Solving Equations in the Form ax + b = cx + d

In equations in the form $ax + b = cx + d$, ax and cx are variable terms and b and d are constants.

EXAMPLES: $\underline{ax + b = cx + d}$

$6x + 2 = x + 17$

$8y = 3y + 20$ (Note: b is zero)

$n - 2 = -3n + 6$

NOTE that $8y = 3y + 20$ still fits the form as $8y$ could be written as $8y + 0 = 3y + 20$.

Our goal in solving these equations is to simplify the equation to the point where we have a variable equal to a constant.

These equations will require us to use both the Addition Property of Equations and the Multiplication Property of Equations.

EXAMPLE: Solve: $6x + 2 = x + 17$

We must first get the variable terms on the same side of the equation.

$-x + 6x + 2 = -x + x + 17$	Add the opposite of x to both sides
$5x + 2 = 17$	Combine like terms on both sides
$5x + 2 + (-2) = 17 + (-2)$	Add the opposite of 2 to both sides
$5x = 15$	Combine like terms on both sides
$\frac{1}{5} \times 5x = 15 \times \frac{1}{5}$	Multiply both sides by the reciprocal of 5
$1x = 3$	
$x = 3$	

CHECK: $6(3) + 2 = 3 + 17$

$18 + 2 = 3 + 17$

$20 = 20$ TRUE

SOLVE: $8y = 3y + 20$

$8y + (-3y) = -3y + 3y + 20$	Add the opposite of $3y$ to both sides
$5y = 20$	Combine like terms on both sides
$\frac{1}{5} \times 5y = 20 \times \frac{1}{5}$	Multiply both sides by the reciprocal of 5
$1y = 4$	
$y = 4$	

CHECK: $8(4) = 3(4) + 20$
$32 = 12 + 20$
$32 = 32$ TRUE

EXAMPLE: $n - 2 = -3n + 6$

$3n + n - 2 = -3n + 3n + 6$	Add the opposite of -3n to both sides
$4n - 2 = 6$	Combine like terms on both sides
$4n - 2 + 2 = 6 + 2$	Add the opposite of -2 to both sides
$4n = 8$	Combine like terms on both sides
$\frac{1}{4} \times 4n = 8 \times \frac{1}{4}$	Multiply both sides by the reciprocal of 4
$1n = 2$	
$n = 2$	

CHECK: $n - 2 = -3n + 6$
$2 - 2 = -3(2) + 6$
$0 = -6 + 6$
$0 = 0$ TRUE

NOTE that in some equations you must combine like terms before you begin to solve.

$3x + 4 - 5x = 2 - 4x$
$-5x + 3x + 4 = 2 - 4x$
$-2x + 4 = 2 - 4x$ Now this is in the $ax + b = cx + d$ form.
Can you finish it? The solution is -1.

<u>EXERCISES</u>: Solve and Check.

1. $9x - 10 = 3x + 2$
2. $-5y - 3 = 2y + 18$
3. $4x - 2 = -16 - 3x$
4. $-10a + 4 = -a - 14$
5. $6x - 1 = 2x + 2$
6. $5a + 7 = 2a + 7$
7. $3 - 2x = 15 + 4x$
8. $8y - 2 = 4y - 5$
9. $5 - 7a = 2 - 6a$
10. $10y - 3 = 3y - 1$

KEY:

1. $x = 2$
2. $y = -3$
3. $x = -2$
4. $a = 2$
5. $x = \frac{3}{4}$
6. $a = 0$
7. $x = -2$
8. $y = -\frac{3}{4}$
9. $a = 3$
10. $y = \frac{2}{7}$