

Mindfulness:

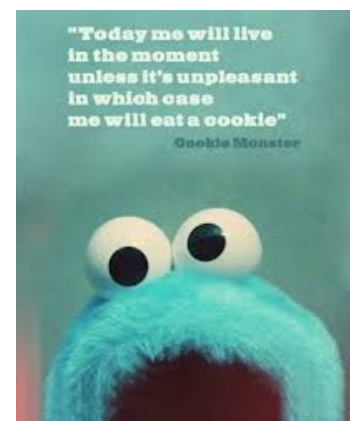
Choose Your Breath:

Initial (focus on breathing)

Heart/Belly

Calming (2 in, 4 out)

Energizing (4 in, 2 out)



Bell Ringer:



Consider the equation $x^2 + 1 = 7 - x$.



- a. Verify that this has the solution set $\{-3, 2\}$. Draw this solution set as a graph on the number line. We will later learn how to show that these happen to be the *ONLY* solutions to this equation.

$$\begin{array}{r} 9 + 1 = 7 + 3 \\ 10 = 10 \end{array} \quad \begin{array}{r} 4 + 1 = 7 - 2 \\ 5 = 5 \end{array}$$

- b. Let's add four to both sides of the equation and consider the new equation $x^2 + 5 = 11 - x$. Verify 2 and -3 are still solutions.

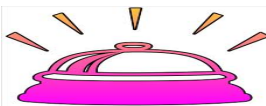
$$14 = 14$$

$$\begin{array}{r} 2^2 + 5 = 11 - 2 \\ 9 = 9 \end{array}$$

- c. Let's now add x to both sides of the equation and consider the new equation $x^2 + 5 + x = 11$. Are 2 and -3 still solutions?

$$\begin{array}{r} 14 + (-3) = 11 \\ 11 = 11 \end{array}$$

$$\begin{array}{r} 9 + 2 = 11 \\ 11 = 11 \end{array}$$



15) ~~$x = 4$
 $x + 2 = 1$~~

$x = 4(x + 2)$

~~$x = 4x + 8$~~

~~$x = 8$~~

$x = 8$

~~$\frac{8}{3}$~~
 $\frac{8}{3} + \frac{6}{3} = 4$

~~$\frac{8}{3}$~~
 $\frac{8}{3} \cdot \frac{3}{3} = \frac{24}{6} = 4$

$$17) -5 - 5x - 6 = -22 - x$$

$$-5 - 6 - 5x = -22 - x$$

$$-11 - 5x = -22 - x$$

$$+x \quad +x$$

$$\cancel{-11} - 4x = -22 + \cancel{11}$$

$$\cancel{-4x} = -11$$

$$\frac{-11}{-4}$$

$11 = 4 + 4 + \frac{2}{4}$
 $x = \frac{11}{4}$
 $2 \frac{3}{4}$
 2.75

$$18) \frac{x+4}{3} = \frac{x+2}{5}$$

$$5(x+4) = 3(x+2)$$

$$\begin{array}{r} 5x+20 = 3x+6 \\ -3x \quad -3x \end{array}$$

$$\begin{array}{r} 2x+20 = 6-20 \\ -20 \end{array}$$

$$\begin{array}{r} x = -14 \\ \sim \\ \sim \end{array}$$

$$x = -7$$

$$19) -5(2r - 0.3) + 0.5(4r + 3) = -64$$

$$-10r + 1.5 + 2.0r + 1.5 = -64$$

$$-8r + \cancel{3} = -64$$

$$\cancel{-8r} = -67$$

$$r = \frac{67}{8}$$

Exercise #1: Consider the equation $5x + 3 = 23$.

- (a) List the operations that have been done to the variable x on the left hand side of the equation in the order in which they occurred.

Multiply by 5,
add 3 to that product

- (b) Solve the equation by reversing what has been done to x . Verify that your value of x is a solution by seeing if it makes the equation true.

$$\begin{array}{r}
 5x + 3 = 23 \\
 - 3 \quad - 3 \\
 \hline
 5x = 20 \\
 \frac{5x}{5} = \frac{20}{5} \quad \text{X} = 4
 \end{array}$$



This is the most basic of all equation solving techniques. It is the most important solving technique in all of mathematics. Be clear on this:

~~*~~ SOLVING EQUATIONS BY INVERSE OPERATIONS ~~*~~

If the **variable** you are solving for shows up only once, identify the operations that have been done on it and reverse them in the opposite order in which they occur.

Exercise #2: Find the value of x that solves each equation. In each case, first identify the operations that have occurred to x and reverse them. Show each step.

(a) $\frac{x-3}{2} + 7 = 23$ ~~7~~ \rightarrow

~~2~~ \cdot $\frac{x-3}{2} = 16$ $\cdot 2$

What happened to x ?

Now reverse.

add neg. 3,
divide that sum by 2
add 7

$$\frac{x-3}{2} = 16 \cdot 2$$

$$\frac{x-3}{2} = 32$$

$$+3 = 32 + 3$$

$$x = 35$$

Exercise #2: Find the value of x that solves each equation. In each case, first identify the operations that have occurred to x and reverse them. Show each step.

(b) $4(x+1) - 2 = -6 + 2$

What happened to x ?

add 1 ✓

mult. sum by 4 ✓

Subtract 2 from
that product ✓

~~$4(x+1) = -4$~~
Now reverse. $\frac{-4}{4}$

~~$x+1 = -1 - 1$~~

$x = -2$

Often equations can be solved in multiple ways. Let's take a look at the next problem to see an example.

Exercise #3: Solve the following equation two different ways. In (a) reverse the operations that have been done to x . In (b), apply the distributive property first.

(a) $-2(x-4)+8=2$ [Reverse the operations]

$$\begin{aligned} & \cancel{-8} - 8 \\ & \cancel{-2(x-4)} = -6 \\ & \quad \quad \quad \underline{\quad} \quad \quad \quad \underline{\quad} \\ & x-4 = 3+4 \\ & \quad \quad \quad \underline{+4} \\ & x = 7 \end{aligned}$$

(b) $-2(x-4)+8=2$ [Use the Distributive Prop First]

$$\begin{aligned} & \overset{\curvearrowright}{-2(x-4)+8} + 8 = 2 \\ & -2x + 8 + 8 = 2 \\ & -2x + 16 = 2 - 16 \\ & -2x = -14 \\ & \quad \quad \quad \underline{\quad} \quad \quad \quad \underline{\quad} \\ & x = 7 \end{aligned}$$

FLUENCY

1. In the expression $\frac{x}{5} - 3$ which is the correct order in which operations have been done to x ?

- (1) x was divided by 5 and the result was subtracted from 3
- (2) x had 3 subtracted from it and the result was then divided by 5.
- (3) x was divided by 5 and 3 was subtracted from the result
- (4) 5 was divided by x and then 3 was subtracted from the result.

$1) 3 - \frac{x}{5}$ $3) \frac{x}{5} - 3$
 $2) \frac{x-3}{5}$ $4) \frac{5}{x} - 3$

2. Which of the following is the solution to $6x + 1 = 4$? Show the steps or explain how you found the solution.

- (1) $x = \frac{7}{6}$
- (2) $x = \frac{1}{2}$
- (3) $x = \frac{4}{3}$
- (4) $x = \frac{5}{6}$

$\cancel{+1} -1$
 $6x = 3$ $x = \frac{1}{2}$
 $\cancel{6} \quad \cancel{3}$

3. The solution to $5(x-2) - 6 = 24$ is which of the following? Show the steps in your solution process.

- (1) $x = 7$
- (2) $x = -12$
- (3) $x = -3$
- (4) $x = 8$

$\cancel{-6} +6$
 $5(x-2) = 30$
 $\cancel{5} \quad \cancel{30}$
 $x-2 = 6+2$
 $x = 8$