

Solving Simple Linear Equations – A Review

Algebra 1

We have already used some algebra skills in this course to solve simple linear equations. The keys to solving these simple equations are contained in the properties of equality shown below.

PROPERTIES OF EQUALITY

If $a, b,$ and c represent any real numbers then:

(1) If $a = b$ then $a + c = b + c$

(Equals added to equals are equal.)

(2) If $a = b$ then $a - c = b - c$

(Equals subtracted from equals are equal.)

(3) If $a = b$ then $c \cdot a = c \cdot b$

(Equals multiplied by equals are equal.)

(4) If $a = b$ then $\frac{a}{c} = \frac{b}{c}$ assuming $c \neq 0$.

(Equals divided by equals are equal.)

answer
 Check on calc
 #1 (3)(x) + 5 = 15
 type in equation
 = 15 (2nd)
 (MATH) [1]
 0 is wrong
 1 is right

These properties lead us to follow one basic rule when manipulating equations – **what you do to one side of the equality you must do to the other side.**

Goal: Isolate the variable

Exercise #1: Solve each of the following one-step linear equations by applying the inverse for each operation that occurs.

(a) $x + 5 = 12$
 Invert
 $\begin{array}{r} x + 5 = 12 \\ -5 \quad -5 \\ \hline x = 7 \end{array}$
 Subtract prop. of Equal

(b) $x - 4 = -10$
 Addition
 $\begin{array}{r} x - 4 = -10 \\ +4 \quad +4 \\ \hline x = -6 \end{array}$
 Prop. of Equal

(c) $x + 4 = 2$
 $\begin{array}{r} x + 4 = 2 \\ -4 \quad -4 \\ \hline x = -2 \end{array}$

Check
 $x + 4 = 2$
 $-2 + 4 = 2$
 $2 = 2$

(d) $4x = 20$
 Divide
 $\begin{array}{r} 4x = 20 \\ \frac{4}{4} \quad \frac{20}{4} \\ \hline x = 5 \end{array}$
 Prop. of Equal

(e) $\frac{2}{3}x = -18$
 $\begin{array}{r} \frac{3}{2} \cdot \frac{2}{3}x = -18 \cdot \frac{3}{2} \\ \frac{2}{3}x = -18 \\ \frac{3}{2} \quad \frac{3}{2} \\ \hline x = -27 \end{array}$
 mut Prop. of Equal
 Div. Prop. of Equal

(f) $\frac{1}{7}x = 3$
 $\begin{array}{r} \frac{7}{1} \cdot \frac{1}{7}x = 3 \cdot \frac{7}{1} \\ x = 21 \end{array}$

Check
 $\frac{x}{7} = 3$
 $\frac{21}{7} = 3$
 $3 = 3$

Exercise #2: Consider the expression $2x + 7$.

(a) Without your calculator, determine the value of this expression for $x = 10$.

$2x + 7$
 $2(10) + 7$
 $20 + 7$
 27
 Follow PEMDAS →

(b) When determining this value, what operation was performed first? Which was performed second?

1st: multiplication 2nd: Addition

(c) Solve the equation $2x + 7 = 15$ for the value of x .

$2x + 7 = 15$
 $-7 \quad -7$
 $2x = 8$
 $\frac{2x}{2} = \frac{8}{2}$
 $x = 4$
 like terms
 Sub Prop. of Equal
 Div. Prop. of Equal

Inverse order of operation from above
 PEADAS
 (S) (A) (D) (M) (E) (P)

When you solve, use reverse PEMDAS

To solve an equation, you perform a series of inverse operations to isolate the variable on one side. When these inverse operations are completed, the other side of the equation is the solution. The properties of equality listed below can be used to justify the steps taken in solving an equation.

Addition Property of Equality	If $a = b$, then $a + c = b + c$
Subtraction Property of Equality	If $a = b$, then $a - c = b - c$
Multiplication Property of Equality	If $a = b$, then $ac = bc$
Division Property of Equality	If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$ ← can't divide by 0 or it will be not real (imaginary)

SADMEP

Exercise #3: Solve each of the following two-step linear equations for the value of x using the properties stated above. You may use your calculator to check your answer.

(a) $6x - 1 = 11$
 $+1 \quad +1$ Add Prop of =
 $\frac{6x}{6} = \frac{12}{6}$ DN Prop of =
 $x = 2$

(b) $\frac{x}{4} + 7 = 13$
 $-7 \quad -7$ Sub Prop of =
 $\frac{x}{4} = 6$ (4) mult Prop of =
 $x = 24$

(c) $2x + 25 = 7$
 $-25 \quad -25$
 $\frac{2x}{2} = \frac{-18}{2}$
 $x = -9$
 Check:
 $2x + 25 = 7$
 $2(-9) + 25 = 7$
 $-18 + 25 = 7$
 $7 = 7$

(d) $\frac{3}{5}x - 6 = 18$
 $+6 \quad +6$ Add Prop of =
 $\frac{3}{5}x = 24$ (5/3) mult Prop of =
 $x = 40$

(e) $15 + 3x = 6$
 $-15 \quad -15$ Sub Prop of =
 $\frac{3x}{3} = \frac{-9}{3}$ Equall
 $x = -3$ DN Prop of equality

(f) $\frac{2}{5}x + 9 = 1$
 $-9 \quad -9$
 $\frac{2}{5}x = -8$ (5/2)
 $x = -20$
 Check:
 $\frac{2}{5}x + 9 = 1$
 $\frac{2}{5}(-20) + 9 = 1$
 $-8 + 9 = 1$
 $1 = 1$

(g) $5x - 2.2 = 4$
 $+2.2 \quad +2.2$ Add Prop of =
 $\frac{5x}{5} = \frac{6.2}{5}$ DN Prop of =
 $x = 1.24$

(h) $3 = 8 - 0.1x$
 $-8 \quad -8$ Sub Prop of =
 $-5 = -0.1x$
 $-0.1 \quad -0.1$ DN Prop of =
 $x = 50$

(i) $-\frac{5}{3}x + 2 = -18$
 $-2 \quad -2$
 $-\frac{5}{3}x = -20$ (3/5)
 $x = 12$
 Check:
 $-\frac{5}{3}x + 2 = -18$
 $-\frac{5}{3}(12) + 2 = -18$
 $-20 + 2 = -18$
 $-18 = -18$

Exercise #4: Translate the following verbal sentence into an equation and solve for the missing number.

1) Five times a number, increased by seven is 37. Find the number.

$5x + 7 = 37$
 $-7 \quad -7$
 $\frac{5x}{5} = \frac{30}{5}$
 $x = 6$