Solving Equations in the Form ax + b = c

In equations of the form $ax + b = c$ (read as "a times x plus b equals c"), x is a variable which represents an unknown quantity and a, b and c are constants.

EXAMPLES: $ax + b = c$

$$3x \overset{+\ =}{} 4\,10$$

$$\overset{-\ -\ =}{} 5x$$

$$12$$

$$18\ 4m \overset{\frac{3}{}}{}$$

$$+\ =2\ 2 \overset{\frac{1}{}}{}$$

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: $\quad 3x + 4 = 10$

$$3x + 4 + (^-4) = 10 + (^-4) \quad \leftarrow \text{Add the opposite of 4 to both sides.}$$
$$3x \quad = \quad 6$$
$$\frac{1}{3} \times 3x = 6 \times \frac{1}{3} \leftarrow \text{Multiply both sides by the reciprocal of 3.}$$
$$1x \quad = \quad \frac{6}{3}$$
$$x = 2$$

CHECK:
$$3x + 4 = 10$$
$$3(2) + 4 = 10$$
$$6 + 4 = 10$$
$$10 = 10 \quad \text{TRUE}$$

EXAMPLE: Solve: $\quad -5y - 12 = 18$

$$-5y \ ^-12 + 12 = 18 + 12 \quad \leftarrow \text{Add the opposite of } ^-12 \text{ to both sides.}$$
$$-5y = 30$$
$$\frac{1}{5} \times (^-5y) = 30 \times -\frac{1}{5} \leftarrow \text{Multiply by the reciprocal of } ^-5.$$
$$1y = -\frac{30}{5}$$
$$y = \ ^-6$$

CHECK: $-5y - 12 = 18$

$$-5(^-6) \ ^-12 = 18$$

$$30 \ ^- 12 = 18$$

$$18 = 18 \quad \text{TRUE}$$

EXAMPLE: Solve: $\dfrac{3}{4}m + 2 = \dfrac{1}{2}$

$$\dfrac{3}{4}m + 2 + (^-2) = \dfrac{1}{2}$$

$$\dfrac{3}{4}m = -\dfrac{3}{2}$$

$$+ (^-2) \leftarrow \text{Add the opposite of 2 to both sides.}$$

$$\dfrac{4}{3} \times \dfrac{3}{4}m = -\dfrac{3}{2} \times \dfrac{4}{3} \leftarrow \text{Multiply by the reciprocal of } \dfrac{3}{4}$$

$$1m = -\dfrac{12}{6}$$

$$m = {}^-2$$

CHECK: $m + 2 = \dfrac{3}{4} \qquad \dfrac{1}{2}$

$$\dfrac{3}{4}(^-\dfrac{1}{2} \ 2) + 2 = $$

$$-\dfrac{6}{4} + 2 = \dfrac{1}{2}$$

$$-\dfrac{3}{2} + \dfrac{4}{2} = \dfrac{1}{2}$$

$$\dfrac{1}{2} = \dfrac{1}{2} \quad \text{TRUE}$$

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

1. $5m \ ^-6 = 9$

2. $4 \ ^-3x = \ ^-2$

3. $^-3y \ ^-21 = 0$

4. $8z + 13 = 3$

5. $2n \ -\dfrac{3}{4} = \dfrac{13}{4}$

6. $\dfrac{x}{\_} \ ^-6 = 14$

7. $^-8y \ ^-3 = \ ^-19$

KEY:

1. $m = 3$

2. $x = 2$

3. $y = {}^-7$

4. $z = -\dfrac{5}{4}$

5. $n = 2$

6. $x = 28$

7. $y = 2$

8. $\dfrac{2}{3}x - 1 = 5$ 8. $x = 9$

9. $4 = 2 - 3a$ 9. $a = -\dfrac{2}{3}$

10. $\dfrac{2}{5}y + 4 = 6$ 10. $y = 5$