Prealgebra and Introductory Algebra 5th edition Martin Gay Solutions Manual

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Mini-Lecture 2.1

Introduction to Integers

Learning Objectives:

1. Represent real-life situations with integers.
2. Graph integers on a number line.
3. Compare integers.
4. Find the absolute value of a number.
5. Find the opposite of a number.
6. Read bar graphs containing integers.
7. Key Vocabulary: *positive numbers, negative numbers, signed numbers, integers, is less than, is greater than, opposite, absolute value.*

Examples:

1. Represent each quantity by an integer.

   a) A scuba diver is swimming 25 feet below sea level.
   b) The record high temperature for the town is 113°F.
   c) The number of televisions sold reflected a 35 percent loss from the previous year.

2. Graph each integer in the list on the same number line.

   a) 1, 3, 5, 6 b) 2, –2, 3, –3 c) 4, 0, –2, –5 d) 0, –1, –2, –5

3. Insert < or > between each pair of integers to make a true statement.

   a) 5 ____ 10 b) 0 ____ –3 c) –42 ____ – 38 d) –22 ____ 22

4. Simplify.

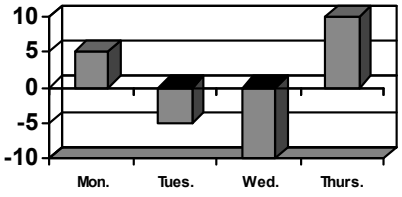
   a) $|2|$ b) $|-12|$ c) $|-3|$ d) $-|14|$

   e) $-|45|$ f) $-|-103|$ g) $|-x|$ if $x = -25$ h) $|x|$ if $x = -8$

5. Find the opposite of each integer.

   a) 9 b) –15 c) 0 d) –16

6. The bar graph shows the January temperatures for four days in Boston..

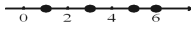
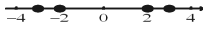
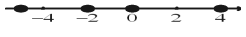


   a) Which day was the coldest?

   b) Which day was the warmest?

Teaching Notes:

- Many students will confuse absolute value and opposite.
- Encourage students to list everyday situation where negative numbers are used.

Answers: 1a) –25; b) +113; c) –35; 2a)  *b)*  *c)* 

d)  *; 3a) <; b) >; c) <; d) <; 4a) 2, b) 12; c) 3; d) –14; e) -45; f) –103;*

g) 25; h)8; 5a) -9; b) 15; c) 0; d) 16; 6a) Wed.; b) Thurs.

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Mini-Lecture 2.2

Adding Integers

Learning Objectives:

1. Add integers.
2. Evaluate an algebraic expression by adding.
3. Solve problems by adding integers.

Examples:

1. Add.

   a) $23+12$ b) $-23+(-17)$ c) $-11+(-2)$ d) $-21+(-13)$

   e) $6+(-8)$ f) $-3+5$ g) $-74+27$ h) $-51+(24)$

   i) $-8+(-13)$ j) $-79+97$ k) $46+(-54)$ l) $-4+(-24)$

   m) $23+(-19)+(-8)$ n) $14+25+(-16)$ o) $-25+(-4)+(-2)+(-6)$

2. Evaluate $x+y$ for the given replacement values.

   a) $x=-5$ and $y=14$ b) $x=-33$ and $y=-27$ c) $x=-43$ and $y=38$

3. Solve.

   a) Find the sum of -7 and 25. b) Find the sum of -52, 13, and -82

   c) During a storm in Anchorage Alaska, the temperature was 10°F at Noon. At 1 p.m., the temperature had dropped 7°. At 2 p.m., the temperature dropped another 5°; and finally, at 3 p.m., the temperature had dropped an additional 9°. Use positive and negative numbers to represent his situation. Then find the present temperature.

Teaching Notes:

- Some students need to see adding integers done on a number line first.
- Many students have a better understanding if they think of depositing and withdrawing money from a bank account.
- Refer students to the rules for adding signed numbers in the textbook.

Answers: 1a) 35; b) –40; c) –13; d) –34; e) –2; f) 2; g) –47; h) –27; i) –21; j)18; k) –8; l) –28; m) –4; n) 23; o) –37; 2a) 9; b) –60; c) –5; 3a) 18; b) –121; c) –11°.

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Mini-Lecture 2.3

Subtracting Integers

Learning Objectives:

1. Subtract integers.
2. Add and subtract integers.
3. Evaluate an algebraic expression by subtracting.
4. Solve problems by subtracting integers.
5. Key Vocabulary: *additive inverse.*

Examples:

1. Subtract.

   a) $-9-(-2)$ b) $-14-(-2)$ c) $4-(-3)$ d) $20-20$

   e) $2-5$ f) $-2-12$ g) $-150-410$ h) $-147-(-85)$

2. Simplify.

   a) $6+20-15$ b) $-1-11-12$ c) $-1-20+10$ d) $-16+11-18+(-4)$

3. Evaluate $x-y$ for the given replacement values.

   a) $x=-2$ and $y=-8$ b) $x=8$ and $y=-32$

   c) $x=-9$ and $y=-9$ d) $x=3$ and $y=-15$

4. Solve.

   a) Amy has $545 in her checking account. She writes a check for $257, makes a deposit of $75, and then writes another check for $409. Find the balance in her account. (Write the amount as an integer.

   b) The city of Manchester has an elevation of 13,005 feet above sea level while the city of Catherine has an elevation of 17,532 feet below sea level. Find the difference in elevation between those two cities.

   c) The temperature on a January morning in Worcester is $-5°F$ at 2 a.m. If the temperature drops 4° by 3 a.m., rise 6° by 4 a.m., and then drops 8° by 5 a.m., find the temperature by 8 a.m.

Teaching Notes:

- Many students find subtracting signed numbers difficult at first.
- Some students like to see subtracting signed numbers on a number line.
- Many students make errors when evaluating x – y when y is a negative number. Encourage students to make a direct substitution first so they do not forget to write the subtraction symbol.

Answers: 1a) –7; b) –12; c) 7; d) 0; e) –3; f) –14; g) –560; h) –62; 2a) 11; b) –24; c) –11; d) –27; 3a) 6; b) 40; c) 0; d) 18; 4a) –$46; b) 4527 ft.; c) –11°F.

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Mini-Lecture 2.4

Multiplying and Dividing Integers

Learning Objectives:

1. Multiply integers.
2. Divide integers.
3. Evaluate an algebraic expression by multiplying or dividing.
4. Solve problems by multiplying or dividing integers.

Examples:

1. Multiply.

   a) $7(-6)$ b) $-4(10)$ c) $-20(13)$ d) $-10(-19)$

   e) $(-4)(-3)(6)$ f) $(-50)(0)(-5)(8)$ g) $(-4)(-5)(-4)(-3)$ h) $(-2)(3)(-1)(-4)(2)$

   i) -4^2 j) $(-3)^3$ k) -3^3 l) $(-8)^2$

2. Find each quotient.

   a) $21 \div 7$ b) $36 \div (-6)$ c) $\dfrac{-48}{6}$ d) $\dfrac{-17}{0}$

3. Evaluate xy and also $\dfrac{x}{y}$ for the given replacement values.

   a) $x = 8$ *and* $y = -4$ b) $x = -30$ *and* $y = -10$ c) $x = 0$ *and* $y = -16$

4. Solve.

   a) Find the product of -13 and -5.

   b) Find the quotient of 63 and -9.

   c) Better Electric Co. marked $15 off the price of each microwave in stock. If there are 57 microwaves in stock, write the total reduction in price of all microwaves as an integer.

   d) During a cold front in Canada the temperature dropped 4°F each hour for 7 hours. Express the total drop in temperature as an integer.

Teaching Notes:

- Some students need a review of basic multiplication and division facts before they begin working with integers.
- Some students mix up the rules for addition of integers and the rules for multiplication/division of integers.
- Many students have a hard time understanding the difference between -3^2 *and* $(-3)^2$

Answers: 1a) –42; b) –40; c) –260; d) 190; e) 72; f) 0; g) 240; h) –48; i) –16; j) –27; k) –27; l) 64; 2a) 3; b) –6; c) –8; d) undefined; 3a) –2; b) 3; c) 0; 4a) 65; b) –7; c) –$855; d) –28°F.

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Mini-Lecture 2.5

Order of Operations

Learning Objectives:

1. Simplify expressions by using the order of operations.
2. Evaluate an algebraic expression.
3. Find the average of a list of numbers.

Examples:

1. Simplify.

a) $-2+5\cdot 6$ b) $-2-5(5-8)$ c) $2(-5)(7-3)-7$

d) $80\div(-8)-15$ e) $3^3-8(2)$ f) $8-2\left(7-2^2\right)+3$

g) $8^2-2(6)+45\div 5$ h) $3(-2)+(8-10)^2$ i) $21\div\left[7\cdot\left(-15\div(-5)\right)\right]$

j) $\dfrac{8(-2)-4+3}{-85\div 5}$ k) $\dfrac{[-36\div(-4)-1]}{[2-(-2)]}$ l) $\dfrac{20(-1)-(-5)(-2)}{3[-12\div(-3-3)]}$

2. Evaluate each expression for $x=-3$, $y=6$, *and* $z=-1$.

a) $x+y+z$ b) $2y-3z+x$ c) x^2-y+z

d) $\dfrac{8x}{2y}$ e) $5y-x^2$ f) x^3+yz

3. Find the average of each list of numbers.

a) –20, –9, –1, 0, 4, 6 , 6 b) –50, –30, –15, –5

Teaching Notes:

- Many students confuse the addition/subtraction rules with the multiplication/division rules when working with many operations in one expression.
- Encourage students to perform one operation at a time.
- Refer students to ***Order of Operations*** in the textbook.

Answers: 1a)2, b)13, c) –47, d) –25, e)11, f) 5, g) 61, h) –2, i) 1, j) 1, k) 2, l) –5; 2a) 2, b) 12, c) 2, d) –2, e) 21, f) –31; 3a) –2, b) –25

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Mini-Lecture 2.6

Solving Equations: The Addition and Multiplication Properties

Learning Objectives:

1. Identify solutions of equations.
2. Use the addition property of equality to solve equations.
3. Use the multiplication property of equality to solve equations.
4. Key Vocabulary: *equation, expression, multiplication, solution, addition and equivalent.*

Examples:

1. Decide whether the given number is a solution of the given equation.

   a) Is 12 a solution of $x + 3 = 15$

   b) Is 8 a solution of $z - 15 = 23$

   c) Is -2 a solution of $4k = k - 6$

   d) Is 5 a solution of $6(x - 2) = 3x + 1$

   e) Is $\frac{1}{2}$ a solution of $-3x = 5x + 1$

   f) Is -2 a solution of $-2x + 5 = 6x - 5x + 7$

2. Solve. Check each solution.

   a) $a + 7 = 25$

   b) $d - 4 = -19$

   c) $10z = 9z - 13$

   d) $-14 = 15 + x$

3. Solve. Check each solution.

   a) $3x = 18$

   b) $\frac{x}{-5} = 5$

   c) $-5y = 0$

   d) $-20x = -20$

Teaching Notes:

- Encourage students to write down all steps in a neat, organized manner. This habit will help students as equations increase in difficulty.
- Encourage students to use the addition property in such a way that the variable ends up with a positive coefficient.
- Mention to students that it does not matter on which side of the equation you isolate the variable.
- Remind students to always check their final answer by substituting it back into the original equation.

Answers: *1a) yes, b) no, c) yes, d) no, e) no, f) no; 2a) 18, b) –15, c) –13, d) –29; 3a) 6, b) –25, c) 0, d) 1*

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Names: **Date:**

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Group Activity A Chapter 2

I.

1. Use order of operations to evaluate: $4 \cdot 6 + 2 - 5$ **1.** _____

2. Insert one or two sets of parentheses to make the statement true. $4 \cdot 6 + 2 - 5 = 27$ **2.** _____

3. Insert one or two sets of parentheses to make the statement true. $4 \cdot 6 + 2 - 5 = 12$ **3.** _____

II.

4. Use order of operations to evaluate: $4 - 8 \cdot 2 + 5$ **4.** _____

5. Insert one or two sets of parentheses to make the statement true. $4 - 8 \cdot 2 + 5 = -3$ **5.** _____

6. Insert one or two sets of parentheses to make the statement true. $4 - 8 \cdot 2 + 5 = -17$ **6.** _____

III.

7. Use order of operations to evaluate: $2 + 5 - 3 \cdot 2$ **7.** _____

8. Insert one or two sets of parentheses to make the statement true. $2 + 5 - 3 \cdot 2 = 6$ **8.** _____

9. Insert one or two sets of parentheses to make the statement true. $2 + 5 - 3 \cdot 2 = 8$ **9.** _____

IV. Write your own expression using four numbers and any operation ($+, -, \times, \div$) and no parentheses. Evaluate the expression. Then insert parentheses to get two different answers.

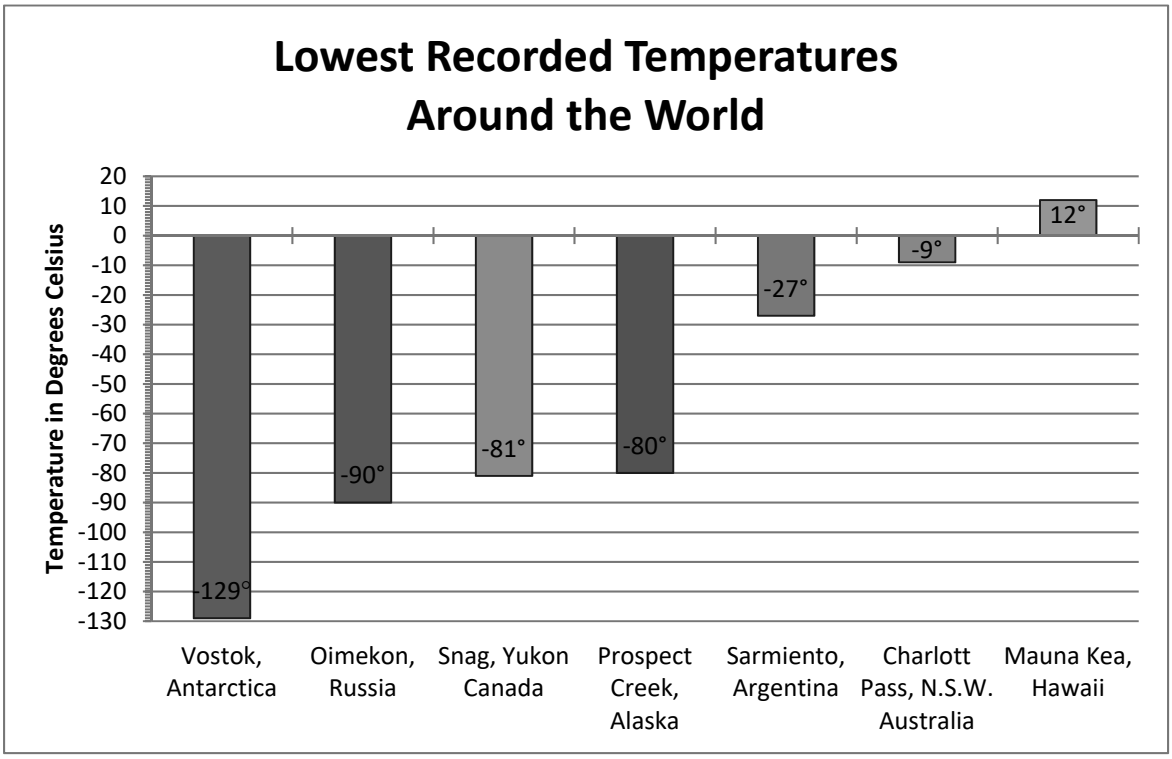
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Instructor: **Section:**

Group Activity B Chapter 2



1. What was the lowest temperature recorded for theses seven locations? **1.** _____

2. What was the lowest temperature recorded for the United States? **2.** _____

3. What is the difference between the lowest temperature of Antarctica and the lowest temperature for Hawaii? **3.** _____

4. What is the difference between the lowest temperature of Antarctica and the lowest temperature for Russia? **4.** _____

5. What is the difference between the lowest temperature of Canada and the lowest temperature for Australia? **5.** _____

6. What is the difference between the lowest temperature of Alaska and the lowest temperature for Hawaii? **6.** _____

7. What is the difference between the lowest temperature of Russia and the lowest temperature for Canada? **7.** _____

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Chapter 2 Pretest Form A

1. A Coal miner works 1400 feet underground. Represent as an integer. **1.** _____

2. The high school football team gained 7 yards on a play. Represent this quantity as an integer. **2.** _____

3. Insert $<$ or $>$ to make the statement true. **3.** _____
$|-7| \quad -|5|$

4. Insert $<$ or $>$ to make the statement true. **4.** _____
$|4| \quad |-6|$

5. Simplify: $|-5|$ **5.** _____

6. Add: $-9 + (-3)$ **6.** _____

7. Add: $(-5) + 6 + (-12) + 3$ **7.** _____

8. Evaluate: $x + y$ if $x = 2$ and $y = -3$ **8.** _____

9. Subtract: $9 - (-4)$ **9.** _____

10. Subtract: $-5 - (-3) - 8$ **10.** _____

11. Subtract -7 from -2. **11.** _____

12. Multiply: $(-5)(-3)$ **12.** _____

13. Multiply: $-2(6)0$ **13.** _____

14. Simplify: $(-3)^3$ **14.** _____

15. Multiply: $-2(6)(-3)$ **15.** _____

16. Divide: $35 \div (-7)$ **16.** _____

17. Evaluate: xy if $x = -4$ and $y = -3$ **17.** _____

18. A football team lost 3 yards on each of three plays. What is the total number of yards lost? **18.** _____

19. Simplify: $2(-3) + (-2)^2$ **19.** _____

20. Simplify: $|3 - 12| \cdot (4) \div 4$ **20.** _____

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Chapter 2 Pretest Form B

1. The Colts (high school football team) gained 8 yards on a play. **1.** _____

Represent this quantity as an integer.

2. The Dow Jones stock market average fell 196 points in one day. Represent this as an integer. **2.** _____

3. Insert $<$ or $>$ to make the statement true. **3.** _____

$-(-18)$ 15

4. Insert $<$ or $>$ to make the statement true. **4.** _____

$-|-8|$ $|8|$

5. Simplify: $-(-5)$ **5.** _____

6. Add: $14 + (-3)$ **6.** _____

7. Add: $-8 + 3 + (-7) + (-5)$ **7.** _____

8. Evaluate: $x + y$ if $x = -3$ and $y = -9$ **8.** _____

9. Subtract: $-4 - (-12)$ **9.** _____

10. Subtract: $-6 - (-2) - 3$ **10.** _____

11. Subtract 5 from -19. **11.** _____

12. Multiply: $4(-7)$ **12.** _____

13. Multiply: $-3(-8)$ **13.** _____

14. Simplify: $(-2)^5$ **14.** _____

15. Multiply: $7(-4)11$ **15.** _____

16. Divide: $-48 \div (-8)$ **16.** _____

17. Evaluate: xy if $x = -4$ and $y = -7$ **17.** _____

18. The Eagles football team lost 5 yards on each of three plays. What is the total number of yards lost? **18.** _____

19. Simplify: $2(-6) + 2^3$ **19.** _____

20. Simplify: $|8 - 4| \cdot (-3) + 6$ **20.** _____

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Chapter 2 Test Form A

Simplify each expression.

1. $-6 + 11$ **1.** _____

2. $20 - 32$ **2.** _____

3. $6 \cdot (-3)$ **3.** _____

4. $(-12) + (-9)$ **4.** _____

5. $63 \div (-9)$ **5.** _____

6. $(-3)(-8)$ **6.** _____

7. $\dfrac{-54}{-6}$ **7.** _____

8. $|-15|$ **8.** _____

9. $-(-52)$ **9.** _____

10. $|5| \cdot |-2|$ **10.** _____

11. $(-18) + 3 \cdot (-4)$ **11.** _____

12. $(-7) + 2 + (-5) - (-3)$ **12.** _____

13. $(-2)^2 - 12 \div (-4)$ **13.** _____

14. $3 - 2(8 - 5)^2$ **14.** _____

15. $\dfrac{-12 + 5(2) - 10}{2^3 - 2}$ **15.** _____

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16. $\dfrac{10(-1)-(-3)(-2)}{-2}$ **16.** _____

17. $\dfrac{-12}{6}$ **17.** _____

Evaluate the following if $x = 0$, $y = -3$, and $z = 4$.

18. $2x + y$ **18.** _____

19. $|y| + |x + z|$ **19.** _____

20. $3 - y$ **20.** _____

21. Carlos has $318 in his checking account. He deposits $207 and writes checks for $212 and $57. What is his new balance? **21.** _____

22. The mountain peak is 1580 feet above sea level. Express this with a positive or negative notation. **22.** _____

23. Find the average of –6, –8, 4, and 6. **23.** _____

Solve.

24. $-3x = 21$ **24.** _____

25. $x + 3 = 12$ **25.** _____

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Name: **Date:**
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Chapter 2 Test Form B

Simplify each expression.

1. $-5 + 10$ **1.** _____

2. $14 - 35$ **2.** _____

3. $-4(-3)$ **3.** _____

4. $(-2) + (-9)$ **4.** _____

5. $(-24) \div (3)$ **5.** _____

6. $-11 - (-4)$ **6.** _____

7. $(-12)(-3)$ **7.** _____

8. $\frac{-25}{-5}$ **8.** _____

9. $-|-5|$ **9.** _____

10. $-(-12)$ **10.** _____

11. $(5)|-2|$ **11.** _____

12. $(-5)(2) \div (-2)$ **12.** _____

13. $(-7) + (-3) - 3 - 12$ **13.** _____

14. $(-2)^3 - 2(-3)$ **14.** _____

15. $8 - (5 + 2)^2$ **15.** _____

16. $\frac{(-2)(-5) - (-2)(-7)}{2^2}$ **16.** _____

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17. $\frac{-6}{6}$ **17.** _____

Evaluate the following if $x = 3$, $y = -2$, and $z = -3$.

18. $3x - y$ **18.** _____

19. $|y| + 2(z)$ **19.** _____

20. $xy + z$ **21.** _____

21. Julie has \$541 in her checking account. She wrote a check for \$214 and a second check for \$27. What is her new balance? **23.** _____

22. A gambler wins \$150 the first night and loses \$185 the second night. Represent these wins and losses with positive or negative numbers. What is the overall outcome? **22.** _____

23. Find the average of −12, −18, 5, 7, and 3. **23.** _____

Solve.

24. $x - 11 = -4$ **24.** _____

25. $-4x = -36$ **25.** _____

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Name: **Date:**
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Chapter 2 Test Form C

Simplify each expression.

1. $-7 + 11 - 4$ **1.** _____

2. $26 - 42$ **2.** _____

3. $(-5)(-1)(3)$ **3.** _____

4. $\frac{-54}{9}$ **4.** _____

5. $-2 + 9 - (-6)$ **5.** _____

6. $-|-2|$ **6.** _____

7. $25(-3)(0)$ **7.** _____

8. $(-3)^4$ **8.** _____

9. $(-3)(-5)$ **9.** _____

10. $(3 - 5)^3$ **10.** _____

11. $(-1)^7$ **11.** _____

12. $(3)(-12) \div (-2)^2$ **12.** _____

13. $(-3)^3 - 2(-2)^2$ **13.** _____

14. $8 - 5(3 - 6)$ **14.** _____

15. $(5 - 8)^3$ **15.** _____

16. $28 \div (-7) + 2^3$ **16.** _____

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17. $\dfrac{-5}{-(-5)}$ **17.** _____

Evaluate the following if $x = -2$, $y = 3$, and $z = 1$.

18. $(x - y)^2$ **18.** _____

19. $3z + x$ **19.** _____

20. $x^2 - y(z)$ **20.** _____

21. The high on Saturday was 7°, the low of Saturday night was 4° below zero. Find the difference between the high and low temperature. **21.** _____

22. Lou wins $50 Friday night playing cards. He loses $63 on Saturday night. What are Lou's overall winnings or losses. **22.** _____

23. Find the average of –12, 8, 16, and 24. **23.** _____

Solve.

24. $x + 15 = 9$ **24.** _____

25. $7x = -21$ **25.** _____

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Name: **Date:**
Instructor: **Section:**

Chapter 2 Test Form D

Simplify each expression.

1. $-9 + 17$ **1.** _____

2. $12 - 25$ **2.** _____

3. $4 \cdot (-20)$ **3.** _____

4. $(-30) \div 5$ **4.** _____

5. $(-17) + (-8)$ **5.** _____

6. $-5 - (-12)$ **6.** _____

7. $(-8) \cdot (11)$ **7.** _____

8. $\dfrac{-33}{-11}$ **8.** _____

9. $18 - |-5|$ **9.** _____

10. $|3| \cdot |-7|$ **10.** _____

11. $(-2) + 12 \div (-2)$ **11.** _____

12. $-5 + (-2) - 7 - 4 + 3$ **12.** _____

13. $(-2)^3 \cdot (3)^2$ **13.** _____

14. $(-3)^2 - 5(3 - 7)$ **14.** _____

15. $(6 - 9)3$ **15.** _____

16. $28 \div (-4) + 2(-5)$ **16.** _____

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17. $25 \div (-5)^2$ **17.** _____

Evaluate the following if $x = 2$, $y = -3$, and $z = -4$.

18. $3x + 2y$ **18.** _____

19. $|x| + |y| + |z|$ **19.** _____

20. $xy + |z|$ **20.** _____

21. A mountain climber is at an elevation of 12,280 feet. He moves down the mountain 250 feet. Represent his final elevation as a sum and find the sum. **21.** _____

22. The temperatures for a week were 5°, –2°, 0°, –4°, 3°, –1°, and 6°. Find the average temperature. **22.** _____

Solve.

23. $3x = 2x + 5$ **23.** _____

24. $x + 5 = 17$ **24.** _____

25. $-4x = -24$ **25.** _____

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Name: **Date:**
Instructor: **Section:**

Chapter 2 Test Form E

Simplify each expression.

1. $-15 + 9$ **1.** _____

2. $21 - 35$ **2.** _____

3. $(-5) \cdot (-9)$ **3.** _____

4. $85 \div (-17)$ **4.** _____

5. $(-5) + (-3)$ **5.** _____

6. $-7 - (-4)(2)$ **6.** _____

7. $\frac{38}{-2}$ **7.** _____

8. $(-6) + 12 \div (-3)(-2)$ **8.** _____

9. $(-4)^2(-1)^3$ **9.** _____

10. $|-2| \cdot |-5|$ **10.** _____

11. $-7 + (-32) - 4$ **11.** _____

12. $(-2)^3 - 24 \div (3)$ **12.** _____

13. $3 - (2 - 8)^2$ **13.** _____

14. $15 \div (-3) \cdot 5 + (-2)$ **14.** _____

15. $|-15| + (-15)$ **15.** _____

16. $(5 - 9)2$ **16.** _____

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17. $\frac{6}{3} - \frac{4^2}{8}$ **17.** _____

Evaluate the following if $x = 0$, $y = -2$, and $z = 3$.

18. $|x| - |y|$ **18.** _____

19. $(3x + y)2$ **19** _____

20. $\frac{4y}{2z - y}$ **20.** _____

21. Find the average of the following numbers: 5, –3, 12, –7, 8 **21.** _____

22. Judy has $214 in her checking account. She deposits $88 and writes checks for $47, $29, and $150. What is her new balance? **22.** _____

Solve.

23. $x - 32 = 17$ **23.** _____

24. $\frac{x}{4} = 8$ **24.** _____

25. $\cdot 4x = 3x - 1$ **25.** _____

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Chapter 2 Test Form F

Simplify each expression and choose the correct response.

1. $(-8) + (-4)$

a. 12 **b.** -12 **c.** 4 **d.** -4

2. $-13 - 39$

a. -52 **b.** 52 **c.** 26 **d.** -26

3. $(-20)(2)$

a. 4 **b.** -4 **c.** -40 **d.** 40

4. $(-25) \div (5)$

a. 5 **b.** -5 **c.** 125 **d.** 15

5. $-7 + (-7)$

a. 14 **b.** -14 **c.** 0 **d.** 1

6. $-8 + 12$

a. -20 **b.** 20 **c.** 4 **d.** -4

7. $(-5)(-8)$

a. 40 **b.** -40 **c.** 45 **d.** -45

8. $\dfrac{-8}{8}$

a. 1 **b.** -1 **c.** 0 **d.** -16

9. $|5| - |-2|$

a. 3 **b.** -3 **c.** 7 **d.** -7

10. $\dfrac{|-18|}{-|-6|}$

a. 12 **b.** -12 **c.** -3 **d.** 3

11. $(-5) + 15 \div 5$

a. -2 **b.** -4 **c.** -8 **d.** 8

12. $-10 + (-29) - 7 + 6$

a. 52 **b.** -40 **c.** 40 **d.** 20

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13. $(-2)^2 - 16 \div (-4)$

a. 3 **b.** 8 **c.** -8 **d.** 0

14. $(4 - 8)^2 \cdot (3 - 5)^2$

a. -32 **b.** 64 **c.** -64 **d.** 32

15. $(3 - 5)^2 + (-4)$

a. 0 **b.** -8 **c.** 4 **d.** 8

16. $10 - (5 - 2)^3$

a. 20 **b.** 17 **c.** -17 **d.** -20

17. $-5 + (-45) \div (-15)$

a. -25 **b.** 25 **c.** -2 **d.** 2

18. $6 - 4^2$

a. 2 **b.** -10 **c.** 10 **d.** -2

19. $0 \cdot (-5)(-5)$

a. -25 **b.** 0 **c.** 25 **d.** undefined

20. $\dfrac{-6(-2)+14}{-2(-3+4)}$

a. -1 **b.** -13 **c.** 1 **d.** 13

21. A mountain climber is at an elevation of 5,280 feet and moves down the mountain a distance of 420 feet. Her final elevation is:

a. 5700 feet **b.** -5700 feet **c.** -4860 feet **d.** 4860 feet

22. The Dow Jones Industrial Average fell 210 points on Monday. Represent by a signed number the total number of points it fell on Tuesday if it fell two times as much as on Monday.

a. -420 points **b.** 420 points **c.** 210 points **d.** -210 points

Solve.

23. Find the average of -20, 6, 9, 8, and 12.

a. -5 **b.** 15 **c.** 3 **d.** -3

24. $x + 5 = -7$

a. -12 **b.** -2 **c.** 2 **d.** 12

25. $-4x = 48$

a. 12 **b.** -12 **c.** -44 **d.** -52

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Chapter 2 Test Form G

Simplify each expression and choose the correct response.

1. $36 - 39$

a. 39 **b.** -3 **c.** -39 **d.** 3

2. $(6 - 9)^2$

a. -9 **b.** 9 **c.** 45 **d.** -45

3. $(-30) \cdot (-5)$

a. -150 **b.** 150 **c.** -15 **d.** 15

4. $(-100) \div (10)$

a. -10 **b.** 10 **c.** 1000 **d.** -1000

5. $(-2)^3$

a. -6 **b.** 6 **c.** 8 **d.** -8

6. $-8 - (-15)$

a. -7 **b.** -23 **c.** 23 **d.** 7

7. $(-4) \cdot (-7)(1)$

a. 28 **b.** -28 **c.** 11 **d.** -11

8. $\dfrac{-18}{-2}$

a. 9 **b.** -9 **c.** 20 **d.** -20

9. $|-28| + (-14)$

a. 7 **b.** -7 **c.** 14 **d.** -14

10. $7 - |-5|$

a. 2 **b.** -2 **c.** 12 **d.** -12

11. $\dfrac{|-15|}{-|-3|}$

a. 5 **b.** -5 **c.** -45 **d.** -3

12. $-5 + 12 \div (-4)$

a. -3 **b.** -8 **c.** 8 **d.** 3

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13. $(-4) + (-8) - 12 + 2$

a. 22 **b.** –22 **c.** 2 **d.** –2

14. $-25 \div (-5) + (2^2)$

a. 9 **b.** –9 **c.** –26 **d.** –34

15. $(4 - 8)^2 \cdot (3 - 9)$

a. 48 **b.** –96 **c.** –48 **d.** 96

16. $\frac{-8}{0}$

a. 0 **b.** –8 **c.** undefined **d.** 8

17. $(3 - 5)^2 + (-3)$

a. 1 **b.** –1 **c.** 12 **d.** –12

18. $-1 + (14) \div (7)$

a. 3 **b.** 1 **c.** –4 **d.** –22

19. $10 - 8^2$

a. 54 **b.** –54 **c.** 4 **d.** –4

20. $\frac{-5(-1) + 22}{-3}$

a. 3 **b.** 9 **c.** –3 **d.** –9

21. Two divers are exploring the bottom of a trench in the Atlantic Ocean. Jim is 146 feet below the surface of the ocean. Represent Richard's depth by a signed number if he is two times as deep as Jim.

a. 144 feet **b.** 148 feet **c.** 292 feet **d.** –292 feet

22. Ryan Smith has $250 in his checking account. He writes one check for $99 and another for $22, and deposits $150. His final balance is:

a. $177 **b.** $377 **c.** $187 **d.** $279

23. Find the average of –12, –15, –30, and 5.

a. 52 **b.** –52 **c.** 13 **d.** –13

24. Solve. $-3x = -6$

a. 2 **b.** –3 **c.** 3 **d.** –2

25. Solve. $x + 12 = -18$

a. –30 **b.** 6 **c.** –6 **d.** 30

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Chapter 2 Test Form H

Simplify each expression and choose the correct response.

1. $-12 + 8 + (-3)$

a. 7 **b.** -7 **c.** 23 **e.** -17

2. $7 - (-11)$

a. 4 **b.** 18 **c.** -18 **d.** -4

3. $(-50) \cdot (2)$

a. -25 **b.** -100 **c.** 100 **d.** 25

4. $(-32) \div (-4)$

a. -8 **b.** 128 **c.** -36 **d.** 8

5. $-21 + 7$

a. -28 **b.** -14 **c.** 28 **d.** 14

6. $-8 - (-8)$

a. -16 **b.** 16 **c.** 0 **d.** 1

7. $(11)(-4)$

a. 44 **b.** -44 **c.** 15 **d.** -15

8. $\frac{-9}{-3}$

a. -3 **b.** 3 **c.** 6 **d.** -12

9. $|-27| + (2)$

a. 25 **b.** -25 **c.** 29 **d.** -29

10. $19 - |-5|$

a. 24 **b.** -14 **c.** 14 **d.** -24

11. $|17| \cdot |-5|$

a. $\frac{17}{5}$ **b.** 85 **c.** -85 **d.** 12

12. $(8) + 12 \div (-3)$

a. 17 **b.** 4 **c.** -17 **d.** -4

13. $-3 + (-4) - 3 + (-10)$

a. 20 **b.** -20 **c.** 0 **d.** 1

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14. $(2)^2 - 21 \div (-3)$

a. 11 **b.** 14 **c.** -14 **d.** -51

15. $(1 - 3)^2 + (-3)(-4)$

a. 16 **b.** -16 **c.** 8 **d.** -8

16. $7 - (9 - 6)^3$

a. 20 **b.** -20 **c.** 27 **d.** -27

17. $\dfrac{0}{-|-12|}$

a. 0 **b.** 12 **c.** undefined **d.** -12

18. $-9 + (-21) \div (-3)(2)$

a. 23 **b.** 5 **c.** -5 **d.** -23

19. $-8 - (-6)$

a. -2 **b.** 14 **c.** 2 **d.** -14

20. $\dfrac{-2(-7) + 8(2)}{-2(4 - 5)}$

a. 1 **b.** 15 **c.** -15 **d.** -1

21. A photographer took a picture of two mountains that had a difference in elevation of 1200 feet. If the taller mountain was 5450 feet, find the elevation of the other mountain.

a. 4250 feet **b.** 4450 feet **c.** 6650 feet **d.** 6850 feet

22. A card player lost \$24 for each of four nights. Find her total losses.

a. -96 **b.** 28 **c.** -28 **d.** 96

23. Find the average of -8, -12, 10, and 10.

a. 0 **b.** -5 **c.** -5 **d.** -20

24. Solve. $-3x = -12$

a. 15 **b.** 9 **c.** 4 **d.** -4

25. Solve. $x - 7 = 12$

a. -5 **b.** 5 **c.** -19 **d.** 19

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Additional Exercises 2.1

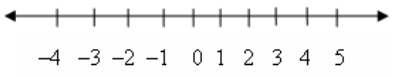
Represent each quantity by an integer.

1. A deep-sea diver is 350 feet below the surface of the ocean. Represent this position using a signed number. **1.** _____

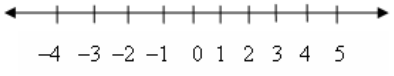
2. A company reports a loss of $2 million for last year. Represent this amount using a signed number. **2.** _____

Graph the signed number in each list on a number line.

3. 4, –2, 3 **3.**



4. –3, 0, –1, 4 **4.**



Insert $<$, $>$ or $=$ between each pair of numbers to make a true statement.

5. –7 0 **5.** _____

6. 5 9 **6.** _____

7. $-|3|$ $|-3|$ **7.** _____

8. $|15|$ $|-15|$ **8.** _____

Find each absolute value.

9. $|0|$ **9.** _____

10. $-|6|$ **10.** _____

11. $|-20|$ **11.** _____

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Additional Exercises 2.1 (cont.)

Find the opposite of each number.

13. -6 **13.** _____

14. 8 **14.** _____

15. -3 **15.** _____

Simplify.

16. $-(-10)$ **16.** _____

17. $-|-5|$ **17.** _____

18. $-|12|$ **18.** _____

Evaluate.

19. $|-x|$ if $x = 4$. **19.** _____

20. $|x|$ if $x = -8$. **20.** _____

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Additional Exercises 2.2

Add.

1. $7 + (-3)$ **1.** _____

2. $(-10) + 5$ **2.** _____

3. $3 + (-5)$ **3.** _____

4. $-18 + (-21)$ **4.** _____

5. $-3 + (-15)$ **5.** _____

6. $-18 + 12$ **6.** _____

7. $-5 + 5$ **7.** _____

8. $17 + (-2)$ **8.** _____

9. $-45 + 15$ **9.** _____

10. $27 + (-83)$ **10.** _____

11. $-19 + 12$ **11.** _____

12. $110 + (-24)$ **12.** _____

13. $8 + (-2)$ **13.** _____

14. $-21 + (-11)$ **14.** _____

15. $-5 + 7 + (-8)$ **15.** _____

16. $20 + (-11) + (-3) + 6$ **16.** _____

17. Evaluate $x + y$ for $x = 3$ and $y = -8$. **17.** _____

18. Evaluate $2x + y$ for $x = -2$ and $y = 6$. **18.** _____

19. Clarise has $290 in her checking account. She writes checks for $102 and $75 and then makes a deposit of $170. Find the amount left in her account. **19.** _____

20. Suppose a deep-sea diver dives from the surface to 125 feet below the surface. She then dives 12 more feet. What is her present depth as a signed number? **20.** _____

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Additional Exercises 2.3

Subtract.

1. $-7 - (-3)$ **1.** _____

2. $7 - 4$ **2.** _____

3. $-14 - (-14)$ **3.** _____

4. $-6 - 8$ **4.** _____

5. $8 - (-8)$ **5.** _____

6. $14 - 28$ **6.** _____

7. $-41 - (-7)$ **7.** _____

8. $6 + (-6)$ **8.** _____

9. $18 - 53$ **9.** _____

10. $9 - (-4)$ **10.** _____

11. Subtract -3 from -12. **11.** _____

12. Find the difference of -15 and -3. **12.** _____

Simplify.

13. $15 - 5 - 4$ **13.** _____

14. $-8 - 3 - (-7)$ **14.** _____

15. $-12 + (-5) - 3$ **15.** _____

16. $21 - (-15) + (-8)$ **16.** _____

17. Evaluate $x - y$ for $x = 5$ and $y = -8$. **17.** _____

18. Evaluate $3x - y$ for $x = -4$ and $y = -2$. **18.** _____

19. On December 21, the average high temperature was $-5°$ F. On June 21, the average high temperature was 62° F. How many degrees warmer was the temperature in June than in December? **19.** _____

20. Winta has $87 in her checking account. She makes a deposit of $130 and writes two checks for $19 and $100. Find the amount left in her account. **20.** _____

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Name: **Date:**
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Additional Exercises 2.4

Multiply.

1. $-3(-8)$ **1.** _____

2. $-2(5)$ **2.** _____

3. $0(-8)$ **3.** _____

4. $4(-2)$ **4.** _____

5. $-8(-4)$ **5.** _____

6. $6(-5)$ **6.** _____

7. $-7(9)$ **7.** _____

Evaluate.

8. $(-3)^4$ **8.** _____

9. -2^4 **9.** _____

Multiply.

10. $-1 \cdot (-1) \cdot (-1) \cdot (1)$ **10.** _____

11. $-2(-7)(3)$ **11.** _____

12. $2(-3)(6)$ **12.** _____

Divide.

13. $-28 \div 7$ **13.** _____

14. $\frac{-27}{0}$ **14.** _____

15. $\frac{-25}{-5}$ **15.** _____

16. $\frac{-185}{5}$ **16.** _____

17. Evaluate ab for $a = -3$ and $b = -2$. **17.** _____

18. Evaluate $\frac{a}{b}$ for $a = -12$ and $b = 4$. **18.** _____

19. Craig Lewis lost $125 on each of three consecutive days at the horse races. Find his total loss as a signed number. **19.** _____

20. A company declared a loss of $10,500 for each of five consecutive months. Find the company's total loss as a signed number. **20.** _____

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Additional Exercises 2.5

Simplify.

1. $3 + (-12) \div 3$ **1.** _____

2. $5 + 4 \cdot 2 - 7$ **2.** _____

3. $(-12) + 16 \div 4$ **3.** _____

4. $6 \cdot 2^3$ **4.** _____

5. $\dfrac{80}{-2-3}$ **5.** _____

6. $[2 + (-3)]^2$ **6.** _____

7. $2^3 - 27$ **7.** _____

8. $(8 - 16) \div 4$ **8.** _____

9. $(-17) + 8 \div 2$ **9.** _____

10. $|3 - 9| \cdot (-2) \div 6$ **10.** _____

11. $4 - 3 \cdot 5 - 6$ **11.** _____

12. $4(7 - 4) + (-2)^3$ **12.** _____

13. $(-5 \div 5) - (5 \div 5)$ **13.** _____

14. $(8 - 2)(5 - 12)$ **14.** _____

15. $9^2 - (5)^2$ **15.** _____

16. $10 - [8 - (2 - 7)]$ **16.** _____

17. $\dfrac{(-5)(-2) - (7)(3)}{11}$ **17.** _____

18. $4^2 - (2)^2$ **18.** _____

19. Evaluate $2x - y - z$ for $x = 2$ and $y = 5$ and $z = -3$. **19.** _____

20. Evaluate $-x^2$ for $x = -4$. **20.** _____

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Additional Exercises 2.6

Determine whether the given number is a solution of the given equation.

1. Is 8 a solution of $x - 4 = 4$? **1.** _____

2. Is 3 a solution of $x + 6 = 6$? **2.** _____

3. Is -4 a solution of $-2x = 4 - x$? **3.** _____

4. Is 1 a solution of $2(x - 4) = 6$? **4.** _____

Solve. Check each solution.

5. $x + 5 = 12$ **5.** _____

6. $x + 7 = -8$ **6.** _____

7. $x - 5 = -3$ **7.** _____

8. $14x = -14$ **8.** _____

9. $12x = 11x - 5$ **9.** _____

10. $3 = x + 5$ **10.** _____

11. $5 = x - 4$ **11.** _____

12. $2x = 18$ **12.** _____

13. $3x = -12$ **13.** _____

14. $-2x = -4$ **14.** _____

15. $\frac{x}{-2} = 2$ **15.** _____

16. $\frac{x}{12} = -1$ **16.** _____

17. $40 = 8x$ **17.** _____

Translate each phrase into an algebraic expression. Use x to represent "a number."

18. Subtract a number from -7 **18.** _____

19. The quotient of -6 and a number. **19.** _____

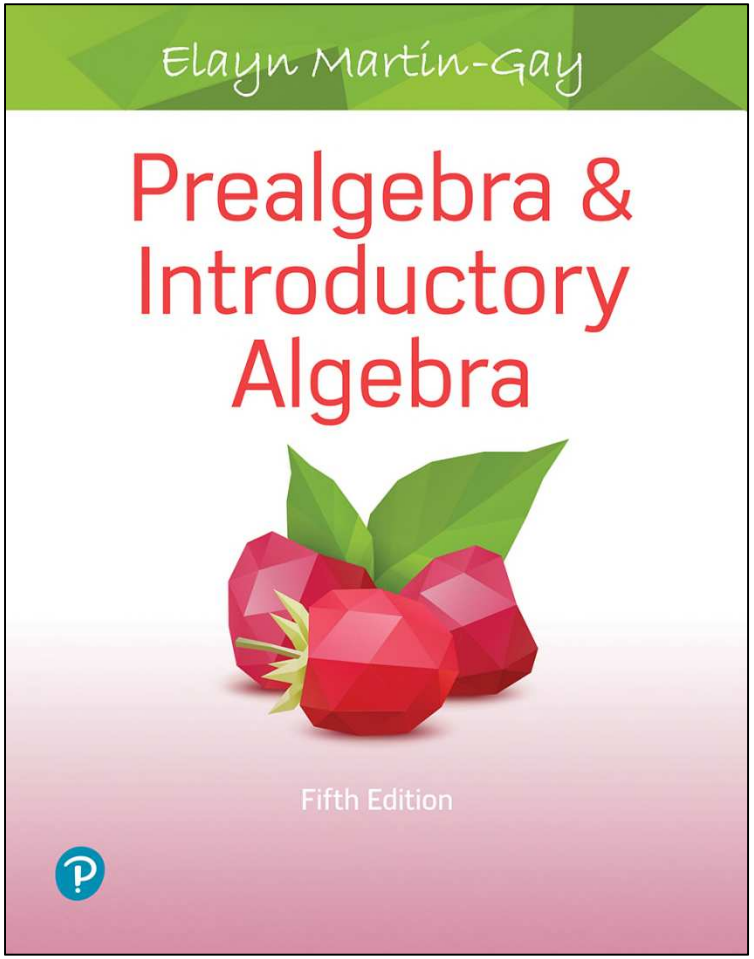
20. four times a number **20.** _____

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Prealgebra & Introductory Algebra

Fifth Edition



Chapter 2

Integers and Introduction to Solving Equations

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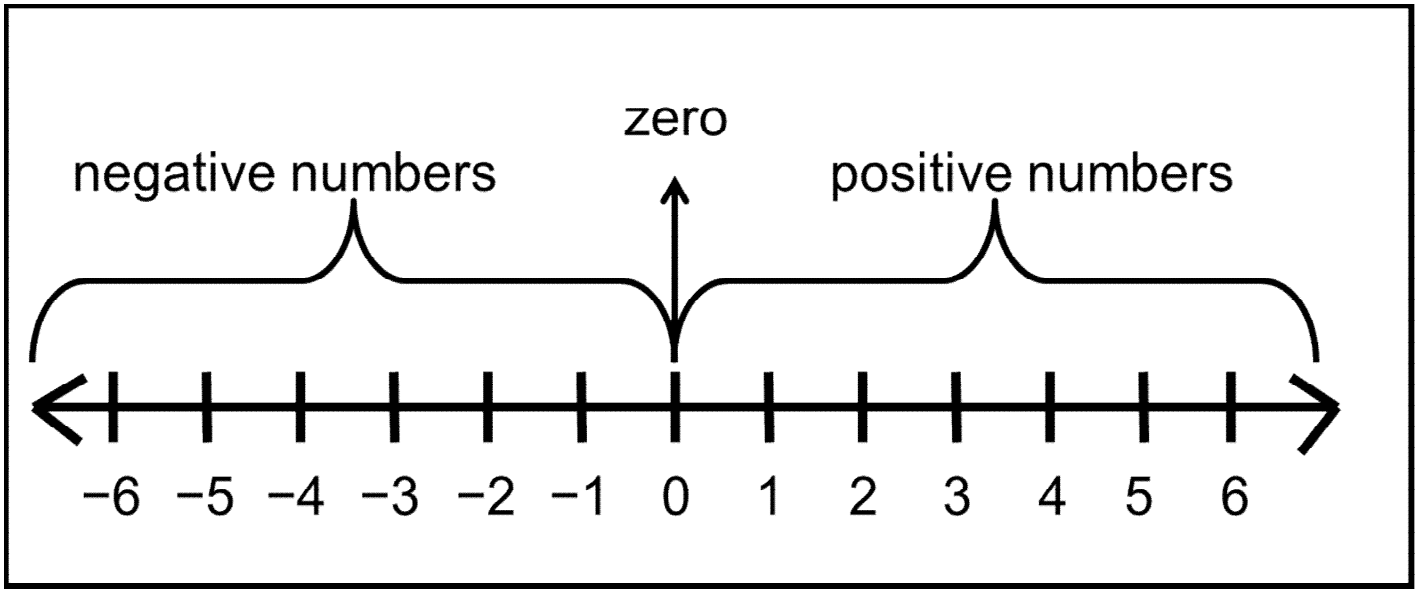
Section 2.1 Introduction to Integers

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Positive and Negative Numbers

Numbers greater than 0 are called positive numbers. Numbers less than 0 are called negative numbers.



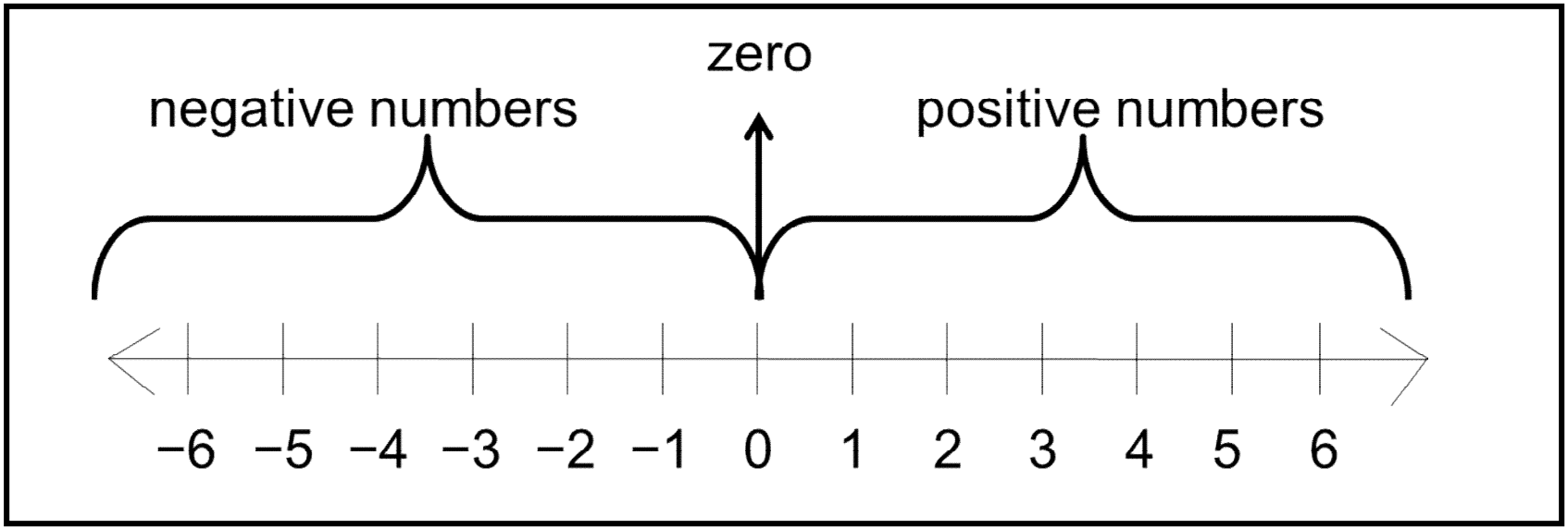
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Negative and Positive Numbers

−3 indicates “negative three.”

3 and + 3 both indicate “positive three.”

The number 0 is neither positive nor negative.



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Example 1

The world's deepest bat colony spends each winter in a New York zinc mine at a depth of 3805 feet. Represent this position with an integer. (Source: Guinness Book of World Records.)

−3805

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Comparing Integers

We compare integers just as we compare whole numbers. For any two numbers graphed on a number line, the number to the **right is the greater number** and the number to the **left is the smaller number**.

$<$	$>$
means "is less than"	means "is greater than"

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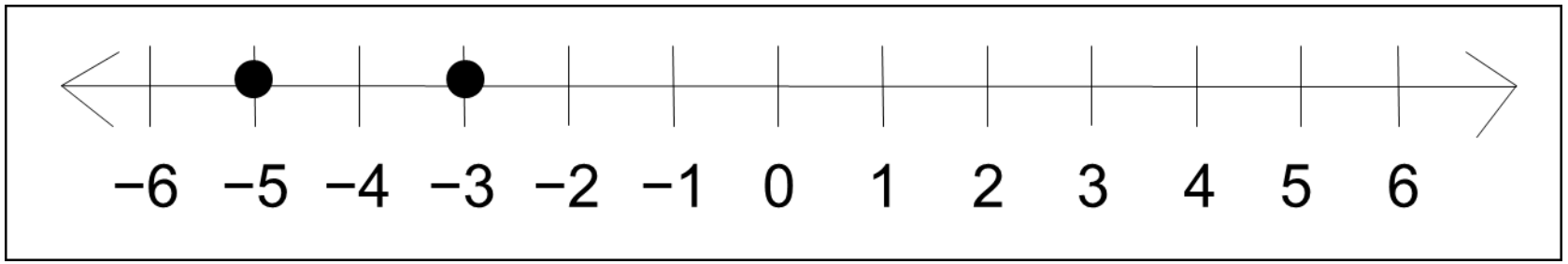
Graphs of Integers

The graph of −5 is to the left of −3, so −5 is less than −3, written as $-5 < -3$.

We can also write $-3 > -5$.

Since −3 is to the right of −5,

−3 is greater than −5.



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Example 3

Insert < or > between each pair of numbers to make a true statement.

a. $-6 __<__ 3$

b. $0 __>__ -\frac{7}{8}$

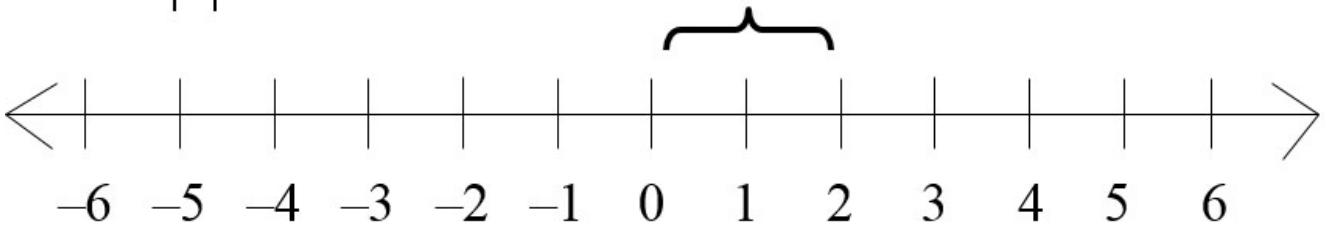
c. $-3.6 __>__ -4.2$

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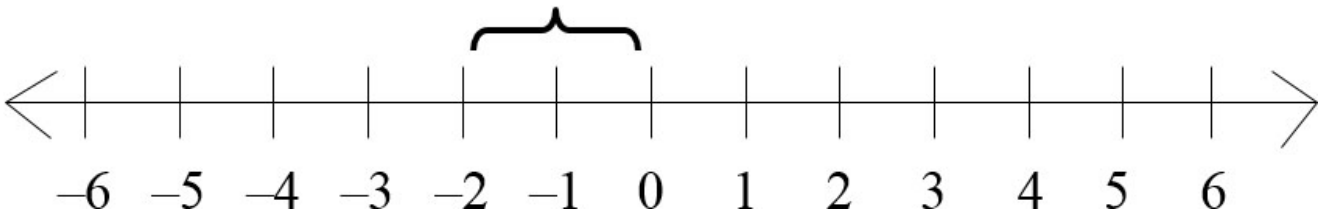
Absolute Value

The **absolute value** of a number is the number's distance from 0 on the number line. The symbol for absolute value is $|\ |$.

$|2|$ is 2 because 2 is 2 units from 0.



$|-2|$ is 2 because –2 is 2 units from 0.



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Example 4

Simplify.

a. $|-8| = 8$ because -8 is 8 units from 0.

b. $|9| = 9$ because 9 is 9 units from 0.

c. $|-15| = 15$ because -15 is 15 units from 0.

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Helpful Hint (1 of 2)

Since the absolute value of a number is that number's distance from 0, the absolute value of a number is always 0 or positive. It is never negative.

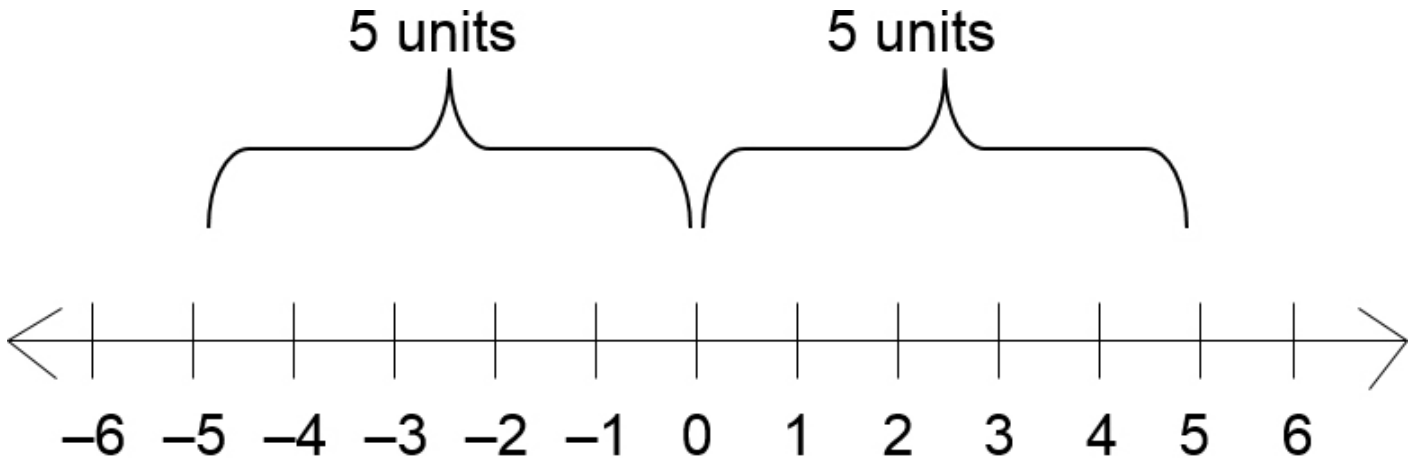
$$|0| = 0 \qquad |-6| = 6$$

zero a positive number

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Opposite Numbers (1 of 2)

Two numbers that are the same distance from 0 on the number line but are on the opposite sides of 0 are called **opposites.**



5 and –5 are opposites.

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Opposite Numbers (2 of 2)

5 is the opposite of −5 and −5 is the opposite of 5.

The opposite of 4 is −4 is written as

$$-(4) = -4$$

The opposite of −4 is 4 is written as

$$-(-4) = 4$$

If a is a number, then $-(-a) = a$.

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Helpful Hint (2 of 2)

Remember that 0 is neither positive nor negative. Therefore, the opposite of 0 is 0.

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Example 5

Find the opposite of each number.

a. 14

The opposite of 14 is −14.

b. −3

The opposite of −3 is $-(-3)$ or 3.

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Example 6

Simplify.

a. $-(-5)$

The opposite of −5 is 5.

b. $-|-8|$

The opposite of the absolute value of −8 is the opposite of 8, or −8.

c. $-|3|$

The opposite of the absolute value of 3 is the opposite of 3, or −3.

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Example 7

Evaluate $-|x|$ if $x = -6$.

Replace x with -6; then simplify.

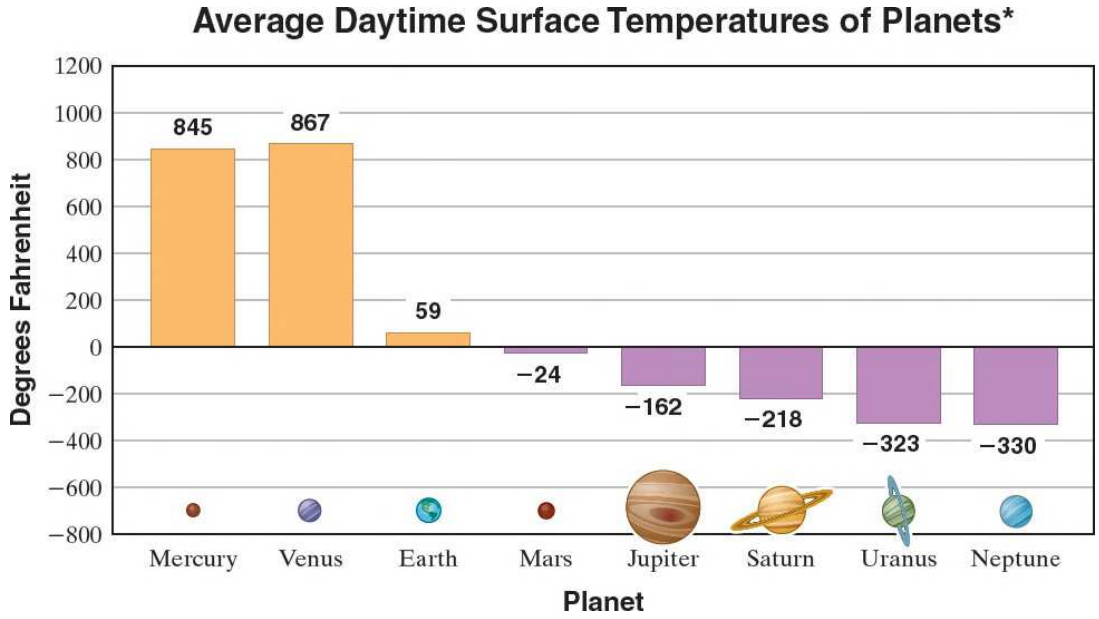
$$-|x| = -|-6|$$

$$= -6$$

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Example 8

Which planet has the highest average daytime surface temperature?



Venus

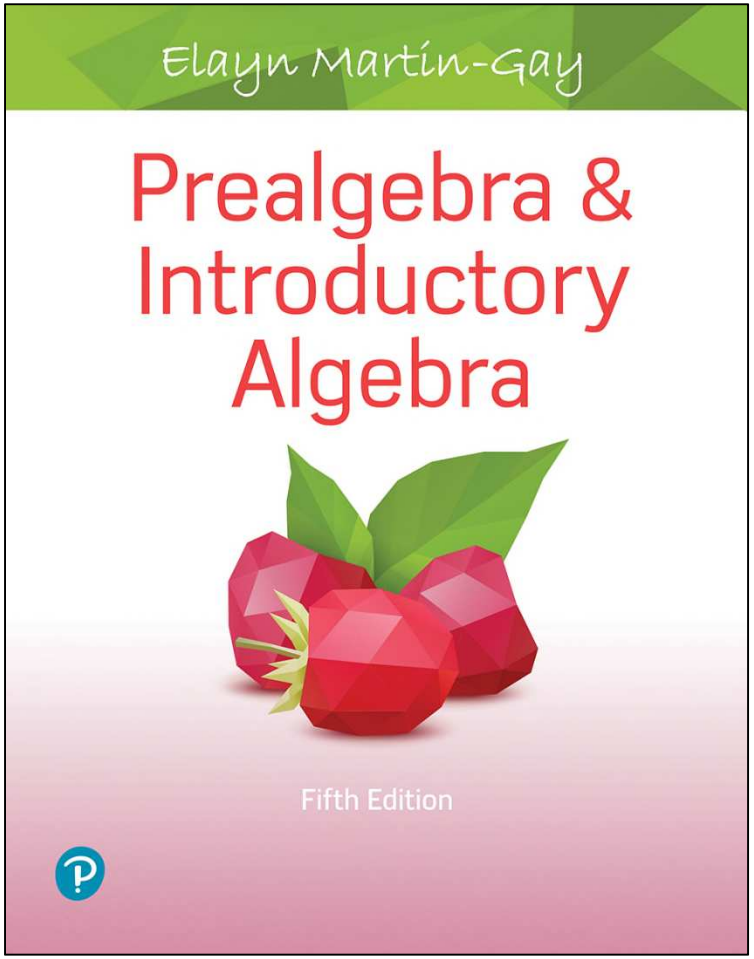
Source: The World Almanac, 2009

* For some planets, the temperature given is the temperature where the atmospheric pressure equals 1 Earth atmosphere.

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Chapter 2

Integers and Introduction to Solving Equations

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Section 2.2 Adding Integers

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Objectives

A. Add Integers.

B. Evaluate an Algebraic Expression by Adding.

C. Solve Problems by Adding Integers.

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Adding Integers

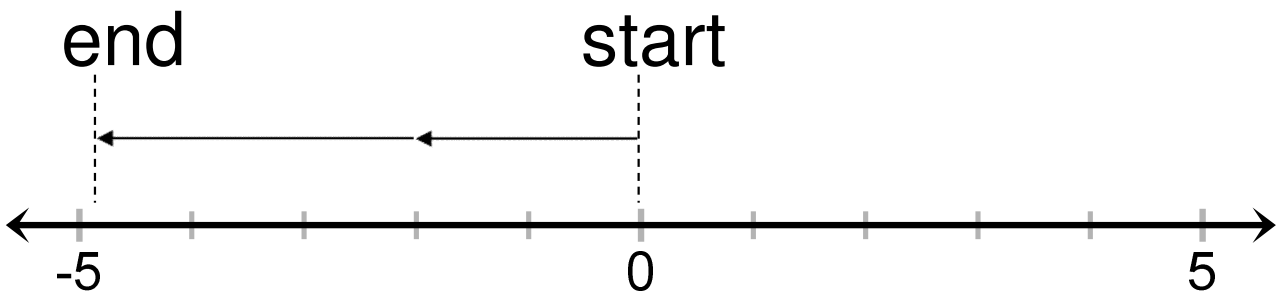
Adding integers can be visualized by using a number line. A positive number can be represented on the number line by an arrow of appropriate length pointing to the right, and a negative number by an arrow of appropriate length pointing to the left.

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Example 1

Add using a number line. $-2+(-3)$

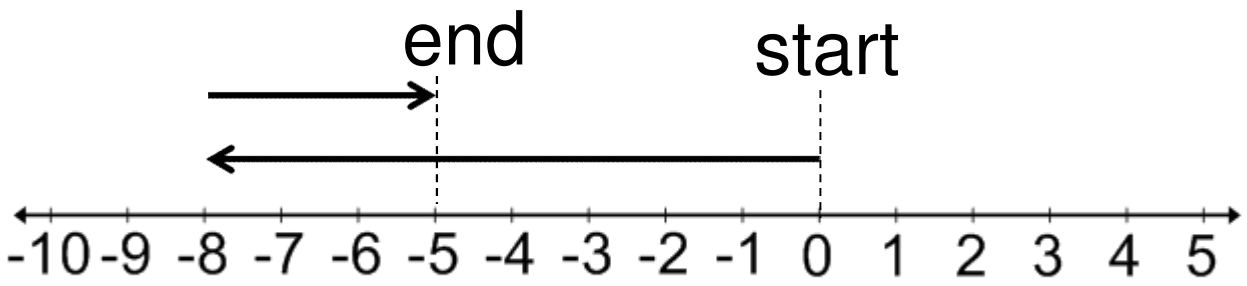


$$-2+(-3)=-5$$

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Example 3

Add using a number line. $-8+3$



$$-8+3=-5$$

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Adding Signed Numbers (1 of 2)

Adding Two Numbers with the Same Sign

Step 1: Add their absolute values.

Step 2: Use their common sign as the sign of the sum.

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Example 5

Add: $-14+(-9)$

Step 1: $|-14|=14,\ |-9|=9,$ and $14+9=23$

Step 2: Therefore the common sign is negative, so the sum is negative.

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Adding Signed Numbers (2 of 2)

Adding Two Numbers with Different Sign

Step 1: Find the larger absolute value minus the smaller absolute value.

Step 2: Use the sign of the number with the larger absolute value as the sign of the sum.

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Example 7

Add: $-11+18$

Step 1: $|-11|=11,\ |18|=18,$ and $18-11=7$

Step 2: 18 has the larger absolute value and its sign is an understood + so the sum is positive.

$$-11+18=+7 \text{ or } 7$$

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Example 8

Add: $8+(-13)$

Step 1: $|8|=8, |-13|=13,$ and $13-8=5$

Step 2: −13 has the larger absolute value and its sign is − so the sum is negative.

$$8+(-13)=-5$$

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Examples 9 to 11

Add.

a. $-21+12=-9$

b. $22+(-9)=13$

c. $0+(-12)=-12$

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Opposites

If a is a number, then $-a$ is its opposite. Also,

$$\left.\begin{aligned} a+(-a)&=0 \\ -a+a&=0 \end{aligned}\right\}$$ The sum of a number and its opposite is 0.

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Examples 12 and 13

Add.

a. $-25+25=0$

b. $72+(-72)=0$

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Example 14

Add: $5+(-7)+3$

$$5+(-7)+3=-2+3$$
$$=1$$

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Example 16

Evaluate $3x + y$ for $x = 2$ and $y = -6$.

Replace x with 2 and y with −6 in $3x + y$.

$$3x + y = 3 \cdot 2 + (-6)$$

$$= 6 + (-6)$$

$$= 0$$

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Example 18

The temperature at 4 p.m. on February 2 was −10° Celsius. By 11 p.m. the temperature had risen 12 degrees. Find the temperature at 11 p.m.

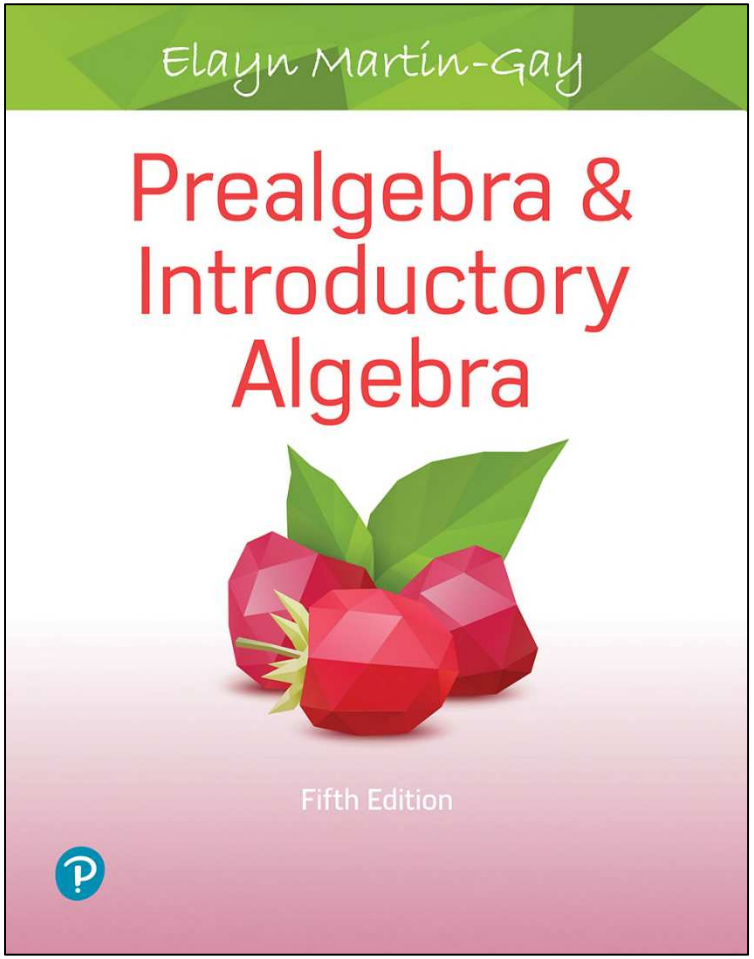
$$\begin{aligned} |12| - |-10| &= 12 - 10 \\ &= 2 \end{aligned}$$

The temperature at 11 p.m. is 2° Celsius.

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Chapter 2

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Section 2.3 Subtracting Integers

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Objectives

A. Subtract Integers.

B. Add and Subtract Integers.

C. Evaluate an Algebraic Expression by Subtracting.

D. Solve Problems by Subtracting Integers.

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Subtracting Integers

Subtracting Two Numbers

If *a* and *b* are numbers, then $a - b = a + (-b)$.

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Examples 1, 2 and 4

Subtract.

a. $6-10 = 6+(-10) = -4$

b. $-14-19 = -14+(-19) = -33$

c. $-12-(-6) = -12+6 = -6$

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Example 5 to 7

Subtract.

a. $6-9=6+(-9)=-3$

b. $-14-5=-14+(-5)=-19$

c. $-3-(-4)=-3+4=1$

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Example 9

Simplify: $12-5-7$

$$12-5-7=12+\underbrace{(-5)+(-7)}$$

$$=12+(-12)$$

$$=12-12$$

$$=0$$

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Example 10

Simplify: $9-6-(-3)+8$

$$9-6-(-3)+8=9+(-6)+3+8$$

$$=3+3+8$$

$$=6+8$$

$$=14$$

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Example 12

Evaluate $3x - y$ for $x = 2$ and $y = -6$.

Replace x with 2 and y with −6 in $3x - y$.

$$\begin{aligned} 3x - y &= 3 \cdot 2 - (-6) \\ &= 6 - (-6) \\ &= 6 + 6 \\ &= 12 \end{aligned}$$

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Example 13

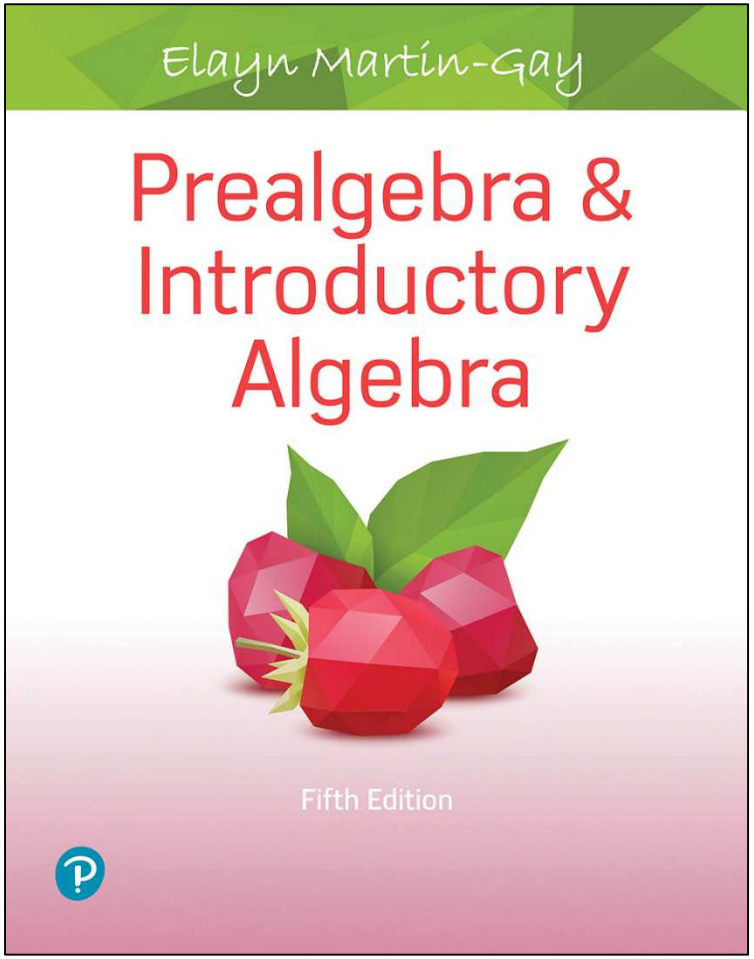
The highest point in Asia is the top of Mount Everest, at a height of 29,028 feet above sea level. The lowest point is the Dead Sea, which is 1312 feet below sea level. How much higher is Mount Everest than the Dead Sea? (Source: National Geographic Society)

$$29,028-(-1312)= \ 29,028+1312=30,340 \text{ feet}$$

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Chapter 2

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Section 2.4 Multiplying an Dividing Integers

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Objectives

A. Multiply Integers.

B. Divide Integers.

C. Evaluate an Algebraic Expression by Multiplying or Dividing.

D. Solve Problems by multiplying or Dividing Integers.

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Multiplying Integers (1 of 3)

Consider the following pattern of products.

First factor decreases by 1 each time.

$$3 \cdot 5 = 15$$
$$2 \cdot 5 = 10$$
$$1 \cdot 5 = 5$$
$$0 \cdot 5 = 0$$

Product decreases by 5 each time.

This pattern continues as follows.

$$-1 \cdot 5 = -5$$
$$-2 \cdot 5 = -10$$
$$-3 \cdot 5 = -15$$

This suggests that the product of a negative number and a positive number is a negative number.

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Multiplying Integers (2 of 3)

Observe the following pattern.

$$2 \cdot (-5) = -10$$
$$1 \cdot (-5) = -5$$
$$0 \cdot (-5) = 0$$

Product increases by 5 each time.

This pattern continues as follows.

$$-1 \cdot (-5) = 5$$
$$-2 \cdot (-5) = 10$$
$$-3 \cdot (-5) = 15$$

This suggests that the product of two negative numbers is a positive number.

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Multiplying Integers (3 of 3)

The product of two numbers having the same sign is a positive number.

$$2 \cdot 4 = 8 \qquad -2 \cdot (-4) = 8$$

The product of two numbers having different signs is a negative number.

$$2 \cdot (-4) = -8 \qquad -2 \cdot 4 = -8$$

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Multiplying Numbers

Product of Like Signs

$$(+)(+) = +$$ $$(-)(-) = +$$

Product of Different Signs

$$(-)(+) = -$$ $$(+)(-) = -$$

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Examples 1 to 4

Multiply.

a. $-3 \cdot 8 = -24$

b. $-5(-2) = 10$

c. $0 \cdot (-50) = 0$

d. $10(-5) = -50$

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Examples 5 to 7

Multiply.



a. $8(-6)(-2) = -48(-2) = 96$

b. $(-9)(-2)(-1) = 18(-1) = -18$

c. $(-3)(-4)(-5)(-1) = -1(-60) = 60$

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Example 8

Evaluate $(-2)^4$.

$$(-2)^4 = (-2)(-2)(-2)(-2)$$
$$= 16$$

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Example 9

Evaluate -8^2.

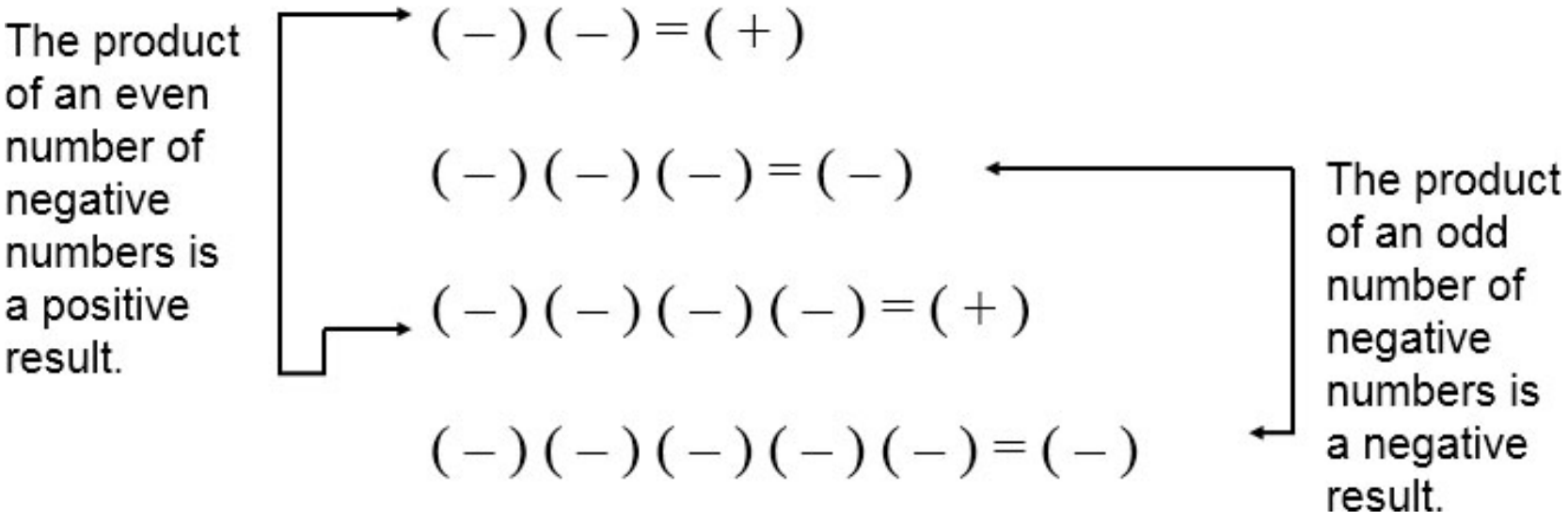
$$\begin{aligned} -8^2 &= -1(8 \cdot 8) \\ &= -64 \end{aligned}$$

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Helpful Hint

If we let (−) represent a negative number and (+) represent a positive number, then



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Dividing Integers (1 of 2)

Division of integers is related to multiplication of integers.

$$\frac{6}{2} = 3 \quad \text{because} \quad 3 \cdot 2 = 6$$

$$\frac{-6}{2} = -3 \quad \text{because} \quad -3 \cdot 2 = -6$$

$$\frac{6}{-2} = -3 \quad \text{because} \quad -3 \cdot (-2) = 6$$

$$\frac{-6}{-2} = 3 \quad \text{because} \quad 3 \cdot (-2) = -6$$

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Dividing Integers (2 of 2)

The quotient of two numbers having the same sign is a positive number.

$$12 \div 4 = 3 \qquad -12 \div (-4) = 3$$

The quotient of two numbers having different signs is a negative number.

$$-12 \div 4 = -3 \qquad 12 \div (-4) = -3$$

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Dividing Numbers

Quotient of Like Signs

$$\frac{(+)}{(+)} = +$$

$$\frac{(-)}{(-)} = +$$

Quotient of Different Signs

$$\frac{(+)}{(-)} = -$$

$$\frac{(-)}{(+)} = -$$

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Examples 10 to 12

Divide.

a. $\dfrac{42}{-7}$

$= -6$

b. $-16 \div (-2)$

$= 8$

c. $\dfrac{-80}{10}$

$= -8$

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Examples 13 and 14

Divide.

a. $\frac{0}{-7} = 0$ because $0(-7) = 0$

b. $\frac{8}{0}$ is undefined because there is no number that gives a product of 8 when multiplied by 0.

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Example 15

Evaluate $7xy$ for x = −6 and y = 8.

Replace *x* with −6 and *y* with 8 in $7xy$.

$$\begin{aligned} 7xy &= 7\,(-6)(8) \\ &= -42 \cdot 8 \\ &= -336 \end{aligned}$$

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Example: Stock Market

Joe Norstrom lost $400 on each of seven consecutive days in the stock market. Represent his total loss as a product of signed numbers and find his total loss.

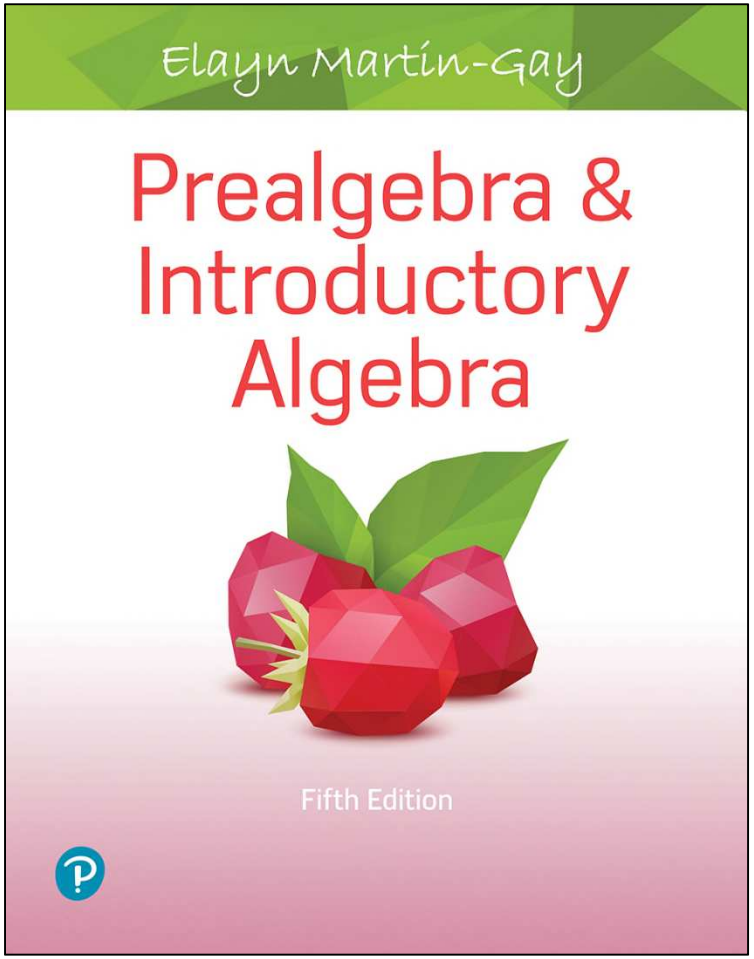
$$7 \cdot (-400) = -2800$$

Joe Norstrom's total loss is $2800.

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Section 2.5 Order of Operations

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Objectives

A. Simplify Expressions by Using the Order of Operations.

B. Evaluate an Algebraic Expression.

C. Find the Average of a List of Numbers.

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Order of Operations

1. Perform all operations within parentheses ( ), brackets [ ], or other grouping symbols such as fraction bars, starting with the innermost set.
2. Evaluate any expressions with exponents.
3. Multiply or divide in order from left to right.
4. Add or subtract in order from left to right.

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Helpful Hint

When simplifying expressions with exponents, parentheses make an important difference.

$(-5)^2$ and -5^2 do not mean the same thing.

$(-5)^2$ means $(-5)(-5) = 25$.

-5^2 means the opposite of $5 \cdot 5$, or −25.

Only with parentheses is the −5 squared.

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Example 4

Simplify.

$$\frac{-8(3)}{-4} = \frac{-24}{-4}$$

$$= 6$$

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Example 6

Simplify.

$$24+19+(-3)^2 = 24+19+9$$

$$= 43+9 \qquad \text{Add from right to left.}$$

$$= 52$$

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Example 8

Simplify $4(5-2)+4^2$.

$$4(5-2)+4^2 = 4(3)+4^2$$ Simplify inside parentheses.

$$= 4(3)+16$$ Write 4^2 as 16.

$$= 12+16$$ Multiply.

$$= 28$$ Add.

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Example 9 (1 of 2)

Simplify.

$$-5^2 + (-7)^2 - 1^3 = -25 + 49 - 1$$

$$= 24 - 1$$

$$= 23$$

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Example 9 (2 of 2)

Simplify.

$$4(6-9)+(-6)-\sqrt{49} = 4(-3)+(-6)-7$$

$$= -12+(-6)-7$$

$$= -18-7$$

$$= -25$$

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Example 10

Simplify.

$$-3\left[-5+2(-4+5)\right]-6.3 = -3\left[-5+2(1)\right]-6.3$$

$$= -3\left[-5+2\right]-6.3$$

$$= -3(-3)-6.3$$

$$= 9-6.3$$

$$= 2.7$$

[AU: ok to use decimals? Chapter is about integers.]

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Example 11

Evaluate $9x^2 + 12$ for $x = -3$.

Replace x with -3 in $9x^2 + 12$.

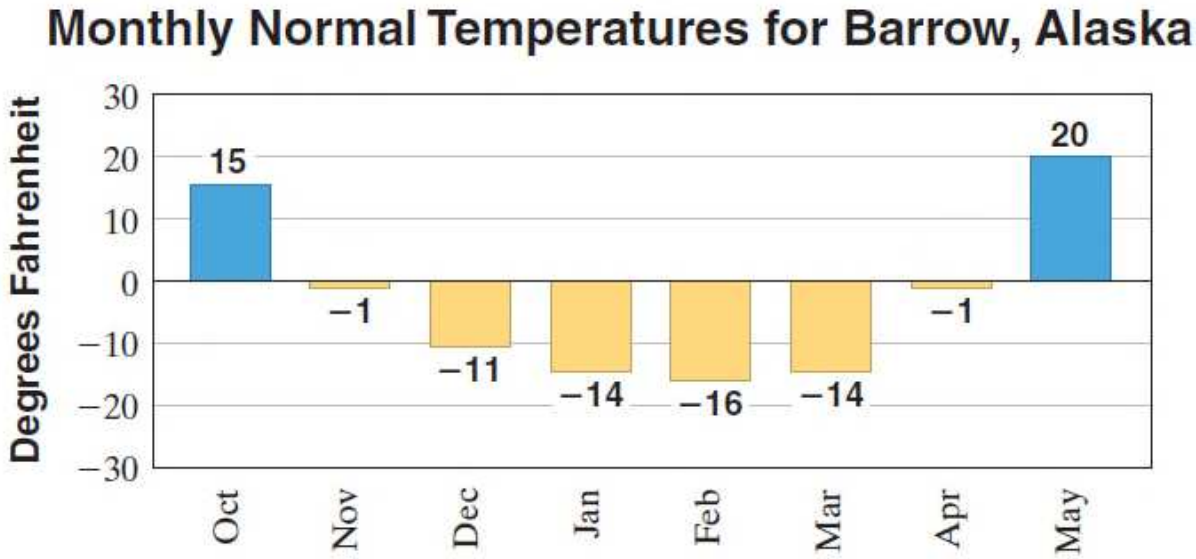
$$\begin{aligned} 9x^2 + 12 &= 9(-3)^2 + 12 \\ &= 9 \cdot 9 + 12 \\ &= 8 + 12 \\ &= 93 \end{aligned}$$

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Example 15 (1 of 2)

The graph shows the monthly normal temperatures for Barrow, Alaska. Use this graph to find the average of the temperatures for the months January through May.



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Example 15 (2 of 2)

$$\text{average} = \frac{-14 + (-16) + (-14) + (-1) + 20}{5}$$

There are 5 months from January through May.

$$= \frac{-25}{5}$$

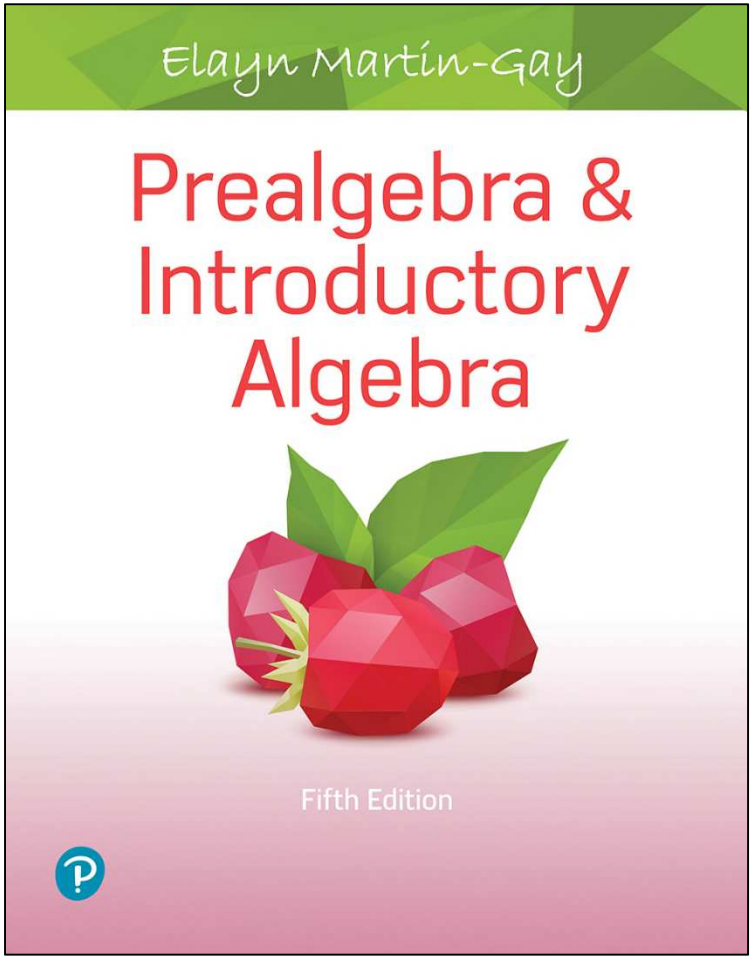
$$= -5$$

The average of the temperatures is -5°F.

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Section 2.6 Solving Equations: The Addition and Multiplication Properties

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Objectives

A. Identify Solutions of Equations.

B. Use the Addition Property of Equality to Solve Equations.

C. Use the Multiplication Property of Equality to Solve Equations.

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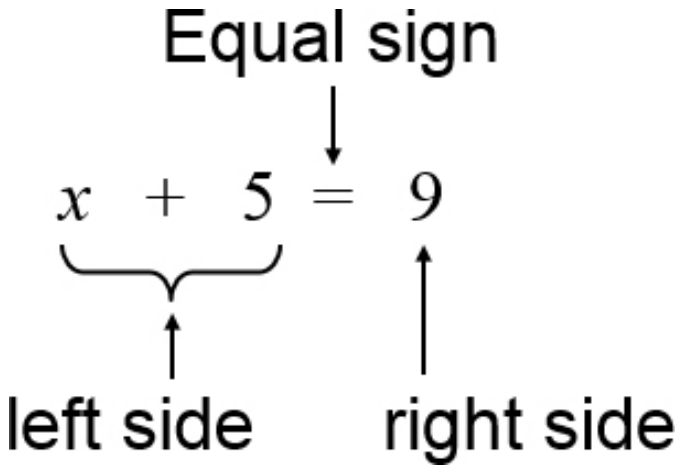
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Equations

Statements like 5 + 2 = 7 are called **equations**.

An equation is of the form **expression = expression**.

An equation can be labeled as



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Solutions of Equations

When an equation contains a variable, deciding which values of the variable make an equation a true statement is called **solving** an equation for the variable.

A **solution** of an equation is a value for the variable that makes an equation a true statement.

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Example 1

Determine whether −2 is a solution of $2y+1=-3$

Replace y with −2 in the equation.

$$2y+1=-3$$

$$2(-2)+1 \stackrel{?}{=} -3$$

$$-4+1 \stackrel{?}{=} -3$$

$$-3=-3 \quad \text{True}$$

Since −3 = −3 is a true statement, −2 is a solution of the equation.

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Solving Equations

To solve an equation, we will use properties of equality to write simpler equations, all equivalent to the original equation, until the final equation has the form

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

Equivalent equations have the **same solution**.

The word "number" above represents the solution of the original equation.

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Addition Property of Equality

Let *a*, *b*, and *c* represent numbers.
If $a = b$, then

$$a + c = b + c$$

and

$$a - c = b - c$$

In other words, the same number may be added to or subtracted from both sides of an equation without changing the solution of the equation.

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Example 2 (1 of 2)

Solve: $x - 4 = 3$ for x.

To solve the equation for x, we need to rewrite the equation in the form

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

To do so, we add 4 to both sides of the equation.

$$x - 4 = 3$$

$$x - 4 + 4 = 3 + 4 \qquad \text{Add 4 to both sides.}$$

$$x = 7 \qquad \text{Simplify.}$$

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Example 2 (2 of 2)

To check, replace x with 7 in the original equation.

$$x - 4 = 3 \qquad \text{Original equation}$$

$$7 - 4 \overset{?}{=} 3 \qquad \text{Replace } x \text{ with } 7.$$

$$3 = 3 \qquad \text{True.}$$

Since 3 = 3 is a true statement, 7 is the **solution** of the equation.

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Helpful Hint

Remember to check the solution in the original equation to see that it makes the equation a true statement.

Remember that we can get the variable alone on either side of the equation. For example, the equations

$$x = 3 \quad \text{and} \quad 3 = x$$

both have a solution of 3.

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Example 3

Solve: $-2 = z + 8$

To solve the equation for z, we need to subtract 8 from both sides of the equation.

$$-2 - 8 = z + 8 - 8$$

$$-10 = z + 0$$

$$-10 = z$$

The check is left to the student.

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Multiplication Property of Equality

Let *a*, *b*, and *c* represent numbers and let $c \neq 0$.

If $a = b$, then

$$a \cdot c = b \cdot c \text{ and } \frac{a}{c} = \frac{b}{c}$$

In other words, both sides of an equation may be multiplied or divided by the same nonzero number without changing the solution of the equation.

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Example 5 (1 of 2)

Solve: $4x = 8$

To solve the equation for *x*, notice that 4 is multiplied by *x*.

To get *x* alone, we divide both sides of the equation by 4 and then simplify.

$$\frac{4x}{4} = \frac{8}{4}$$

$$1 \cdot x = 2 \text{ or } x = 2$$

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Example 5 (2 of 2)

To **check**, replace x with 2 in the original equation.

$$4x = 8 \qquad \text{Original equation}$$

$$4 \cdot 2 \stackrel{?}{=} 8 \qquad \text{Let } x = 2.$$

$$8 = 8 \qquad \text{True.}$$

The **solution** is 2.

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Example 8

Solve: $\frac{x}{-4} = 7$

$$\frac{x}{-4} = 7$$

$$-4 \cdot \frac{x}{-4} = 7 \cdot (-4)$$

$$x = -28$$

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