\ \ -3$
$-x=4$
$\frac{-x}{-1}=\frac{4}{-1}$
$x=-4$

*divide by -1 to change the sign

f) $-x-3=7$
$+3\ \ +3$
$-x=10$
$\frac{-x}{-1}=\frac{10}{-1}$
$x=-10$

a) $\frac{x}{6} = 2$ $\times 6$ $\times 6$

$x = 12$

b) $\frac{6}{x} = 2$ $\times x$ $\times x$

$6 = 2x$

$\frac{6}{2} = \frac{2x}{2}$ $x = 3$

c) $\frac{x}{6} = -2$ $\times 6$ $\times 6$

$x = -12$

d) $\frac{6}{x} = -2$ $\times x$ $\times x$

$6 = -2x$

$\frac{6}{-2} = \frac{-2x}{-2}$ $x = -3$

e) $\frac{x}{10} = 5$ $\times 10$ $\times 10$

$x = 50$

f) $\frac{10}{x} = 5$ $\times x$ $\times x$

$10 = 5x$

$\frac{10}{5} = \frac{5x}{5}$

$2 = x$

CHALLENGE
LET'S START-OFF

g) $3x + 2 = 2x - 3$

$-2 \quad -2$

$3x = 2x - 5$

$-2x \quad -2x$

$x = -5$

h) $-3x + 2 = -2x - 3$

$-2 \quad -2$

$-3x = -2x - 5$

$+2x \quad +2x$

$x = -5$

i) $3x - 2 = 2x - 3$

$+2 \quad +2$

$3x = 2x - 1$

$-2x \quad -2x$

$x = -1$

j) $-3x - 2 = -2x - 3$

$+2 \quad +2$

$-3x = -2x - 1$

$+2x \quad +2x$

$-x = -1$

$\frac{-x}{-1} = \frac{-1}{-1}$ $\Rightarrow x = 1$

3. Determine the solution of each equation.

a) $\frac{2}{3}x = 12$ $\times 3$ $\times 3$

$\frac{2x}{2} = \frac{36}{2}$ $x = 18$

b) $\frac{2}{3}x = -12$ $\times 3$ $\times 3$

$\frac{2x}{2} = \frac{-36}{2}$ $x = -18$

c) $-\frac{2}{3}x = 12$ $\times(-3)$ $\times(-3)$

$\frac{2x}{2} = \frac{-36}{2}$ $x = -18$

d) $-\frac{2}{3}x = -12$ $\times(-3)$ $\times(-3)$

$\frac{2x}{2} = \frac{36}{2}$ $x = 18$

* multiply by a (-) to cancel the signs

e) $\frac{4}{5}x + 3 = 11$

f) $\frac{4}{5}x - 3 = 9$

g) $-\frac{4}{5}x + 5 = -7$

h) $-\frac{4}{5}x - 7 = -3$

i) $\frac{3}{4}x - 6 + 12 = 0$

j) $-\frac{3}{4}x - 6 + 12 = 0$

Remember your BEDMAS

inverse operations!

5

e) $\frac{4}{5}x + 3 = 11$

$-3 \quad -3$

$\times 5$ $\frac{4}{5}x = 8$ $\times 5$

$\frac{4x}{4} = \frac{40}{4}$

$x = 10$

f) $\frac{4}{5}x - 3 = 9$

$+3 \quad +3$

$\times 5$ $\frac{4}{5}x = 12$ $\times 5$

$\frac{4x}{4} = \frac{60}{4}$

$x = 15$

g) $-\frac{4}{5}x + 5 = -7$

$-5 \quad -5$

$\times 5$ $-\frac{4}{5}x = -12$ $\times 5$

$\frac{-4x}{-4} = \frac{-60}{-4}$

$x = 15$

h) $-\frac{4}{5}x - 7 = -3$

$+7 \quad +7$

$\times 5$ $-\frac{4}{5}x = 4$ $\times 5$

$\frac{-4x}{-4} = \frac{20}{-4}$

$x = -5$

$-4x = -60$

$\frac{-4}{-4} \quad \frac{-4}{-4}$

$x = 15$

i) $\frac{3}{4}x - 6 + 12 = 0$

$\frac{3}{4}x + 6 = 0$

$-6 \quad -6$

$4 \times \frac{3}{4}x = -6 \times 4$

$3x = -24$

$\frac{3}{3} \quad \frac{-24}{3}$

$x = -8$

$-4x = 20$

$\frac{-4}{-4} \quad \frac{-4}{-4}$

$x = -5$

j) $-\frac{3}{4}x - 6 + 12 = 0$

$-\frac{3}{4}x + 6 = 0$

$-6 \quad -6$

$4 \times -\frac{3}{4}x = -6 \times 4$

$-3x = -24$

$\frac{-3}{-3} \quad \frac{-24}{-3}$

$x = 8$