Prealgebra Textbook

Second Edition

Chapter 3 Odd Solutions

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Chapter 3

The Fundamentals of Algebra

3.1 Algebraic Expressions

1. The word "times" corresponds to multiplication. Therefore, the width is multiplied by 8. In terms of the variable n, the corresponding mathematical expression is $8n$.

3. The word "sum" corresponds to addition, and the word "times" corresponds to multiplication. Therefore, the numbers n and 3 are first added, and then the result is multiplied by 6. In terms of the variable n, the corresponding mathematical expression is $6(n + 3)$.

5. When a quantity is quadrupled, it is multiplied by 4. Therefore, in terms of the variable b, the corresponding mathematical expression is $4b$.

7. To decrease a quantity is by 33, we must subtract 33. Therefore, in terms of the variable y, the corresponding mathematical expression is $y - 33$.

9. The word "times" corresponds to multiplication. Therefore, the width is multiplied by 10. In terms of the variable n, the corresponding mathematical expression is $10n$.

11. The word "sum" corresponds to addition, and the word "times" corresponds to multiplication. Therefore, the numbers z and 2 are first added, and then the result is multiplied by 9. In terms of the variable z, the corresponding mathematical expression is $9(z + 2)$.

13. When a quantity is doubled, it is multiplied by 2. Therefore, in terms of the variable y, the corresponding mathematical expression is $2y$.

15. The phrase "more than" corresponds to addition, and the word "times" corresponds to multiplication. Therefore, the number p is multiplied by 15, and then 13 is added. In terms of the variable p, the corresponding mathematical expression is $15p + 13$.

17. The phrase "less than" corresponds to subtraction, and the word "times" corresponds to multiplication. Therefore, the number x is multiplied by 11, and then 4 is subtracted. In terms of the variable x, the corresponding mathematical expression is $11x - 4$.

19. To decrease a quantity is by 10, we must subtract 10. Therefore, in terms of the variable u, the corresponding mathematical expression is $u - 10$.

21.

i) Since n is representing a whole number, adding one to n would give you the next whole number after n. For instance, suppose $n = 3$. Then $n+1$ would be $3 + 1 = 4$.

ii) Since n is representing a whole number, adding two to n would give two *more than* n. For instance, suppose $n = 3$. Then $n + 2$ would represent $3 + 2 = 5$.

iii) Since n represents a whole number, subtracting one from n would represent *one less than* n. For instance, suppose $n = 3$. Then $n - 1$ would represent $3 - 1 = 2$.

23. Since $2n + 1$ is an odd whole number, the next odd number would be *two more than* $2n + 1 + 2$, represented by $2n + 3$.

25. The statement says "Steve sells twice as much product as Mike". The amount of product that Steve sells in given in terms of what Mike sells. So let Mike's sales be represented by the variable p. Once we have an expression of Mike's sales, we can write Steve's sales as twice as much as Mike's, or, $2p$.

3.2 Evaluating Algebraic Expressions

1. First replace all occurrences of the variables in the expression with open parentheses:

$$-3x^2 - 6x + 3 = -3(\quad)^2 - 6(\quad) + 3$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} -3x^2 - 6x + 3 &= -3(7)^2 - 6(7) + 3 && \text{Substitute 7 for } x. \\ &= -3(49) - 6(7) + 3 && \text{Evaluate exponents first.} \\ &= -147 - 42 + 3 && \text{Perform multiplications, left to right.} \\ &= -186 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

3. First replace all occurrences of the variables in the expression with open parentheses:

$$-6x - 6 = -6(\quad) - 6$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} -6x - 6 &= -6(3) - 6 && \text{Substitute 3 for } x. \\ &= -18 - 6 && \text{Multiply first: } -6(3) = -18 \\ &= -24 && \text{Subtract.} \end{aligned}$$

5. First replace all occurrences of the variables in the expression with open parentheses:

$$5x^2 + 2x + 4 = 5(\quad)^2 + 2(\quad) + 4$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} 5x^2 + 2x + 4 &= 5(-1)^2 + 2(-1) + 4 && \text{Substitute } -1 \text{ for } x. \\ &= 5(1) + 2(-1) + 4 && \text{Evaluate exponents first.} \\ &= 5 - 2 + 4 && \text{Perform multiplications, left to right.} \\ &= 7 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

7. First replace all occurrences of the variables in the expression with open parentheses:

$$-9x - 5 = -9(\quad) - 5$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} -9x - 5 &= -9(-2) - 5 && \text{Substitute } -2 \text{ for } x. \\ &= 18 - 5 && \text{Multiply first: } -9(-2) = 18 \\ &= 13 && \text{Subtract.} \end{aligned}$$

9. First replace all occurrences of the variables in the expression with open parentheses:

$$4x^2 + 2x + 6 = 4(\quad)^2 + 2(\quad) + 6$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} 4x^2 + 2x + 6 &= 4(-6)^2 + 2(-6) + 6 && \text{Substitute } -6 \text{ for } x. \\ &= 4(36) + 2(-6) + 6 && \text{Evaluate exponents first.} \\ &= 144 - 12 + 6 && \text{Perform multiplications, left to right.} \\ &= 138 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

11. First replace all occurrences of the variables in the expression with open parentheses:

$$12x + 10 = 12(\quad) + 10$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} 12x + 10 &= 12(-12) + 10 && \text{Substitute } -12 \text{ for } x. \\ &= -144 + 10 && \text{Multiply first: } 12(-12) = -144 \\ &= -134 && \text{Add.} \end{aligned}$$

13. First replace all occurrences of the variables in the expression with open parentheses:

$$|x| - |y| = |(\quad)| - |(\quad)|$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} |x| - |y| &= |(-5)| - |(4)| && \text{Substitute } -5 \text{ for } x \text{ and } 4 \text{ for } y. \\ &= 5 - 4 && \text{Compute absolute values first.} \\ &= 1 && \text{Subtract.} \end{aligned}$$

15. First replace all occurrences of the variables in the expression with open parentheses:

$$-5x^2 + 2y^2 = -5(\quad)^2 + 2(\quad)^2$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} -5x^2 + 2y^2 &= -5(4)^2 + 2(2)^2 && \text{Substitute 4 for } x \text{ and 2 for } y. \\ &= -5(16) + 2(4) && \text{Evaluate exponents first.} \\ &= -80 + 8 && \text{Perform multiplications, left to right.} \\ &= -72 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

17. First replace all occurrences of the variables in the expression with open parentheses:

$$|x| - |y| = |(\quad)| - |(\quad)|$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} |x| - |y| &= |(0)| - |(2)| && \text{Substitute 0 for } x \text{ and 2 for } y. \\ &= -2 && \text{Compute absolute values first.} \\ &= -2 && \text{Subtract.} \end{aligned}$$

19. First replace all occurrences of the variables in the expression with open parentheses:

$$|x - y| = |(\quad) - (\quad)|$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} |x - y| &= |(4) - (5)| && \text{Substitute 4 for } x \text{ and 5 for } y. \\ &= |-1| && \text{Subtract.} \\ &= 1 && \text{Compute the absolute value.} \end{aligned}$$

21. First replace all occurrences of the variables in the expression with open parentheses:

$$5x^2 - 4xy + 3y^2 = 5(\quad)^2 - 4(\quad)(\quad) + 3(\quad)^2$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} 5x^2 - 4xy + 3y^2 &= 5(1)^2 - 4(1)(-4) + 3(-4)^2 && \text{Substitute 1 for } x \text{ and } -4 \text{ for } y. \\ &= 5(1) - 4(1)(-4) + 3(16) && \text{Evaluate exponents first.} \\ &= 5 + 16 + 48 && \text{Perform multiplications, left to right.} \\ &= 69 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

23. First replace all occurrences of the variables in the expression with open parentheses:

$$|x - y| = |(\quad) - (\quad)|$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} |x - y| &= |(4) - (4)| && \text{Substitute 4 for } x \text{ and 4 for } y. \\ &= |0| && \text{Subtract.} \\ &= 0 && \text{Compute the absolute value.} \end{aligned}$$

25. First replace all occurrences of the variables in the expression with open parentheses:

$$-5x^2 - 3xy + 5y^2 = -5(\quad)^2 - 3(\quad)(\quad) + 5(\quad)^2$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} -5x^2 - 3xy + 5y^2 &= -5(-1)^2 - 3(-1)(-2) + 5(-2)^2 && \text{Substitute } -1 \text{ for } x \text{ and } -2 \text{ for } y. \\ &= -5(1) - 3(-1)(-2) + 5(4) && \text{Evaluate exponents first.} \\ &= -5 - 6 + 20 && \text{Perform multiplications, left to right.} \\ &= 9 && \text{Perform additions and subtractions, left to right} \end{aligned}$$

27. First replace all occurrences of the variables in the expression with open parentheses:

$$5x^2 + 4y^2 = 5(\quad)^2 + 4(\quad)^2$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} 5x^2 + 4y^2 &= 5(-2)^2 + 4(-2)^2 && \text{Substitute } -2 \text{ for } x \text{ and } -2 \text{ for } y. \\ &= 5(4) + 4(4) && \text{Evaluate exponents first.} \\ &= 20 + 16 && \text{Perform multiplications, left to right.} \\ &= 36 && \text{Perform additions and subtractions, left to right.} \end{aligned}$$

29. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{9 + 9x}{-x} = \frac{9 + 9(\quad)}{-(\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{9 + 9x}{-x} &= \frac{9 + 9(-3)}{-(-3)} && \text{Substitute } -3 \text{ for } x. \\ &= \frac{-18}{3} && \text{Evaluate numerator and denominator.} \\ &= -6 && \text{Divide.} \end{aligned}$$

31. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{-8x + 9}{-9 + x} = \frac{-8(\quad) + 9}{-9 + (\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{-8x + 9}{-9 + x} &= \frac{-8(10) + 9}{-9 + (10)} && \text{Substitute } 10 \text{ for } x. \\ &= \frac{-71}{1} && \text{Evaluate numerator and denominator.} \\ &= -71 && \text{Divide.} \end{aligned}$$

33. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{-4+9x}{7x} = \frac{-4+9(\quad)}{7(\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{-4+9x}{7x} &= \frac{-4+9(2)}{7(2)} && \text{Substitute 2 for } x. \\ &= \frac{14}{14} && \text{Evaluate numerator and denominator.} \\ &= 1 && \text{Divide.} \end{aligned}$$

35. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{-12-7x}{x} = \frac{-12-7(\quad)}{(\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{-12-7x}{x} &= \frac{-12-7(-1)}{(-1)} && \text{Substitute } -1 \text{ for } x. \\ &= \frac{-5}{-1} && \text{Evaluate numerator and denominator.} \\ &= 5 && \text{Divide.} \end{aligned}$$

37. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{6x-10}{5+x} = \frac{6(\quad)-10}{5+(\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{6x-10}{5+x} &= \frac{6(-6)-10}{5+(-6)} && \text{Substitute } -6 \text{ for } x. \\ &= \frac{-46}{-1} && \text{Evaluate numerator and denominator.} \\ &= 46 && \text{Divide.} \end{aligned}$$

39. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{10x+11}{5+x} = \frac{10(\quad)+11}{5+(\quad)}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} \frac{10x+11}{5+x} &= \frac{10(-4)+11}{5+(-4)} && \text{Substitute } -4 \text{ for } x. \\ &= \frac{-29}{1} && \text{Evaluate numerator and denominator.} \\ &= -29 && \text{Divide.} \end{aligned}$$

41. First replace all occurrences of the variables in the expression with open parentheses:

$$16t^2 = 16(\quad)^2$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} d &= 16(4)^2 \text{ feet} && \text{Substitute 4 for } t. \\ &= 16(16) \text{ feet} && \text{Evaluate exponents first.} \\ &= 256 \text{ feet} && \text{Multiply.} \end{aligned}$$

43. First replace all occurrences of the variables in the expression with open parentheses:

$$\frac{5(F-32)}{9} = \frac{5((\quad)-32)}{9}$$

Then replace each variable with its given value, and evaluate the expression:

$$\begin{aligned} C &= \frac{5((230)-32)}{9} \text{ degrees} && \text{Substitute 230 for } F. \\ &= \frac{5(198)}{9} \text{ degrees} && \text{Subtract inside the parentheses in the numerator.} \\ &= \frac{990}{9} \text{ degrees} && \text{Multiply in the numerator.} \\ &= 110 \text{ degrees} && \text{Divide.} \end{aligned}$$

45. Prepare the formula for a substitution for K.

$$F = \frac{9\left((\quad)-273\right)}{5} + 32$$

Now, substitute 28 for K and simplify.

$$\begin{aligned}
F &= \frac{9\left((28)-273\right)}{5}+32 && \text{Substitute 28 for } K. \\
&= \frac{9(-245)}{5}+32 && \text{Parentheses: } 28-273=-245. \\
&= \frac{-2205}{5}+32 && \text{Multiply: } 9(-245)=-2205. \\
&= -441+32 && \text{Divide: } -2205/5=-441. \\
&= -409 && \text{Add: } -441+32=-409.
\end{aligned}$$

Hence, the Fahrenheit temperature is $F = -409°\,\mathrm{F}$.

47. If we substitute the initial velocity 272 for v_0 and the acceleration 32 for g, the formula

$$v = v_0 - gt$$

becomes

$$v = 272 - 32t.$$

To find the velocity at $t = 6$ seconds, substitute 6 for t and simplify.

$$\begin{aligned}
v &= 272-32t && \text{Velocity equation.} \\
v &= 272-32(6) && \text{Substitute 6 for } t. \\
v &= 272-192 && \text{Multiply: } 32(6)=192. \\
v &= 80 && \text{Add: } 272-192=80.
\end{aligned}$$

Thus, the velocity at 6 seconds is 80 feet per second.

49.

i) Let $n = 1$. Then, $2 \cdot 1 = 2$

ii) Let $n = 2$. Then, $2 \cdot 2 = 4$

iii) Let $n = 3$. Then, $2 \cdot 3 = 6$

iv) Let $n = -4$. Then, $2 \cdot -4 = -8$

v) Let $n = -5$. Then, $2 \cdot -5 = -10$

vi) Any number multiplied by 2 will always result in an even number as the result will always have 2 as a factor. Any number with 2 as a factor must necessarily be even.

3.3 Simplifying Algebraic Expressions

1. Use the associative property to regroup, then simplify.

$$\begin{aligned} 10(-4x) &= (10 \cdot (-4))x && \text{Apply the associative property.} \\ &= -40x && \text{Simplify.} \end{aligned}$$

3. Use the commutative and associative properties to reorder and regroup, then simplify.

$$\begin{aligned} (-10x)(-3) &= ((-10) \cdot (-3))x && \text{Change the order and regroup.} \\ &= 30x && \text{Simplify.} \end{aligned}$$

5. Use the associative property to regroup, then simplify.

$$\begin{aligned} -5(3x) &= ((-5) \cdot 3)x && \text{Apply the associative property.} \\ &= -15x && \text{Simplify.} \end{aligned}$$

7. Use the commutative and associative properties to reorder and regroup, then simplify.

$$\begin{aligned} (-4x)10 &= ((-4) \cdot 10)x && \text{Change the order and regroup.} \\ &= -40x && \text{Simplify.} \end{aligned}$$

9. Use the commutative and associative properties to reorder and regroup, then simplify.

$$\begin{aligned} (5x)3 &= (5 \cdot 3)x && \text{Change the order and regroup.} \\ &= 15x && \text{Simplify.} \end{aligned}$$

11. Use the commutative and associative properties to reorder and regroup, then simplify.

$$\begin{aligned} (5x)10 &= (5 \cdot 10)x && \text{Change the order and regroup.} \\ &= 50x && \text{Simplify.} \end{aligned}$$

13. Use the associative property to regroup, then simplify.

$$\begin{aligned} -9(-7x) &= ((-9) \cdot (-7))x && \text{Apply the associative property.} \\ &= 63x && \text{Simplify.} \end{aligned}$$

15. Use the associative property to regroup, then simplify.

$$\begin{aligned} 6(2x) &= (6 \cdot 2)x && \text{Apply the associative property.} \\ &= 12x && \text{Simplify.} \end{aligned}$$

17. Use the associative property to regroup, then simplify.

$$\begin{aligned} -8(-9x) &= ((-8) \cdot (-9))x && \text{Apply the associative property.} \\ &= 72x && \text{Simplify.} \end{aligned}$$

19. Use the commutative and associative properties to reorder and regroup, then simplify.

$$\begin{aligned} (6x)7 &= (6 \cdot 7)x && \text{Change the order and regroup.} \\ &= 42x && \text{Simplify.} \end{aligned}$$

21. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 8(7x + 8) &= 8(7x) + 8(8) && \text{Apply the distributive property.} \\ &= 56x + 64 && \text{Simplify.} \end{aligned}$$

23. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 9(-2 + 10x) &= 9(-2) + 9(10x) && \text{Apply the distributive property.} \\ &= -18 + 90x && \text{Simplify.} \end{aligned}$$

25. To negate a sum, simply negate each term of the sum:

$$-(-2x + 10y - 6) = 2x - 10y + 6$$

27. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 2(10 + x) &= 2(10) + 2(x) && \text{Apply the distributive property.} \\ &= 20 + 2x && \text{Simplify.} \end{aligned}$$

29. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 3(3+4x) &= 3(3)+3(4x) && \text{Apply the distributive property.} \\ &= 9+12x && \text{Simplify.} \end{aligned}$$

31. To negate a sum, simply negate each term of the sum:

$$-(-5-7x+2y) = 5+7x-2y$$

33. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 4(-6x+7) &= 4(-6x)+4(7) && \text{Apply the distributive property.} \\ &= -24x+28 && \text{Simplify.} \end{aligned}$$

35. Use the distributive property to expand the expression, and then use order of operations to simplify.

$$\begin{aligned} 4(8x-9) &= 4(8x)-4(9) && \text{Apply the distributive property.} \\ &= 32x-36 && \text{Simplify.} \end{aligned}$$

37. To negate a sum, simply negate each term of the sum:

$$-(4-2x-10y) = -4+2x+10y$$

39. To negate a sum, simply negate each term of the sum:

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

41. To negate a sum, simply negate each term of the sum:

$$-(6x+2-10y) = -6x-2+10y$$

43. To negate a sum, simply negate each term of the sum:

$$-(-3y-4+4x) = 3y+4-4x$$

3.4 Combining Like Terms

1. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 17xy^2 + 18xy^2 + 20xy^2 &= (17 + 18 + 20)xy^2 && \text{Distributive property.} \\ &= 55xy^2 && \text{Simplify.} \end{aligned}$$

3. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -8xy^2 - 3xy^2 - 10xy^2 &= (-8 - 3 - 10)xy^2 && \text{Distributive property.} \\ &= -21xy^2 && \text{Simplify.} \end{aligned}$$

5. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 4xy - 20xy &= (4 - 20)xy && \text{Distributive property.} \\ &= -16xy && \text{Simplify.} \end{aligned}$$

7. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 12r - 12r &= (12 - 12)r && \text{Distributive property.} \\ &= 0 && \text{Simplify.} \end{aligned}$$

9. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -11x - 13x + 8x &= (-11 - 13 + 8)x && \text{Distributive property.} \\ &= -16x && \text{Simplify.} \end{aligned}$$

11. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -5q + 7q &= (-5 + 7)q && \text{Distributive property.} \\ &= 2q && \text{Simplify.} \end{aligned}$$

13. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} r - 13r - 7r &= (1 - 13 - 7)r && \text{Distributive property.} \\ &= -19r && \text{Simplify.} \end{aligned}$$

15. First use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 3x^3 - 18x^3 &= (3 - 18)x^3 && \text{Distributive property.} \\ &= -15x^3 && \text{Simplify.} \end{aligned}$$

17. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -8 + 17n + 10 + 8n &= -8 + 10 + 17n + 8n && \text{Rearrange terms.} \\ &= (-8 + 10) + (17 + 8)n && \text{Distributive property.} \\ &= 2 + 25n && \text{Simplify.} \end{aligned}$$

19. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -2x^3 - 19x^2y - 15x^2y + 11x^3 &= -2x^3 + 11x^3 - 19x^2y - 15x^2y && \text{Rearrange terms.} \\ &= (-2 + 11)x^3 + (-19 - 15)x^2y && \text{Distributive property.} \\ &= 9x^3 - 34x^2y && \text{Simplify.} \end{aligned}$$

21. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -14xy - 2x^3 - 2x^3 - 4xy &= -14xy - 4xy - 2x^3 - 2x^3 && \text{Rearrange terms.} \\ &= (-14 - 4)xy + (-2 - 2)x^3 && \text{Distributive property.} \\ &= -18xy - 4x^3 && \text{Simplify.} \end{aligned}$$

23. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -13 + 16m + m + 16 &= -13 + 16 + 16m + m && \text{Rearrange terms.} \\ &= (-13 + 16) + (16 + 1)m && \text{Distributive property.} \\ &= 3 + 17m && \text{Simplify.} \end{aligned}$$

25. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -14x^2y - 2xy^2 + 8x^2y + 18xy^2 &= -14x^2y + 8x^2y - 2xy^2 + 18xy^2 && \text{Rearrange terms.} \\ &= (-14 + 8)x^2y + (-2 + 18)xy^2 && \text{Distributive property.} \\ &= -6x^2y + 16xy^2 && \text{Simplify.} \end{aligned}$$

27. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} -14x^3 + 16xy + 5x^3 + 8xy &= -14x^3 + 5x^3 + 16xy + 8xy && \text{Rearrange terms.} \\ &= (-14 + 5)x^3 + (16 + 8)xy && \text{Distributive property.} \\ &= -9x^3 + 24xy && \text{Simplify.} \end{aligned}$$

29. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 9n + 10 + 7 + 15n &= 9n + 15n + 10 + 7 && \text{Rearrange terms.} \\ &= (9 + 15)n + (10 + 7) && \text{Distributive property.} \\ &= 24n + 17 && \text{Simplify.} \end{aligned}$$

31. First rearrange the terms and use the distributive property to factor out the common variable part. Then simplify.

$$\begin{aligned} 3y + 1 + 6y + 3 &= 3y + 6y + 1 + 3 && \text{Rearrange terms.} \\ &= (3 + 6)y + (1 + 3) && \text{Distributive property.} \\ &= 9y + 4 && \text{Simplify.} \end{aligned}$$

33. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -4(9x^2y + 8) + 6(10x^2y - 6) &= -36x^2y - 32 + 60x^2y - 36 && \text{Distribute.} \\ &= -36x^2y + 60x^2y - 32 - 36 && \text{Rearrange terms.} \\ &= 24x^2y - 68 && \text{Combine like terms.} \end{aligned}$$

35. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} 3(-4x^2 + 10y^2) + 10(4y^2 - x^2) &= -12x^2 + 30y^2 + 40y^2 - 10x^2 && \text{Distribute.} \\ &= -12x^2 - 10x^2 + 30y^2 + 40y^2 && \text{Rearrange terms.} \\ &= -22x^2 + 70y^2 && \text{Combine like terms.} \end{aligned}$$

37. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -s+7-(-1-3s) &= -s+7+1+3s && \text{Distribute (negate the sum).} \\ &= -s+3s+7+1 && \text{Rearrange terms.} \\ &= 2s+8 && \text{Combine like terms.} \end{aligned}$$

39. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -10q-10-(-3q+5) &= -10q-10+3q-5 && \text{Distribute (negate the sum).} \\ &= -10q+3q-10-5 && \text{Rearrange terms.} \\ &= -7q-15 && \text{Combine like terms.} \end{aligned}$$

41. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} 7(8y+7)-6(8-7y) &= 56y+49-48+42y && \text{Distribute.} \\ &= 56y+42y+49-48 && \text{Rearrange terms.} \\ &= 98y+1 && \text{Combine like terms.} \end{aligned}$$

43. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} 7(10x^2-8xy^2)-7(9xy^2+9x^2) &= 70x^2-56xy^2-63xy^2-63x^2 && \text{Distribute.} \\ &= 70x^2-63x^2-56xy^2-63xy^2 && \text{Rearrange terms.} \\ &= 7x^2-119xy^2 && \text{Combine like terms.} \end{aligned}$$

45. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -2(6+4n)+4(-n-7) &= -12-8n-4n-28 && \text{Distribute.} \\ &= -12-28-8n-4n && \text{Rearrange terms.} \\ &= -40-12n && \text{Combine like terms.} \end{aligned}$$

47. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} 8-(4+8y) &= 8-4-8y && \text{Distribute (negate the sum).} \\ &= 4-8y && \text{Combine like terms.} \end{aligned}$$

49. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -8(-n+4)-10(-4n+3) &= 8n-32+40n-30 && \text{Distribute.} \\ &= 8n+40n-32-30 && \text{Rearrange terms.} \\ &= 48n-62 && \text{Combine like terms.} \end{aligned}$$

51. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -5-(10p+5) &= -5-10p-5 && \text{Distribute (negate the sum).} \\ &= -5-5-10p && \text{Rearrange terms.} \\ &= -10-10p && \text{Combine like terms.} \end{aligned}$$

53. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} 7(1+7r)+2(4-5r) &= 7+49r+8-10r && \text{Distribute.} \\ &= 7+8+49r-10r && \text{Rearrange terms.} \\ &= 15+39r && \text{Combine like terms.} \end{aligned}$$

55. First use the distributive property to expand the expression. Then rearrange the terms and combine like terms.

$$\begin{aligned} -2(-5-8x^2)-6(6) &= 10+16x^2-36 && \text{Distribute.} \\ &= 10-36+16x^2 && \text{Rearrange terms.} \\ &= -26+16x^2 && \text{Combine like terms.} \end{aligned}$$

57. The perimeter P is given by the formula

$$P = 2L + 2W$$

Since the length is 2 feet longer than 6 times its width, it follows that

$$L = 2 + 6W$$

Because $L = 2 + 6W$, we can substitute $2 + 6W$ for L into the perimeter equation to obtain

$$\begin{aligned} P &= 2L+2W && \text{Perimeter formula.} \\ &= 2(2+6W)+2W && \text{Substitute } L = 2+6W. \\ &= 4+12W+2W && \text{Distribute.} \\ &= 4+14W && \text{Combine like terms.} \end{aligned}$$

59. The perimeter P is given by the formula

$$P = 2L + 2W$$

Since the width is 8 feet shorter than its length, it follows that

$$W = L - 8$$

Because $W = L - 8$, we can substitute $L - 8$ for W into the perimeter equation to obtain

$$\begin{aligned} P &= 2L + 2W && \text{Perimeter formula.} \\ &= 2L + 2(L-8) && \text{Substitute } W = 4L - 8. \\ &= 2L + 2L - 16 && \text{Distribute.} \\ &= 4L - 16 && \text{Combine like terms.} \end{aligned}$$

61. The perimeter P is given by the formula

$$P = 2L + 2W$$

Since the length is 9 feet shorter than 4 times its width, it follows that

$$L = 4W - 9$$

Because $L = 4W - 9$, we can substitute $4W - 9$ for L into the perimeter equation to obtain

$$\begin{aligned} P &= 2L + 2W && \text{Perimeter formula.} \\ &= 2(4W-9) + 2W && \text{Substitute } L = 4W - 9. \\ &= 8W - 18 + 2W && \text{Distribute.} \\ &= 10W - 18 && \text{Combine like terms.} \end{aligned}$$

3.5 Solving Equations Involving Integers II

1. Combine like terms on each side of the equation, if possible. Then isolate the term containing x on one side of the equation.

$$\begin{aligned} -9x + x &= -8 && \text{Original equation.} \\ -8x &= -8 && \text{Combine like terms on the left side.} \\ \frac{-8x}{-8} &= \frac{-8}{-8} && \text{Divide both sides by } -8. \\ x &= 1 && \text{Simplify.} \end{aligned}$$

3. Combine like terms on each side of the equation, if possible. Then isolate the term containing x on one side of the equation.

$$\begin{aligned} -4 &= 3x - 4x && \text{Original equation.} \\ -4 &= -x && \text{Combine like terms on the left side.} \\ \frac{-4}{-1} &= \frac{-x}{-1} && \text{Divide both sides by } -1. \\ 4 &= x && \text{Simplify.} \end{aligned}$$

5. First isolate the term containing x on one side of the equation.

$$\begin{aligned} 27x + 51 &= -84 && \text{Original equation.} \\ 27x + 51 - 51 &= -84 - 51 && \text{Subtract 51 from both sides.} \\ 27x &= -135 && \text{Simplify} \\ \frac{27x}{27} &= \frac{-135}{27} && \text{Divide both sides by 27.} \\ x &= -5 && \text{Simplify.} \end{aligned}$$

7. Combine like terms on each side of the equation, if possible. Then isolate the term containing x on one side of the equation.

$$\begin{aligned} 9 &= 5x + 9 - 6x && \text{Original equation.} \\ 9 &= -x + 9 && \text{Combine like terms on the left side.} \\ 9 - 9 &= -x + 9 - 9 && \text{Subtract 9 from both sides.} \\ 0 &= -x && \text{Simplify.} \\ \frac{0}{-1} &= \frac{-x}{-1} && \text{Divide both sides by } -1. \\ 0 &= x && \text{Simplify.} \end{aligned}$$

9. First isolate the term containing x on one side of the equation.

$$\begin{aligned} 0 &= -18x + 18 && \text{Original equation.} \\ -18 &= -18x + 18 - 18 && \text{Subtract 18 from both sides.} \\ -18 &= -18x && \text{Simplify.} \\ \frac{-18}{-18} &= \frac{-18x}{-18} && \text{Divide both sides by } -18. \\ 1 &= x && \text{Simplify.} \end{aligned}$$

11. First isolate the term containing x on one side of the equation.

$$
\begin{aligned}
41 &= 28x + 97 && \text{Original equation.}\\
41 - 97 &= 28x + 97 - 97 && \text{Subtract 97 from both sides.}\\
-56 &= 28x && \text{Simplify}\\
\frac{-56}{28} &= \frac{28x}{28} && \text{Divide both sides by 28.}\\
-2 &= x && \text{Simplify.}
\end{aligned}
$$

13. Combine like terms on each side of the equation, if possible. Then isolate the term containing x on one side of the equation.

$$
\begin{aligned}
8x - 8 - 9x &= -3 && \text{Original equation.}\\
-x - 8 &= -3 && \text{Combine like terms on the left side.}\\
-x - 8 + 8 &= -3 + 8 && \text{Add 8 to both sides.}\\
-x &= 5 && \text{Simplify.}\\
\frac{-x}{-1} &= \frac{5}{-1} && \text{Divide both sides by } -1.\\
x &= -5 && \text{Simplify.}
\end{aligned}
$$

15. First isolate the term containing x on one side of the equation.

$$
\begin{aligned}
-85x + 85 &= 0 && \text{Original equation.}\\
-85x + 85 - 85 &= -85 && \text{Subtract 85 from both sides.}\\
-85x &= -85 && \text{Simplify.}\\
\frac{-85x}{-85} &= \frac{-85}{-85} && \text{Divide both sides by } -85.\\
x &= 1 && \text{Simplify.}
\end{aligned}
$$

17. Isolate the terms containing x on one side of the equation.

$$
\begin{aligned}
-6x &= -5x - 9 && \text{Original equation.}\\
-6x + 5x &= -5x - 9 + 5x && \text{Add 5x to both sides.}\\
-x &= -9 && \text{Combine like terms.}\\
\frac{-x}{-1} &= \frac{-9}{-1} && \text{Divide both sides by } -1.\\
x &= 9 && \text{Simplify.}
\end{aligned}
$$

19. Isolate the terms containing x on one side of the equation.

$6x - 7 = 5x$	Original equation.
$6x - 7 - 6x = 5x - 6x$	Subtract 6x from both sides.
$-7 = -x$	Combine like terms.
$\dfrac{-7}{-1} = \dfrac{-x}{-1}$	Divide both sides by -1.
$7 = x$	Simplify.

21. Isolate the terms containing x on one side of the equation.

$4x - 3 = 5x - 1$	Original equation.
$4x - 3 - 5x = 5x - 1 - 5x$	Subtract 5x from both sides.
$-x - 3 = -1$	Combine like terms.
$-x - 3 + 3 = -1 + 3$	Add 3 to both sides.
$-x = 2$	Simplify.
$\dfrac{-x}{-1} = \dfrac{2}{-1}$	Divide both sides by -1.
$x = -2$	Simplify.

23. Isolate the terms containing x on one side of the equation.

$-3x + 5 = 3x - 1$	Original equation.
$-3x + 5 - 3x = 3x - 1 - 3x$	Subtract 3x from both sides.
$-6x + 5 = -1$	Combine like terms.
$-6x + 5 - 5 = -1 - 5$	Subtract 5 from both sides.
$-6x = -6$	Simplify.
$\dfrac{-6x}{-6} = \dfrac{-6}{-6}$	Divide both sides by -6.
$x = 1$	Simplify.

25. Isolate the terms containing x on one side of the equation.

$-5x = -3x + 6$	Original equation.
$-5x + 3x = -3x + 6 + 3x$	Add 3x to both sides.
$-2x = 6$	Combine like terms.
$\dfrac{-2x}{-2} = \dfrac{6}{-2}$	Divide both sides by -2.
$x = -3$	Simplify.

27. Isolate the terms containing x on one side of the equation.

$2x - 2 = 4x$	Original equation.
$2x - 2 - 2x = 4x - 2x$	Subtract 2x from both sides.
$-2 = 2x$	Combine like terms.
$\dfrac{-2}{2} = \dfrac{2x}{2}$	Divide both sides by 2.
$-1 = x$	Simplify.

29. Isolate the terms containing x on one side of the equation.

$-6x + 8 = -2x$	Original equation.
$-6x + 8 + 6x = -2x + 6x$	Add 6x to both sides.
$8 = 4x$	Combine like terms.
$\dfrac{8}{4} = \dfrac{4x}{4}$	Divide both sides by 4.
$2 = x$	Simplify.

31. Isolate the terms containing x on one side of the equation.

$6x = 4x - 4$	Original equation.
$6x - 4x = 4x - 4 - 4x$	Subtract 4x from both sides.
$2x = -4$	Combine like terms.
$\dfrac{2x}{2} = \dfrac{-4}{2}$	Divide both sides by 2.
$x = -2$	Simplify.

33. Isolate the terms containing x on one side of the equation.

$-8x + 2 = -6x + 6$	Original equation.
$-8x + 2 + 6x = -6x + 6 + 6x$	Add 6x to both sides.
$-2x + 2 = 6$	Combine like terms.
$-2x + 2 - 2 = 6 - 2$	Subtract 2 from both sides.
$-2x = 4$	Simplify.
$\dfrac{-2x}{-2} = \dfrac{4}{-2}$	Divide both sides by -2.
$x = -2$	Simplify.

35. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
1 - (x - 2) &= -3 && \text{Original equation.} \\
1 - x + 2 &= -3 && \text{Apply the distributive property.} \\
-x + 3 &= -3 && \text{Combine like terms on the left side.} \\
-x + 3 - 3 &= -3 - 3 && \text{Subtract 3 from both sides.} \\
-x &= -6 && \text{Simplify.} \\
\frac{-x}{-1} &= \frac{-6}{-1} && \text{Divide both sides by } -1. \\
x &= 6 && \text{Simpify.}
\end{aligned}$$

37. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
-7x + 6(x + 8) &= -2 && \text{Original equation.} \\
-7x + 6x + 48 &= -2 && \text{Apply the distributive property.} \\
-x + 48 &= -2 && \text{Combine like terms on the left side.} \\
-x + 48 - 48 &= -2 - 48 && \text{Subtract 48 from both sides.} \\
-x &= -50 && \text{Simplify.} \\
\frac{-x}{-1} &= \frac{-50}{-1} && \text{Divide both sides by } -1. \\
x &= 50 && \text{Simplify.}
\end{aligned}$$

39. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
8(-6x - 1) &= -8 && \text{Original equation.} \\
-48x - 8 &= -8 && \text{Apply the distributive property.} \\
-48x - 8 + 8 &= -8 + 8 && \text{Add 8 to both sides.} \\
-48x &= 0 && \text{Simplify.} \\
\frac{-48x}{-48} &= \frac{0}{-48} && \text{Divide both sides by } -48. \\
&= 0 && \text{Simplify.}
\end{aligned}$$

41. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
-7(-4x-6) &= -14 && \text{Original equation.}\\
28x+42 &= -14 && \text{Apply the distributive property.}\\
28x+42-42 &= -14-42 && \text{Subtract 42 from both sides.}\\
28x &= -56 && \text{Simplify.}\\
\frac{28x}{28} &= \frac{-56}{28} && \text{Divide both sides by 28.}\\
&= -2 && \text{Simplify.}
\end{aligned}$$

43. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
2-9(x-5) &= -16 && \text{Original equation.}\\
2-9x+45 &= -16 && \text{Apply the distributive property.}\\
-9x+47 &= -16 && \text{Combine like terms on the left side.}\\
-9x+47-47 &= -16-47 && \text{Subtract 47 from both sides.}\\
-9x &= -63 && \text{Simplify.}\\
\frac{-9x}{-9} &= \frac{-63}{-9} && \text{Divide both sides by } -9.\\
x &= 7 && \text{Simpify.}
\end{aligned}$$

45. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
7x+2(x+9) &= -9 && \text{Original equation.}\\
7x+2x+18 &= -9 && \text{Apply the distributive property.}\\
9x+18 &= -9 && \text{Combine like terms on the left side.}\\
9x+18-18 &= -9-18 && \text{Subtract 18 from both sides.}\\
9x &= -27 && \text{Simplify.}\\
\frac{9x}{9} &= \frac{-27}{9} && \text{Divide both sides by 9.}\\
x &= -3 && \text{Simplify.}
\end{aligned}$$

47. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
2(-x+8) &= 10 && \text{Original equation.}\\
-2x+16 &= 10 && \text{Apply the distributive property.}\\
-2x+16-16 &= 10-16 && \text{Subtract 16 from both sides.}\\
-2x &= -6 && \text{Simplify.}\\
\frac{-2x}{-2} &= \frac{-6}{-2} && \text{Divide both sides by } -2.\\
&= 3 && \text{Simplify.}
\end{aligned}$$

49. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
8+2(x-5) &= -4 && \text{Original equation.}\\
8+2x-10 &= -4 && \text{Apply the distributive property.}\\
2x-2 &= -4 && \text{Combine like terms on the left side.}\\
2x-2+2 &= -4+2 && \text{Add 2 to both sides.}\\
2x &= -2 && \text{Simplify.}\\
\frac{2x}{2} &= \frac{-2}{2} && \text{Divide both sides by 2.}\\
x &= -1 && \text{Simpify.}
\end{aligned}$$

51. First use the distributive property to expand the expression on the left side, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
9x-2(x+5) &= -10 && \text{Original equation.}\\
9x-2x-10 &= -10 && \text{Apply the distributive property.}\\
7x-10 &= -10 && \text{Combine like terms on the left side.}\\
7x-10+10 &= -10+10 && \text{Add 10 to both sides.}\\
7x &= 0 && \text{Simplify.}\\
\frac{7x}{7} &= \frac{0}{7} && \text{Divide both sides by 7.}\\
x &= 0 && \text{Simplify.}
\end{aligned}$$

53. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$4(-7x + 5) + 8 = 3(-9x - 1) - 2$	Original equation.
$-28x + 20 + 8 = -27x - 3 - 2$	Apply the distributive property on both sides.
$-28x + 28 = -27x - 5$	Simplify both sides.
$-28x + 28 + 27x = -27x - 5 + 27x$	Add 27x to both sides.
$-x + 28 = -5$	Combine like terms.
$-x + 28 - 28 = -5 - 28$	Subtract 28 from both sides.
$-x = -33$	Simplify.
$\dfrac{-x}{-1} = \dfrac{-33}{-1}$	Divide both sides by -1.
$x = 33$	Simplify.

55. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$-8(-2x - 6) = 7(5x - 1) - 2$	Original equation.
$16x + 48 = 35x - 7 - 2$	Apply the distributive property on both sides.
$16x + 48 = 35x - 9$	Simplify the right side.
$16x + 48 - 16x = 35x - 9 - 16x$	Subtract 16x from both sides.
$48 = 19x - 9$	Combine like terms.
$48 + 9 = 19x - 9 + 9$	Add 9 to both sides.
$57 = 19x$	Simplify.
$\dfrac{57}{19} = \dfrac{19x}{19}$	Divide both sides by 19.
$3 = x$	Simplify.

57. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$2(2x-9)+5=-7(-x-8)$	Original equation.
$4x-18+5=7x+56$	Apply the distributive property on both sides.
$4x-13=7x+56$	Simplify the left side.
$4x-13-7x=7x+56-7x$	Subtract 7x from both sides.
$-3x-13=56$	Combine like terms.
$-3x-13+13=56+13$	Add 13 to both sides.
$-3x=69$	Simplify.
$\dfrac{-3x}{-3}=\dfrac{69}{-3}$	Divide both sides by -3.
$x=-23$	Simplify.

59. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$6(-3x+4)-6=-8(2x+2)-8$	Original equation.
$-18x+24-6=-16x-16-8$	Apply the distributive property on both sides.
$-18x+18=-16x-24$	Simplify both sides.
$-18x+18+16x=-16x-24+16x$	Add 16x to both sides.
$-2x+18=-24$	Combine like terms.
$-2x+18-18=-24-18$	Subtract 18 from both sides.
$-2x=-42$	Simplify.
$\dfrac{-2x}{-2}=\dfrac{-42}{-2}$	Divide both sides by -2.
$x=21$	Simplify.

61. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$2(-2x-3)=3(-x+2)$	Original equation.
$-4x-6=-3x+6$	Apply the distributive property on both sides.
$-4x-6+3x=-3x+6+3x$	Add 3x to both sides.
$-x-6=6$	Combine like terms.
$-x-6+6=6+6$	Add 6 to both sides.
$-x=12$	Simplify.
$\dfrac{-x}{-1}=\dfrac{12}{-1}$	Divide both sides by -1.
$x=-12$	Simplify.

63. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$-5(-9x+7)+7=-(-9x-8)$	Original equation.
$45x-35+7=9x+8$	Apply the distributive property on both sides.
$45x-28=9x+8$	Simplify the left side.
$45x-28-9x=9x+8-9x$	Subtract 9x from both sides.
$36x-28=8$	Combine like terms.
$36x-28+28=8+28$	Add 28 to both sides.
$36x=36$	Simplify.
$\dfrac{36x}{36}=\dfrac{36}{36}$	Divide both sides by 36.
$x=1$	Simplify.

65. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$5(5x-2)=4(8x+1)$	Original equation.
$25x-10=32x+4$	Apply the distributive property on both sides.
$25x-10-32x=32x+4-32x$	Subtract 32x from both sides.
$-7x-10=4$	Combine like terms.
$-7x-10+10=4+10$	Add 10 to both sides.
$-7x=14$	Simplify.
$\dfrac{-7x}{-7}=\dfrac{14}{-7}$	Divide both sides by -7.
$x=-2$	Simplify.

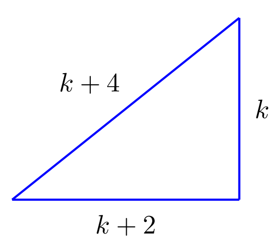
67. First use the distributive property to expand the expressions on both sides, then combine like terms. Next, isolate the terms containing x on one side of the equation.

$$\begin{aligned}
-7(9x-6) &= 7(5x+7)-7 && \text{Original equation.}\\
-63x+42 &= 35x+49-7 && \text{Apply the distributive property on both sides.}\\
-63x+42 &= 35x+42 && \text{Simplify the right side.}\\
-63x+42+63x &= 35x+42+63x && \text{Add 63x to both sides.}\\
42 &= 98x+42 && \text{Combine like terms.}\\
42-42 &= 98x+42-42 && \text{Subtract 42 from both sides.}\\
0 &= 98x && \text{Simplify.}\\
\frac{0}{98} &= \frac{98x}{98} && \text{Divide both sides by 98.}\\
0 &= x && \text{Simplify.}
\end{aligned}$$

3.6 Applications

1. We follow the *Requirements for Word Problem Solutions*.

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent an odd integer, the length of the smallest side of the triangle. Then the next two sides of the triangle are the next two consecutive odd intergers, namely $k+2$ and $k+4$.



In our schematic diagram, we've labeled the three sides of the triangle with expressions representing three consecutive odd integers k, $k+2$, and $k+4$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.

$$P = k + (k+2) + (k+4)$$

However, we're given the fact that the perimeter is 39 inches. Thus,

$$39 = k + (k+2) + (k+4)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$39 = 3k + 6$$

Now, solve.

$$\begin{aligned} 39 - 6 &= 3k + 6 - 6 && \text{Subtract 6 from both sides.} \\ 33 &= 3k && \text{Simplify both sides.} \\ \frac{33}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 11 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 11 for k into the expressions $k+2$ and $k+4$.

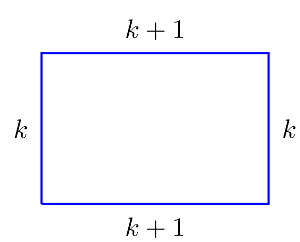
$$\begin{aligned} k + 2 &= 11 + 2 \\ &= 13 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k + 4 &= 11 + 4 \\ &= 15 \end{aligned}$$

Hence, the three sides measure 11 inches, 13 inches, and 15 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive odd integers, and their sum is 11 inches+13 inches+15 inches = 39 inches, which was the given perimeter. Therefore, our solution is correct.

3. We follow the *Requirements for Word Problem Solutions*.

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



In our schematic diagram, if the width k is an integer, then the length $k+1$ is the next consecutive integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k + 1) + k + (k + 1)$$

However, we're given the fact that the perimeter is 142 centimeters. Thus,

$$142 = k + (k + 1) + k + (k + 1)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$142 = 4k + 2$$

Now, solve.

$$\begin{aligned}
142 - 2 &= 4k + 2 - 2 && \text{Subtract 2 from both sides.} \\
140 &= 4k && \text{Simplify both sides.} \\
\frac{140}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\
35 &= k && \text{Simplify both sides.}
\end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 35 for k into the expression $k + 1$.

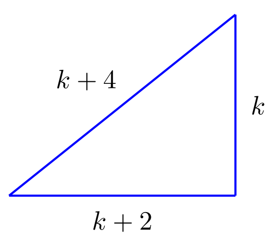
$$\begin{aligned}
k + 1 &= 35 + 1 \\
&= 36
\end{aligned}$$

Hence, the width is 35 centimeters and the length is 36 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 35 cm and the length is 36 cm, certainly consecutive integers. Further, the perimeter would be $35\,\text{cm} + 36\,\text{cm} + 35\,\text{cm} + 36\,\text{cm} = 142\,\text{cm}$, so our solution is correct.

5. We follow the *Requirements for Word Problem Solutions*.

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent an even integer, the length of the smallest side of the triangle. Then the next two sides of the triangle are the next two consecutive even intergers, namely $k + 2$ and $k + 4$.



In our schematic diagram, we've labeled the three sides of the triangle with expressions representing three consecutive even integers k, $k + 2$, and $k + 4$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.

$$P = k + (k + 2) + (k + 4)$$

However, we're given the fact that the perimeter is 240 inches. Thus,

$$240 = k + (k + 2) + (k + 4)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$240 = 3k + 6$$

Now, solve.

$$\begin{aligned} 240 - 6 &= 3k + 6 - 6 && \text{Subtract 6 from both sides.} \\ 234 &= 3k && \text{Simplify both sides.} \\ \frac{234}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 78 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 78 for k into the expressions $k + 2$ and $k + 4$.

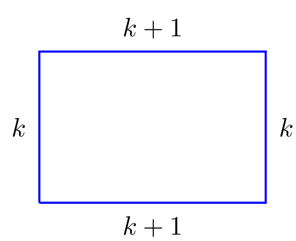
$$\begin{aligned} k + 2 &= 78 + 2 \\ &= 80 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k + 4 &= 78 + 4 \\ &= 82 \end{aligned}$$

Hence, the three sides measure 78 inches, 80 inches, and 82 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive even integers, and their sum is 78 inches+80 inches+82 inches = 240 inches, which was the given perimeter. Therefore, our solution is correct.

7. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



In our schematic diagram, if the width k is an integer, then the length $k+1$ is the next consecutive integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k+1) + k + (k+1)$$

However, we're given the fact that the perimeter is 374 centimeters. Thus,

$$374 = k + (k+1) + k + (k+1)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$374 = 4k + 2$$

Now, solve.

$$\begin{aligned} 374 - 2 &= 4k + 2 - 2 && \text{Subtract 2 from both sides.} \\ 372 &= 4k && \text{Simplify both sides.} \\ \frac{372}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\ 93 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 93 for k into the expression $k+1$.

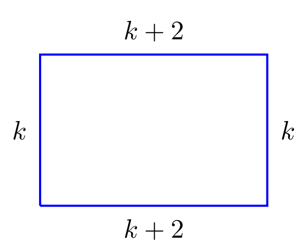
$$\begin{aligned} k + 1 &= 93 + 1 \\ &= 94 \end{aligned}$$

Hence, the width is 93 centimeters and the length is 94 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 93 cm and the length is 94 cm, certainly consecutive integers. Further, the perimeter would be $93\,\text{cm} + 94\,\text{cm} + 93\,\text{cm} + 94\,\text{cm} = 374\,\text{cm}$, so our solution is correct.

9. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



In our schematic diagram, if the width k is an odd integer, then the length $k+2$ is the next consecutive odd integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k+2) + k + (k+2)$$

However, we're given the fact that the perimeter is 208 centimeters. Thus,

$$208 = k + (k+2) + k + (k+2)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$208 = 4k + 4$$

Now, solve.

$$\begin{aligned} 208 - 4 &= 4k + 4 - 4 && \text{Subtract 4 from both sides.} \\ 204 &= 4k && \text{Simplify both sides.} \\ \frac{204}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\ 51 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 51 for k into the expression $k+2$.

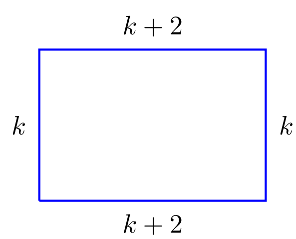
$$\begin{aligned} k + 2 &= 51 + 2 \\ &= 53 \end{aligned}$$

Hence, the width is 51 centimeters and the length is 53 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 51 cm and the length is 53 cm, certainly consecutive odd integers. Further, the perimeter would be $51\,\text{cm} + 53\,\text{cm} + 51\,\text{cm} + 53\,\text{cm} = 208\,\text{cm}$, so our solution is correct.

11. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



In our schematic diagram, if the width k is an even integer, then the length $k+2$ is the next consecutive even integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k+2) + k + (k+2)$$

However, we're given the fact that the perimeter is 76 centimeters. Thus,

$$76 = k + (k+2) + k + (k+2)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$76 = 4k + 4$$

Now, solve.

$$\begin{aligned} 76 - 4 &= 4k + 4 - 4 && \text{Subtract 4 from both sides.} \\ 72 &= 4k && \text{Simplify both sides.} \\ \frac{72}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\ 18 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 18 for k into the expression $k+2$.

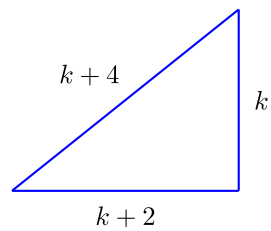
$$\begin{aligned} k + 2 &= 18 + 2 \\ &= 20 \end{aligned}$$

Hence, the width is 18 centimeters and the length is 20 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 18 cm and the length is 20 cm, certainly consecutive even integers. Further, the perimeter would be $18\,\text{cm} + 20\,\text{cm} + 18\,\text{cm} + 20\,\text{cm} = 76\,\text{cm}$, so our solution is correct.

13. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent an even integer, the length of the smallest side of the triangle. Then the next two sides of the triangle are the next two consecutive even intergers, namely $k+2$ and $k+4$.



In our schematic diagram, we've labeled the three sides of the triangle with expressions representing three consecutive even integers k, $k+2$, and $k+4$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.
$$P = k + (k+2) + (k+4)$$
However, we're given the fact that the perimeter is 144 inches. Thus,
$$144 = k + (k+2) + (k+4)$$

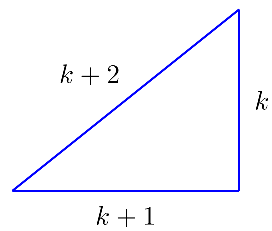
3. *Solve the Equation.* On the right, regroup and combine like terms.
$$144 = 3k + 6$$
Now, solve.
$$\begin{aligned} 144 - 6 &= 3k + 6 - 6 && \text{Subtract 6 from both sides.} \\ 138 &= 3k && \text{Simplify both sides.} \\ \frac{138}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 46 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 46 for k into the expressions $k+2$ and $k+4$.
$$\begin{aligned} k + 2 &= 46 + 2 \\ &= 48 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k + 4 &= 46 + 4 \\ &= 50 \end{aligned}$$
Hence, the three sides measure 46 inches, 48 inches, and 50 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive even integers, and their sum is $46\,\text{inches} + 48\,\text{inches} + 50\,\text{inches} = 144\,\text{inches}$, which was the given perimeter. Therefore, our solution is correct.

15. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent one side, then the next two sides are the next two consecutive intergers, namely $k+1$ and $k+2$.



   In our schematic diagram, we've labeled the three sides of the triangle with expressions representing the consecutive integers k, $k+1$, and $k+2$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.
$$P = k + (k+1) + (k+2)$$
   However, we're given the fact that the perimeter is 228 inches. Thus,
$$228 = k + (k+1) + (k+2)$$

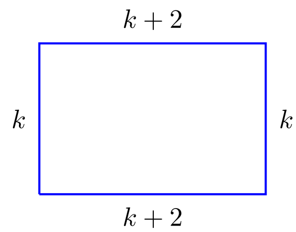
3. *Solve the Equation.* On the right, regroup and combine like terms.
$$228 = 3k + 3$$
   Now, solve.
$$\begin{aligned} 228 - 3 &= 3k + 3 - 3 && \text{Subtract 3 from both sides.} \\ 225 &= 3k && \text{Simplify both sides.} \\ \frac{225}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 75 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 75 for k into the expressions $k+1$ and $k+2$.
$$\begin{aligned} k+1 &= 75+1 \\ &= 76 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k+2 &= 75+2 \\ &= 77 \end{aligned}$$
   Hence, the three sides measure 75 inches, 76 inches, and 77 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive integers, and their sum is 75 inches + 76 inches + 77 inches = 228 inches, which was the given perimeter. Therefore, our solution is correct.

17. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



   In our schematic diagram, if the width k is an even integer, then the length $k+2$ is the next consecutive even integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k+2) + k + (k+2)$$

   However, we're given the fact that the perimeter is 92 centimeters. Thus,

$$92 = k + (k+2) + k + (k+2)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$92 = 4k + 4$$

   Now, solve.

$$\begin{aligned} 92 - 4 &= 4k + 4 - 4 && \text{Subtract 4 from both sides.} \\ 88 &= 4k && \text{Simplify both sides.} \\ \frac{88}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\ 22 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 22 for k into the expression $k+2$.

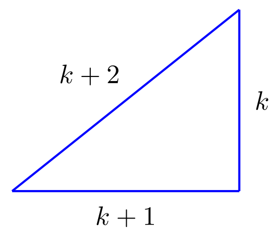
$$\begin{aligned} k + 2 &= 22 + 2 \\ &= 24 \end{aligned}$$

   Hence, the width is 22 centimeters and the length is 24 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 22 cm and the length is 24 cm, certainly consecutive even integers. Further, the perimeter would be $22\,\text{cm} + 24\,\text{cm} + 22\,\text{cm} + 24\,\text{cm} = 92\,\text{cm}$, so our solution is correct.

19. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent one side, then the next two sides are the next two consecutive intergers, namely $k+1$ and $k+2$.



In our schematic diagram, we've labeled the three sides of the triangle with expressions representing the consecutive integers k, $k+1$, and $k+2$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.

$$P = k + (k+1) + (k+2)$$

However, we're given the fact that the perimeter is 105 inches. Thus,

$$105 = k + (k+1) + (k+2)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$105 = 3k + 3$$

Now, solve.

$$\begin{aligned} 105 - 3 &= 3k + 3 - 3 && \text{Subtract 3 from both sides.} \\ 102 &= 3k && \text{Simplify both sides.} \\ \frac{102}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 34 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 34 for k into the expressions $k+1$ and $k+2$.

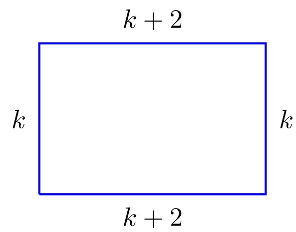
$$\begin{aligned} k+1 &= 34+1 \\ &= 35 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k+2 &= 34+2 \\ &= 36 \end{aligned}$$

Hence, the three sides measure 34 inches, 35 inches, and 36 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive integers, and their sum is $34\,\text{inches} + 35\,\text{inches} + 36\,\text{inches} = 105\,\text{inches}$, which was the given perimeter. Therefore, our solution is correct.

21. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents.



   In our schematic diagram, if the width k is an odd integer, then the length $k+2$ is the next consecutive odd integer.

2. *Set up an Equation.* To find the perimeter of the rectangle, sum the four sides.

$$P = k + (k+2) + k + (k+2)$$

   However, we're given the fact that the perimeter is 288 centimeters. Thus,

$$288 = k + (k+2) + k + (k+2)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$288 = 4k + 4$$

   Now, solve.

$$\begin{aligned} 288 - 4 &= 4k + 4 - 4 && \text{Subtract 4 from both sides.} \\ 284 &= 4k && \text{Simplify both sides.} \\ \frac{284}{4} &= \frac{4k}{4} && \text{Divide both sides by 4.} \\ 71 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found the width, but the question asks for the measure of both the width and the length. However, the length can be found by substituting 71 for k into the expression $k+2$.

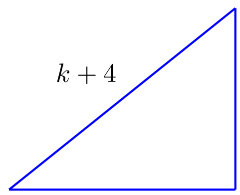
$$\begin{aligned} k + 2 &= 71 + 2 \\ &= 73 \end{aligned}$$

   Hence, the width is 71 centimeters and the length is 73 centimeters.

5. *Look Back.* Does our solution make sense? Well, the width is 71 cm and the length is 73 cm, certainly consecutive odd integers. Further, the perimeter would be $71\,\text{cm} + 73\,\text{cm} + 71\,\text{cm} + 73\,\text{cm} = 288\,\text{cm}$, so our solution is correct.

23. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* In this case, a carefully labeled diagram is the best way to indicate what the unknown variable represents. We let k represent an odd integer, the length of the smallest side of the triangle. Then the next two sides of the triangle are the next two consecutive odd intergers, namely $k+2$ and $k+4$.



In our schematic diagram, we've labeled the three sides of the triangle with expressions representing three consecutive odd integers k, $k+2$, and $k+4$.

2. *Set up an Equation.* To find the perimeter P of the triangle, sum the three sides.

$$P = k + (k+2) + (k+4)$$

However, we're given the fact that the perimeter is 165 inches. Thus,

$$165 = k + (k+2) + (k+4)$$

3. *Solve the Equation.* On the right, regroup and combine like terms.

$$165 = 3k + 6$$

Now, solve.

$$\begin{aligned} 165 - 6 &= 3k + 6 - 6 && \text{Subtract 6 from both sides.} \\ 159 &= 3k && \text{Simplify both sides.} \\ \frac{159}{3} &= \frac{3k}{3} && \text{Divide both sides by 3.} \\ 53 &= k && \text{Simplify both sides.} \end{aligned}$$

4. *Answer the Question.* We've only found one side, but the question asks for the measure of all three sides. However, the remaining two sides can be found by substituting 53 for k into the expressions $k+2$ and $k+4$.

$$\begin{aligned} k + 2 &= 53 + 2 \\ &= 55 \end{aligned} \qquad \text{and} \qquad \begin{aligned} k + 4 &= 53 + 4 \\ &= 57 \end{aligned}$$

Hence, the three sides measure 53 inches, 55 inches, and 57 inches.

5. *Look Back.* Does our solution make sense? Well, the three sides are certainly consecutive odd integers, and their sum is 53 inches + 55 inches + 57 inches = 165 inches, which was the given perimeter. Therefore, our solution is correct.

25. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let A represent the number of adult tickets purchased. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting A represent the number of adult tickets is better than letting x represent the number of adult tickets.*

	Number of Tickets	Cost (dollars)
Adults ($19 apiece)	A	$19A$
Children ($7 apiece)	$8A$	$7(8A)$
Totals	—	975

Because there are 8 times as many children's tickets purchased than adult tickets, the number of children's tickets purchased is $8A$, recorded in the second column. In the third column, $8A$ children's tickets at $7 apiece will cost $7(8A)$ dollars, and A adult tickets at $19 apiece will cost $19A$ dollars. The final entry in the column gives the total cost of all tickets as $975.

2. *Set up an Equation.* The third column of the table reveals that the sum of the costs for both children and adult tickets is $975. Hence, the equation that models this application is

$$19A + 7(8A) = 975$$

which sums the cost of children and adult tickets at $975.

3. *Solve the Equation.* On the left, use the associative property to remove parentheses.

$$19A + 56A = 975$$

Combine like terms.

$$75A = 975$$

Now, solve.

$$\frac{75A}{75} = \frac{975}{75} \qquad \text{Divide both sides by 75.}$$

$$A = 13 \qquad \text{Simplify.}$$

4. *Answer the Question.* The number of adult tickets is 13.

5. *Look Back.* Does our solution make sense? The number of children's tickets purchased is 8 times more than the 13 adult tickets purchased, or 104 children's tickets. Also, the monetary value of 104 children's tickets at \$7 apiece is \$728, and the monetary value of 13 adult tickets at \$19 apiece is \$247, a total cost of \$975. Our solution is correct.

27. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let N represent the number of nickels from the piggy bank. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting N represent the number of nickels is better than letting x represent the number of nickels.*

Coins	Number of Coins	Value (cents)
Nickels (5 cents apiece)	N	$5N$
Dimes (10 cents apiece)	$N + 15$	$10(N + 15)$
Totals	—	330

   Because there are 15 more dimes than nickels, the number of dimes is $N + 15$, recorded in the second column. In the third column, N nickels, worth 5 cents apiece, have a value of $5N$ cents. Next, $N + 15$ dimes, worth 10 cents apiece, have a value of $10(N + 15)$ cents. The final entry in the column gives the total value of the coins as 330 cents.

2. *Set up an Equation.* The third column of the table reveals that the sum of the coin values is 330 cents. Hence, the equation that models this application is

   $$5N + 10(N + 15) = 330,$$

   which sums the value of the nickels and the value of the dimes to a total of 330 cents.

3. *Solve the Equation.* On the left, use the distributive property to remove parentheses.

   $$5N + 10N + 150 = 330$$

   Combine like terms.

   $$15N + 150 = 330$$

Now, solve.

$$\begin{aligned}
15N + 150 - 150 &= 330 - 150 && \text{Subtract 150 from both sides.}\\
15N &= 180 && \text{Simplify.}\\
\frac{15N}{15} &= \frac{180}{15} && \text{Divide both sides by 15.}\\
N &= 12 && \text{Simplify.}
\end{aligned}$$

4. *Answer the Question.* There are 12 nickels.

5. *Look Back.* Does our solution make sense? Well, the number of dimes is 15 more than 12 nickels, which is 27 dimes. Also, the monetary value of 12 nickels is 60 cents and the monetary value of 27 dimes is 270 cents, a total of 330 cents, or \$3.30, so our solution is correct.

29. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let N represent the number of nickels from the piggy bank. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting N represent the number of nickels is better than letting x represent the number of nickels.*

Coins	Number of Coins	Value (cents)
Nickels (5 cents apiece)	N	$5N$
Dimes (10 cents apiece)	$N+7$	$10(N+7)$
Totals	—	400

Because there are 7 more dimes than nickels, the number of dimes is $N + 7$, recorded in the second column. In the third column, N nickels, worth 5 cents apiece, have a value of $5N$ cents. Next, $N+7$ dimes, worth 10 cents apiece, have a value of $10(N + 7)$ cents. The final entry in the column gives the total value of the coins as 400 cents.

2. *Set up an Equation.* The third column of the table reveals that the sum of the coin values is 400 cents. Hence, the equation that models this application is

$$5N + 10(N + 7) = 400,$$

which sums the value of the nickels and the value of the dimes to a total of 400 cents.

3. *Solve the Equation.* On the left, use the distributive property to remove parentheses.

$$5N + 10N + 70 = 400$$

Combine like terms.

$$15N + 70 = 400$$

Now, solve.

$$\begin{aligned} 15N + 70 - 70 &= 400 - 70 && \text{Subtract 70 from both sides.} \\ 15N &= 330 && \text{Simplify.} \\ \frac{15N}{15} &= \frac{330}{15} && \text{Divide both sides by 15.} \\ N &= 22 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* There are 22 nickels.

5. *Look Back.* Does our solution make sense? Well, the number of dimes is 7 more than 22 nickels, which is 29 dimes. Also, the monetary value of 22 nickels is 110 cents and the monetary value of 29 dimes is 290 cents, a total of 400 cents, or $4.00, so our solution is correct.

31. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let S represent the amount Jason invests in the savings account. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting S represent the amount invested in savings is better than letting x represent the amount invested in savings.*

Account Type	Amount Deposited
Savings Account (2.5%)	S
Certificate of Deposit (5%)	$S + 7300$
Totals	20300

Because S represents the investment in savings, and we're told that the investment in the certificate of deposit (CD) is $7300 more than the investment in savings, the investment in the CD is therefore $S + 7300$, as indicated in the table.

2. *Set up an Equation.* The second column of the table reveals that the sum of the individual investments in the CD and savings totals $TotalInvestmentF. Hence, the equation that models this application is

$$(S + 7300) + S = 20300.$$

3. *Solve the Equation.* On the left, regroup and combine like terms.

$$2S + 7300 = 20300$$

Now, solve.

$$\begin{aligned}
2S + 7300 - 7300 &= 20300 - 7300 && \text{Subtract 7300 from both sides.}\\
2S &= 13000 && \text{Simplify.}\\
\frac{2S}{2} &= \frac{13000}{2} && \text{Divide both sides by 2.}\\
S &= 6500 && \text{Simplify.}
\end{aligned}$$

4. *Answer the Question.* The amount invested in the savings account is $\$6,500$.

5. *Look Back.* Does our solution make sense? Well, the amount invested in the CD is $7,300 more than the $\$6,500$ invested in the savings account, or $\$13,800$. Secondly, the two investments total $\$6,500 + \$13,800 = \$20,300$, so our solution is correct.

33. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let N represent the number of nickels from the piggy bank. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting N represent the number of nickels is better than letting x represent the number of nickels.*

Coins	Number of Coins	Value (cents)
Nickels (5 cents apiece)	N	$5N$
Dimes (10 cents apiece)	$N + 15$	$10(N + 15)$
Totals	—	450

Because there are 15 more dimes than nickels, the number of dimes is $N + 15$, recorded in the second column. In the third column, N nickels, worth 5 cents apiece, have a value of $5N$ cents. Next, $N + 15$ dimes, worth 10 cents apiece, have a value of $10(N + 15)$ cents. The final entry in the column gives the total value of the coins as 450 cents.

2. *Set up an Equation.* The third column of the table reveals that the sum of the coin values is 450 cents. Hence, the equation that models this application is

$$5N + 10(N + 15) = 450,$$

which sums the value of the nickels and the value of the dimes to a total of 450 cents.

3. *Solve the Equation.* On the left, use the distributive property to remove parentheses.

$$5N + 10N + 150 = 450$$

Combine like terms.

$$15N + 150 = 450$$

Now, solve.

$$\begin{aligned} 15N + 150 - 150 &= 450 - 150 && \text{Subtract 150 from both sides.} \\ 15N &= 300 && \text{Simplify.} \\ \frac{15N}{15} &= \frac{300}{15} && \text{Divide both sides by 15.} \\ N &= 20 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* There are 20 nickels.

5. *Look Back.* Does our solution make sense? Well, the number of dimes is 15 more than 20 nickels, which is 35 dimes. Also, the monetary value of 20 nickels is 100 cents and the monetary value of 35 dimes is 350 cents, a total of 450 cents, or \$4.50, so our solution is correct.

35. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let A represent the number of adult tickets purchased. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting A represent the number of adult tickets is better than letting x represent the number of adult tickets.*

	Number of Tickets	Cost (dollars)
Adults (\$10 apiece)	A	$10A$
Children (\$4 apiece)	$2A$	$4(2A)$
Totals	—	216

Because there are 2 times as many children's tickets purchased than adult tickets, the number of children's tickets purchased is $2A$, recorded in the second column. In the third column, $2A$ children's tickets at \$4 apiece will cost $4(2A)$ dollars, and A adult tickets at \$10 apiece will cost $10A$ dollars. The final entry in the column gives the total cost of all tickets as \$216.

2. *Set up an Equation.* The third column of the table reveals that the sum of the costs for both children and adult tickets is \$216. Hence, the equation that models this application is

$$10A + 4(2A) = 216$$

which sums the cost of children and adult tickets at \$216.

3. *Solve the Equation.* On the left, use the associative property to remove parentheses.

$$10A + 8A = 216$$

Combine like terms.

$$18A = 216$$

Now, solve.

$$\frac{18A}{18} = \frac{216}{18} \quad \text{Divide both sides by 18.}$$
$$A = 12 \quad \text{Simplify.}$$

4. *Answer the Question.* The number of adult tickets is 12.

5. *Look Back.* Does our solution make sense? The number of children's tickets purchased is 2 times more than the 12 adult tickets purchased, or 24 children's tickets. Also, the monetary value of 24 children's tickets at \$4 apiece is \$96, and the monetary value of 12 adult tickets at \$10 apiece is \$120, a total cost of \$216. Our solution is correct.

37. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let N represent the number of nickels from the piggy bank. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting N represent the number of nickels is better than letting x represent the number of nickels.*

Coins	Number of Coins	Value (cents)
Nickels (5 cents apiece)	N	$5N$
Dimes (10 cents apiece)	$N + 7$	$10(N + 7)$
Totals	—	370

Because there are 7 more dimes than nickels, the number of dimes is $N + 7$, recorded in the second column. In the third column, N nickels, worth 5 cents apiece, have a value of $5N$ cents. Next, $N + 7$ dimes, worth 10 cents apiece, have a value of $10(N + 7)$ cents. The final entry in the column gives the total value of the coins as 370 cents.

2. *Set up an Equation.* The third column of the table reveals that the sum of the coin values is 370 cents. Hence, the equation that models this application is
$$5N + 10(N + 7) = 370,$$
which sums the value of the nickels and the value of the dimes to a total of 370 cents.

3. *Solve the Equation.* On the left, use the distributive property to remove parentheses.
$$5N + 10N + 70 = 370$$
Combine like terms.
$$15N + 70 = 370$$
Now, solve.
$$\begin{aligned} 15N + 70 - 70 &= 370 - 70 && \text{Subtract 70 from both sides.} \\ 15N &= 300 && \text{Simplify.} \\ \frac{15N}{15} &= \frac{300}{15} && \text{Divide both sides by 15.} \\ N &= 20 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* There are 20 nickels.

5. *Look Back.* Does our solution make sense? Well, the number of dimes is 7 more than 20 nickels, which is 27 dimes. Also, the monetary value of 20 nickels is 100 cents and the monetary value of 27 dimes is 270 cents, a total of 370 cents, or \$3.70, so our solution is correct.

39. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let S represent the amount Mary invests in the savings account. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting S represent the amount invested in savings is better than letting x represent the amount invested in savings.*

Account Type	Amount Deposited
Savings Account (2%)	S
Certificate of Deposit (4%)	$S + 7300$
Totals	22300

Because S represents the investment in savings, and we're told that the investment in the certificate of deposit (CD) is \$7300 more than the investment in savings, the investment in the CD is therefore $S + 7300$, as indicated in the table.

2. *Set up an Equation.* The second column of the table reveals that the sum of the individual investments in the CD and savings totals \$TotalInvestmentF. Hence, the equation that models this application is

$$(S + 7300) + S = 22300.$$

3. *Solve the Equation.* On the left, regroup and combine like terms.

$$2S + 7300 = 22300$$

Now, solve.

$$\begin{aligned} 2S + 7300 - 7300 &= 22300 - 7300 && \text{Subtract 7300 from both sides.} \\ 2S &= 15000 && \text{Simplify.} \\ \frac{2S}{2} &= \frac{15000}{2} && \text{Divide both sides by 2.} \\ S &= 7500 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* The amount invested in the savings account is $\$7,500$.

5. *Look Back.* Does our solution make sense? Well, the amount invested in the CD is \$7,300 more than the $\$7,500$ invested in the savings account, or $\$14,800$. Secondly, the two investments total $\$7,500 + \$14,800 = \$22,300$, so our solution is correct.

41. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let A represent the number of adult tickets purchased. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting A represent the number of adult tickets is better than letting x represent the number of adult tickets.*

	Number of Tickets	Cost (dollars)
Adults (\$16 apiece)	A	$16A$
Children (\$6 apiece)	$8A$	$6(8A)$
Totals	—	1024

Because there are 8 times as many children's tickets purchased than adult tickets, the number of children's tickets purchased is $8A$, recorded in the second column. In the third column, $8A$ children's tickets at \$6 apiece will cost $6(8A)$ dollars, and A adult tickets at \$16 apiece will cost $16A$ dollars. The final entry in the column gives the total cost of all tickets as \$1024.

2. *Set up an Equation.* The third column of the table reveals that the sum of the costs for both children and adult tickets is \$1024. Hence, the equation that models this application is

$$16A + 6(8A) = 1024$$

which sums the cost of children and adult tickets at \$1024.

3. *Solve the Equation.* On the left, use the associative property to remove parentheses.

$$16A + 48A = 1024$$

Combine like terms.

$$64A = 1024$$

Now, solve.

$$\frac{64A}{64} = \frac{1024}{64} \qquad \text{Divide both sides by 64.}$$

$$A = 16 \qquad \text{Simplify.}$$

4. *Answer the Question.* The number of adult tickets is 16.

5. *Look Back.* Does our solution make sense? The number of children's tickets purchased is 8 times more than the 16 adult tickets purchased, or 128 children's tickets. Also, the monetary value of 128 children's tickets at \$6 apiece is \$768, and the monetary value of 16 adult tickets at \$16 apiece is \$256, a total cost of \$1,024. Our solution is correct.

43. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let S represent the amount Alan invests in the savings account. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting S represent the amount invested in savings is better than letting x represent the amount invested in savings.*

Account Type	Amount Deposited
Savings Account (3.5%)	S
Certificate of Deposit (6%)	$S + 6400$
Totals	25600

Because S represents the investment in savings, and we're told that the investment in the certificate of deposit (CD) is \$6400 more than the investment in savings, the investment in the CD is therefore $S + 6400$, as indicated in the table.

2. *Set up an Equation.* The second column of the table reveals that the sum of the individual investments in the CD and savings totals $TotalInvestmentF. Hence, the equation that models this application is

$$(S + 6400) + S = 25600.$$

3. *Solve the Equation.* On the left, regroup and combine like terms.

$$2S + 6400 = 25600$$

Now, solve.

$$\begin{aligned} 2S + 6400 - 6400 &= 25600 - 6400 && \text{Subtract 6400 from both sides.} \\ 2S &= 19200 && \text{Simplify.} \\ \frac{2S}{2} &= \frac{19200}{2} && \text{Divide both sides by 2.} \\ S &= 9600 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* The amount invested in the savings account is $\$9,600$.

5. *Look Back.* Does our solution make sense? Well, the amount invested in the CD is $6,400 more than the $\$9,600$ invested in the savings account, or $\$16,000$. Secondly, the two investments total $\$9,600 + \$16,000 = \$25,600$, so our solution is correct.

45. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let S represent the amount Tony invests in the savings account. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting S represent the amount invested in savings is better than letting x represent the amount invested in savings.*

Account Type	Amount Deposited
Savings Account (2%)	S
Certificate of Deposit (4%)	$S + 9200$
Totals	20600

Because S represents the investment in savings, and we're told that the investment in the certificate of deposit (CD) is $9200 more than the investment in savings, the investment in the CD is therefore $S + 9200$, as indicated in the table.

2. *Set up an Equation.* The second column of the table reveals that the sum of the individual investments in the CD and savings totals \$TotalInvestmentF. Hence, the equation that models this application is

$$(S + 9200) + S = 20600.$$

3. *Solve the Equation.* On the left, regroup and combine like terms.

$$2S + 9200 = 20600$$

Now, solve.

$$\begin{aligned} 2S + 9200 - 9200 &= 20600 - 9200 && \text{Subtract 9200 from both sides.} \\ 2S &= 11400 && \text{Simplify.} \\ \frac{2S}{2} &= \frac{11400}{2} && \text{Divide both sides by 2.} \\ S &= 5700 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* The amount invested in the savings account is $\$5,700$.

5. *Look Back.* Does our solution make sense? Well, the amount invested in the CD is \$9,200 more than the $\$5,700$ invested in the savings account, or $\$14,900$. Secondly, the two investments total $\$5,700 + \$14,900 = \$20,600$, so our solution is correct.

47. We follow the *Requirements for Word Problem Solutions.*

1. *Set up a Variable Dictionary.* We're going to use a table to summarize information and declare variables. In the table that follows, we let A represent the number of adult tickets purchased. *Using a variable letter that "sounds like" the quantity it represents is an excellent strategy. Thus, in this case, letting A represent the number of adult tickets is better than letting x represent the number of adult tickets.*

	Number of Tickets	Cost (dollars)
Adults (\$14 apiece)	A	$14A$
Children (\$2 apiece)	$2A$	$2(2A)$
Totals	—	234

Because there are 2 times as many children's tickets purchased than adult tickets, the number of children's tickets purchased is $2A$, recorded in the second column. In the third column, $2A$ children's tickets at \$2 apiece will cost $2(2A)$ dollars, and A adult tickets at \$14 apiece will cost $14A$ dollars. The final entry in the column gives the total cost of all tickets as \$234.

2. *Set up an Equation.* The third column of the table reveals that the sum of the costs for both children and adult tickets is \$234. Hence, the equation that models this application is

$$14A + 2(2A) = 234$$

which sums the cost of children and adult tickets at \$234.

3. *Solve the Equation.* On the left, use the associative property to remove parentheses.

$$14A + 4A = 234$$

Combine like terms.

$$18A = 234$$

Now, solve.

$$\begin{aligned} \frac{18A}{18} &= \frac{234}{18} && \text{Divide both sides by 18.} \\ A &= 13 && \text{Simplify.} \end{aligned}$$

4. *Answer the Question.* The number of adult tickets is 13.

5. *Look Back.* Does our solution make sense? The number of children's tickets purchased is 2 times more than the 13 adult tickets purchased, or 26 children's tickets. Also, the monetary value of 26 children's tickets at \$2 apiece is \$52, and the monetary value of 13 adult tickets at \$14 apiece is \$182, a total cost of \$234. Our solution is correct.