Mindfulness:

Choose Your Breath:

Initial (focus on breathing)

Heart/Belly

Calming (2 in, 4 out)

Energizing (4 in, 2 out)

Bell Ringer:

(a) Ten less than five times a number results in thirty five. What is the number? Carefully set up an equation, solve it, and check your answer for reasonableness. Watch out! Subtraction is involved.

$5x - \cancel{10} = 35$

$\quad\ \ \cancel{+10} \quad +10$

$\frac{5x}{5} = \frac{45}{5}$

$x = 9$

(b) When three times the sum of a number and seven is increased by ten, the result is four. What is the number? Carefully set up an equation and solve it. Check for reasonableness.

$3(x+7) + \cancel{10} = 4 - 10$

$\qquad\quad\ \ \cancel{-10}$

$\frac{\cancel{3}(x+7)}{\cancel{3}} = \frac{-6}{3}$

$x + \cancel{7} = -2 - 7$

$\quad\ \ \cancel{-7}$

$x = -9$

~~$P = 2L + 2w$~~

$24 + 30 =$

54

$120 \neq 54$

6a) $F = 2w + L$

$= 2(12) + 20$

$= 24 + 20$

6b) $= 44$ ft.

6c) $F = 2w + L$

$120 = 2w + \cancel{30}$

$-30 \qquad\qquad \cancel{-30}$

$\dfrac{90}{2} = \dfrac{\cancel{2}w}{\cancel{2}}$

$w = 45$ ft.

7a) $\frac{5(2x-1)}{3} - 4 = 11$

$+4 \quad +4$

~~mult. by 2~~

~~subtract 1, product~~

~~mult. by 5, difference~~

~~divide by 3, product~~

~~subtract 4~~

$\cancel{3} \cdot \frac{5(2x-1)}{\cancel{3}} = 15 \cdot 3$

$\frac{\cancel{5}(2x-1)}{\cancel{5}} = \frac{45}{5}$

$2x - \cancel{1} = 9 + 1$

$+1$

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

$x = 5$

Some Potential Dangers When Solving Equations

Consider the equations $x + 1 = 4$ and $(x + 1)^2 = 16$.

a. Verify that $x = 3$ is a solution to both equations.

$\{3\}$

b. Find a second solution to the second equation.

$\{3, -5\}$

c. Based on your results, what effect does squaring both sides of an equation appear to have on the solution set?

1 sol. v. 2 sol.

$(x-2)(x-2)=(6-x)(6-x)$

Consider the equations $x - \cancel{2} = 6 - x$ and $(x-2)^2 = (6-x)^2$.

$+\cancel{2} \quad +2$

$x^2-2x-2x+4=36-6x-6x+x^2$

a. Did squaring both sides of the equation affect the solution sets?

$x = 8 - \cancel{x}$

$+x \quad \cancel{+x}$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{8}{2}$ $x=4$

$x^2 - \cancel{4x} + 4 = 36 - 12x + x^2$

$+\cancel{4x} \quad +4x$

$\cancel{x^2} + 4 = 36 - 8x + \cancel{x^2}$

$-\cancel{x^2} \quad -\cancel{x^2}$

b. Based on your results, does your answer to part (c) of the previous question need to be modified?

$\{4\}$ vs. $\{4\}$

$4 = \cancel{36} - 8x$

$-36 \quad -\cancel{36}$

$\frac{-32}{-8} = \frac{-8x}{-8}$

$x=4$

***Exercise* #1:** Solve each of the following "two-step" linear equations. Keep in mind, this is what we were doing in the last lesson by reversing the operations that had occurred to the variable. Some of these answers will be non-integer **rational** numbers. Simplify where possible.

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

$+7$

$\frac{3x}{3}=5\cdot 3$

$x=15$

(b) $4x+3=-17$

$-3 \quad -3$

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

$x=-5$

(c) $5x+12=87$

$-12 \quad -12$

$\frac{5x}{5}=\frac{75}{5}$

$x=15$

(d) $\frac{x+7}{3}=2$

$x+7=6$
$-7 \quad -7$
$\boxed{x=-1}$

(e) $-6(x-1)=18$

$x-1=-3$
$+1 \quad +1$
$x=-2$

(f) $8x+2=-2$

$-2 \quad -2$
$\frac{8x}{8}=\frac{-4}{8}$
$\boxed{x=-\frac{1}{2}}$

(g) $\frac{3}{4}x-5=4$

$+5 \quad +5$
$\frac{3}{4}x=9$
$x=9\cdot\frac{4}{3}=12$
$x=12$

(h) $-\frac{5}{2}x+6=1$

$-6 \quad -6$
$-\frac{5}{2}x=-5$
$x=-5\cdot-\frac{2}{5}=2$
$\boxed{x=2}$

(i) $6x+3=-1$

$-3 \quad -3$
$\frac{6x}{6}=\frac{-4}{6}$
$\boxed{x=-\frac{2}{3}}$

For most of what we do the rest of the way, you will be using the distributive property as well as others to solve the problems. Don't forget our primary technique of solving by reversing the operations that have been done to our variable. This technique is particularly useful when **the variable shows up only once!**

***Exercise* #2:** Solve the following equation for x by identifying the operations that have been done to x and reversing them.

$$\frac{5(x-3)}{8}+\cancel{2}=7-2$$
$$-\cancel{2}$$

Reverse them!

$$\cancel{8}\cdot\frac{5(x-3)}{\cancel{8}}=5\cdot 8$$

Operations?

Subtract 3

5 times that Difference

Divide that product by 8

Add 2

$$\frac{\cancel{5}(x-3)}{\cancel{5}}=\frac{40}{5}$$

$$x-\cancel{3}=8+3$$
$$+\cancel{3}$$

$$x=11$$

O.k. Now we move onto problems where this technique is used, but only towards the end. We also need to review how to solve problems where the variable shows up more than once. Since this is review, we will jump right into the most complex scenario.

***Exercise* #3:** Consider the equation $5(x-3)+2x=4(x+3)$.

(a) By using the distributive property, write equivalent expressions for both sides of the equation. Show the work below.

(b) Solve the equation for x. Check to make sure the **original equation** has a true value for the x you find.

$5x-15+2x=4x+12$

$7x-15=4x+12$

$-4x \qquad -4x$

$3x-15=12+15$

$+15$

$\cancel{3}x=27/3 \rightarrow x=9$

***Exercise* #4:** Get more practice on these more complicated equations. Check that your final answer makes the equation true. Generally, use the distributive property when needed.

(a) $7(x-2)-3(x+3)=5(x-3)+x$

$7x-14-3x-9=5x-15+x$

$4x-23=6x-15$

$-4x \qquad -4x$

$-23=2x-15$

$+15 \qquad +15$

$\frac{-8}{2}=\frac{2x}{2}$

$\boxed{x=-4}$

(b) $9-6(x+1)=2(x-4)+27$

$9-6x-6=2x-8+27$

$3-6x=2x+19$

$+6x \qquad +6x$

$3=8x+19$

$-19 \qquad -19$

$\frac{-16}{8}=\frac{8x}{8}$

$\boxed{x=-2}$

Solve each equation for x. For each step, describe the operation used to convert the equation. How do you know that the initial equation and the final equation have the same solution set?

$\frac{10}{5} - \frac{5}{5}$

a. $\frac{1}{5}(10 - 5)(x - 2) = \frac{1}{10}(x + 1)$

$(2 - 1)(x - 2) = \frac{x}{10} + \frac{1}{10}$

$(1)(x - 2) = \frac{x}{10} + \frac{1}{10}$

$x - \cancel{2} = \frac{x}{10} + \frac{1}{10} + 2$

$+2$

$x = \frac{x}{10} + 2\frac{1}{10}$

$-\frac{x}{10} \quad -\frac{x}{10}$

$\frac{10}{10}x - \frac{1}{10}x = \frac{21}{10}$

$\frac{\frac{9}{10}x}{\frac{9}{10}} = \frac{\frac{21}{10}}{\frac{9}{10}} \Rightarrow x = \frac{\overset{7}{\cancel{21}}}{\cancel{10}} \cdot \frac{\cancel{10}}{\underset{3}{\cancel{9}}} = \frac{7}{3}$

$\boxed{x = \frac{7}{3}}$