

Section 1.4

Solving Linear Equations



Up. Up. and Away!

Inflation!

It seems that everything costs more and more each year.

What cost \$10,000 in 1967 would have cost you \$24,900 in 1980 and \$64,500 in 2008!

In the Exercise Set of this section of the textbook, we will look mathematical formulas that model this increase.



First Steps:

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 1.4 of your textbook which begins on page 40.
- Complete the *Concept and Vocabulary Check* which begins on page 49 of the textbook.

Guided Practice:

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

Objective #1: Solve linear equations.

✓ *Solved Problem #1*

1a. Solve and check: $4x + 5 = 29$

$$\begin{aligned}4x + 5 &= 29 \\4x + 5 - 5 &= 29 - 5 \\4x &= 24 \\ \frac{4x}{4} &= \frac{24}{4} \\x &= 6\end{aligned}$$

Check:

$$\begin{aligned}4x + 5 &= 29 \\4(6) + 5 &= 29 \\24 + 5 &= 29 \\29 &= 29\end{aligned}$$

The check verifies that the solution set is {6}.

Pencil Problem #1

1a. Solve and check: $6x - 3 = 63$

1b. Solve and check: $2(x-3)-17=13-3(x+2)$

$$\begin{aligned}
2(x-3)-17 &= 13-3(x+2) \\
2x-6-17 &= 13-3x-6 \\
2x-23 &= 7-3x \\
2x+3x &= 7+23 \\
5x &= 30 \\
\frac{5x}{5} &= \frac{30}{5} \\
x &= 6
\end{aligned}$$

Check:

$$\begin{aligned}
2(x-3)-17 &= 13-3(x+2) \\
2(6-3)-17 &= 13-3(6+2) \\
2(3)-17 &= 13-3(8) \\
6-17 &= 13-24 \\
-11 &= -11
\end{aligned}$$

The check verifies that the solution set is {6}.

1b. Solve and check: $16=3(x-1)-(x-7)$ **1c.** Solve: $\frac{x+5}{7} + \frac{x-3}{4} = \frac{5}{14}$

$$\begin{aligned}
\frac{x+5}{7} + \frac{x-3}{4} &= \frac{5}{14} \\
28\left(\frac{x+5}{7} + \frac{x-3}{4}\right) &= 28\left(\frac{5}{14}\right) \\
\frac{28}{1}\left(\frac{x+5}{7}\right) + \frac{28}{1}\left(\frac{x-3}{4}\right) &= \frac{28}{1}\left(\frac{5}{14}\right) \\
4(x+5) + 7(x-3) &= 2(5) \\
4x+20+7x-21 &= 10 \\
11x-1 &= 10 \\
11x &= 11 \\
\frac{11x}{11} &= \frac{11}{11} \\
x &= 1
\end{aligned}$$

The solution set is {1}.

1c. Solve and check: $\frac{x+3}{6} = \frac{2}{3} + \frac{x-5}{4}$

Objective #2: Recognize identities, conditional equations, and inconsistent equations.

 **Solved Problem #2**

- 2a.** Solve and determine whether the equation is an identity, a conditional equation, or an inconsistent equation.

$$4x - 7 = 4(x - 1) + 3$$

$$4x - 7 = 4(x - 1) + 3$$

$$4x - 7 = 4x - 4 + 3$$

$$4x - 7 = 4x - 1$$

$$-7 = -1$$

This equation is an inconsistent equation and thus has no solution.

The solution set is $\{ \}$.

 **Pencil Problem #2**

- 2a.** Solve and determine whether the equation is an identity, a conditional equation, or an inconsistent equation.

$$5x + 9 = 9(x + 1) - 4x$$

- 2b.** Solve and determine whether the equation is an identity, a conditional equation, or an inconsistent equation.

$$7x + 9 = 9(x + 1) - 2x$$

$$7x + 9 = 9(x + 1) - 2x$$

$$7x + 9 = 9x + 9 - 2x$$

$$7x + 9 = 7x + 9$$

$$9 = 9$$

This equation is an identity and all real numbers are solutions.

The solution set is $\{x \mid x \text{ is a real number}\}$ or $(-\infty, \infty)$ or \mathbb{R} .

- 2b.** Solve and determine whether the equation is an identity, a conditional equation, or an inconsistent equation.

$$10x + 3 = 8x + 3$$

Objective #3: Solve applied problems using mathematical models.**✓ Solved Problem #3**

3. The formula $T = 385x + 3129$ models the average cost of tuition and fees, T , at public four-year colleges for the school year ending x years after 2000. When will tuition and fees reach \$8904?

$$\begin{aligned} T &= 385x + 3129 \\ 8904 &= 385x + 3129 \\ 8904 - 3129 &= 385x \\ 5775 &= 385x \\ \frac{5775}{385} &= \frac{385x}{385} \\ 15 &= x \end{aligned}$$

The average cost of tuition and fees at public colleges will reach \$8904 in the school year ending 15 years after 2000, or 2015.

✎ Pencil Problem #3 ✎

3. The formula $T = 1074x + 15,145$ models the average cost of tuition and fees, T , at private four-year colleges for the school year ending x years after 2000. When will tuition and fees reach \$33,403?

Answers for Pencil Problems (Textbook Exercise references in parentheses):

- 1a. {11} (1.4 #3) 1b. {6} (1.4 #19) 1c. {13} (1.4 #33)
- 2a. The solution set is $\{x \mid x \text{ is a real number}\}$ or $(-\infty, \infty)$ or \mathbb{R} . The equation is an identity. (1.4 #39)
- 2b. The solution set is $\{0\}$. The equation is conditional. (1.4 #43)
3. the school year ending 2017 (1.4 #67b)

Homework:

- Review the Section 1.4 summary** on page 95 of the textbook.
- Insert your homework** into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.