

Elementary Algebra Skill

Solving Linear Equations: Variable on Both Sides

Solve each equation.

$$1) 6r + 7 = 13 + 7r$$

$$\begin{array}{r} -6r \\ \hline 7 = 13 + r \\ -13 \quad -13 \\ \hline -6 = r \end{array}$$

$$3) -7x - 3x + 2 = -8x - 8$$

$$\begin{array}{r} -10x + 2 = -8x - 8 \\ +8x \quad +8x \\ \hline -2x + 2 = -8 \\ -2 \quad -2 \\ \hline -2x = -10 \\ -2x = -10 \\ \hline x = 5 \end{array}$$

$$5) -14 + 6b + 7 - 2b = 1 + 5b$$

$$\begin{array}{r} -7 + 4b = 1 + 5b \\ -4b \quad -4b \\ \hline -7 = 1 + b \\ -1 \quad -1 \\ \hline -8 = b \\ -8 = b \end{array}$$

$$7) n - 3n = 14 - 4n$$

$$\begin{array}{r} -2n = 14 - 4n \\ +4n \quad +4n \\ \hline 2n = 14 \\ \frac{2n}{2} = \frac{14}{2} \\ n = 7 \end{array}$$

$$9) 5 + 2x = 2x + 6$$

no solution

$$11) -8n + 4(1 + 5n) = -6n - 14$$

$$\begin{array}{r} -8n + 4 + 20n = -6n - 14 \\ 12n + 4 = -6n - 14 \\ 12n + 4 = -6n - 14 \\ -4 \quad -4 \\ \hline 12n = -6n - 18 \\ +6n \quad +6n \\ \hline 18n = -18 \\ \frac{18n}{18} = \frac{-18}{18} \\ n = -1 \end{array}$$

$$13) 4n - 40 = 7(-2n + 2)$$

$$\begin{array}{r} 4n - 40 = -14n + 14 \\ -4n \quad -4n \\ \hline -40 = -14n + 14 \\ -14 \quad -14 \\ \hline -54 = -18n \\ -54 = -18n \\ \hline 3 = n \end{array}$$

$$15) -31 - 4x = -5 - 5(1 + 5x)$$

$$\begin{array}{r} -31 - 4x = -5 - 5 - 25x \\ -31 - 4x = -10 - 25x \\ +4x \quad +4x \\ \hline -31 = -10 - 21x \\ +10 \quad +10 \\ \hline -21 = -21x \\ -21 \quad -21 \\ \hline 1 = x \end{array}$$

$$17) 8x + 4(4x - 3) = 4(6x + 4) - 4$$

$$\begin{array}{r} 8x + 16x - 12 = 24x + 16 - 4 \\ 24x - 12 = 24x + 12 \\ \hline x = \text{no solution} \end{array}$$

$$19) 4(-8x + 5) = -32x - 26$$

$$\begin{array}{r} -32x + 20 = -32x - 26 \\ -20 \quad -20 \\ \hline -32x = -32x - 6 \\ \hline x = \text{no solution} \end{array}$$

Key

$$13 - 4x = 1 - x$$

$$\begin{array}{r} 13 - 4x = 1 - x \\ +x \quad +x \\ \hline 13 - 3x = 1 \\ -13 \quad -13 \\ \hline -3x = -12 \\ \frac{-3x}{-3} = \frac{-12}{-3} \\ x = 4 \end{array}$$

$$2) 13 - 4x = 1 - x$$

$$4) -8 - x = x - 4x$$

$$\begin{array}{r} -8 - x = x - 4x \\ +x \quad +x \\ \hline -8 = x - 3x \\ -8 = -2x \\ \frac{-8}{-2} = \frac{-2x}{-2} \\ 4 = x \end{array}$$

$$6) n + 2 = -14 - n$$

$$\begin{array}{r} n + 2 = -14 - n \\ +n \quad +n \\ \hline 2n + 2 = -14 \\ -2 \quad -2 \\ \hline 2n = -16 \\ \frac{2n}{2} = \frac{-16}{2} \\ n = -8 \end{array}$$

$$8) 7a - 3 = 3 + 6a$$

$$\begin{array}{r} 7a - 3 = 3 + 6a \\ -6a \quad -6a \\ \hline a - 3 = 3 \\ +3 \quad +3 \\ \hline a = 6 \end{array}$$

$$10) -10 + x + 4 - 5 = 7x - 5$$

$$\begin{array}{r} -11 + x = 7x - 5 \\ -x \quad -x \\ \hline -11 = 6x - 5 \\ +5 \quad +5 \\ \hline -6 = 6x \\ \frac{-6}{6} = \frac{6x}{6} \\ -1 = x \end{array}$$

$$12) -6n - 20 = -2n + 4(1 - 3n)$$

$$\begin{array}{r} -6n - 20 = -2n + 4 - 12n \\ -6n - 20 = -14n + 4 \\ +6n \quad +6n \\ \hline -20 = -14n + 4 \\ -4 \quad -4 \\ \hline -24 = -8n \\ \frac{-24}{-8} = \frac{-8n}{-8} \\ 3 = n \end{array}$$

$$14) 7(5a - 4) - 1 = 14 - 8a$$

$$\begin{array}{r} 35a - 28 - 1 = 14 - 8a \\ 35a - 29 = 14 - 8a \\ +29 \quad +29 \\ \hline 35a = 43 - 8a \\ +8a \quad +8a \\ \hline 43a = 43 \\ \frac{43a}{43} = \frac{43}{43} \\ a = 1 \end{array}$$

$$16) 38 + 7k = 8(k + 4)$$

$$\begin{array}{r} 38 + 7k = 8k + 32 \\ -7k \quad -7k \\ \hline 38 = k + 32 \\ -32 \quad -32 \\ \hline 6 = k \end{array}$$

$$18) 3(1 - 3x) = 2(-4x + 7)$$

$$\begin{array}{r} 3 - 9x = -8x + 14 \\ +8x \quad +8x \\ \hline 3 - x = 14 \\ -3 \quad -3 \\ \hline -x = 11 \\ (-1) \cdot x = 11(-1) \\ x = -11 \end{array}$$

$$20) -3(x - 1) + 8(x - 3) = 6x + 7 - 5x$$

$$\begin{array}{r} -3x + 3 + 8x - 24 = x + 7 \\ 5x - 21 = x + 7 \\ +21 \quad +21 \\ \hline 5x = x + 28 \\ -x \quad -x \\ \hline 4x = 28 \\ \frac{4x}{4} = \frac{28}{4} \\ x = 7 \end{array}$$

$$11. 5x - 7 = -10x + 8$$

$$\begin{array}{r} -5x \quad -5x \\ \hline -7 = -15x + 8 \\ -8 \qquad \qquad -8 \\ \hline -15 = -15x \\ -15 \quad -15 \\ \hline 1 = x \end{array}$$

$$13. -3(y+3) = 2y+3$$

$$\begin{array}{r} -3y - 9 = 2y + 3 \\ -2y \qquad -2y \\ \hline -5y - 9 = 3 \\ +9 \quad +9 \\ \hline -5y = 12 \\ -5 \quad -5 \\ \hline y = -\frac{12}{5} \end{array}$$

$$15. 6x - 4 = 2(3x - 2)$$

$$6x - 4 = 6x - 4$$

$$x = \text{all numbers}$$

$$17. 3(x+2) = -5 - 2(x-3)$$

$$\begin{array}{r} 3x + 6 = -5 - 2x + 6 \\ 3x + 6 = -2x + 1 \\ +2x \qquad +2x \\ \hline 5x + 6 = 1 \\ -6 \quad -6 \\ \hline 5x = -5 \\ 5 \quad 5 \\ \hline x = -1 \end{array}$$

$$19. 2(x-3) = (x-1) + 7$$

$$\begin{array}{r} 2x - 6 = x - 1 + 7 \\ 2x - 6 = x + 6 \\ +6 \qquad +6 \\ \hline 2x = x + 12 \\ -x \quad -x \\ \hline x = 12 \end{array}$$

$$12. 7y + 3 = 4y - 18$$

$$\begin{array}{r} -3 \qquad -3 \\ \hline 7y = 4y - 21 \\ -4y \quad -4y \\ \hline 3y = -21 \\ 3 \quad 3 \\ \hline y = -7 \end{array}$$

$$14. 2(-3a+5) = -4(a+4)$$

$$\begin{array}{r} -6a + 10 = -4a - 16 \\ +4a \qquad +4a \\ \hline -2a + 10 = -16 \\ -10 \quad -10 \\ \hline -2a = -26 \\ -2 \quad -2 \\ \hline a = 13 \end{array}$$

$$16. -6x + 9 = 4(5 - x)$$

$$\begin{array}{r} -6x + 9 = 20 - 4x \\ +4x \qquad +4x \\ \hline -2x + 9 = 20 \\ -9 \quad -9 \\ \hline -2x = 11 \\ -2 \quad -2 \\ \hline x = -5\frac{1}{2} \text{ or } -\frac{11}{2} \end{array}$$

$$18. 2(x-3) = \frac{1}{2}(4x-12)$$

$$2x - 6 = 2x - 6$$

$$x = \text{any number}$$

$$20. -(x+7) = -6x + 8$$

$$\begin{array}{r} -x - 7 = -6x + 8 \\ +x \qquad +x \\ \hline -7 = -5x + 8 \\ -8 \qquad -8 \\ \hline -15 = -5x \\ -5 \quad -5 \\ \hline 3 = x \end{array}$$