

INSTRUCTOR'S
SOLUTIONS MANUAL

BEVERLY FUSFIELD

PREALGEBRA


SIXTH EDITION

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PRETEST: WHOLE NUMBERS COMPUTATION

Adding Whole Numbers

1.
$$\begin{array}{r} 1 \\ 368 \\ + 22 \\ \hline 390 \end{array}$$
2.
$$\begin{array}{r} 1 \\ 7\ 093 \\ + 6\ 073 \\ \hline 13,166 \end{array}$$
3.
$$\begin{array}{r} 111 \\ 85 \\ + 2968 \\ \hline 3053 \end{array}$$
4.
$$\begin{array}{r} 11\ 12 \\ 57,208 \\ 915 \\ + 59,387 \\ \hline 117,510 \end{array}$$
5. $714 + 3728 + 9 + 683,775$

$$\begin{array}{r} 2\ 12 \\ 714 \\ 3\ 728 \\ 9 \\ + 683,775 \\ \hline 688,226 \end{array}$$

Subtracting Whole Numbers

1.
$$\begin{array}{r} 312 \\ \cancel{4}26 \\ - 76 \\ \hline 350 \end{array}$$
2.
$$\begin{array}{r} 213418 \\ \cancel{3}3\cancel{5}8 \\ - 2729 \\ \hline 629 \end{array}$$
3.
$$\begin{array}{r} 9\ 15\ 9 \\ 2\cancel{1}0\ \cancel{3}\cancel{1}0\cancel{1}2 \\ \cancel{3}0,\ \cancel{6}0\ \cancel{2} \\ - 5\ 7\ 0\ 8 \\ \hline 2\ 4,\ 8\ 9\ 4 \end{array}$$
4. $4006 - 97$

$$\begin{array}{r} 9\ 9 \\ 3\cancel{1}0\cancel{1}0\cancel{1}6 \\ \cancel{4}0\ \cancel{0} \cancel{0} \\ - 9\ 7 \\ \hline 3909 \end{array}$$

5. $679,420 - 88,033$

$$\begin{array}{r} 11 \\ 517\ \cancel{3}\cancel{1}10 \\ \cancel{6}79,\ \cancel{4}2\ \cancel{0} \\ - 88,033 \\ \hline 591,387 \end{array}$$

Multiplying Whole Numbers

1. $3 \times 3 \times 0 \times 6 = 0$ because 0 times any number is 0.
2.
$$\begin{array}{r} 52 \\ 3841 \\ \times 7 \\ \hline 26,887 \end{array}$$
3. $(520)(3000)$

$$\begin{array}{r} 520 \\ \times 3000 \\ \hline 1,560,000 \end{array}$$
4.
$$\begin{array}{r} 71 \\ \times 26 \\ \hline 426 \leftarrow 6 \times 71 \\ 142 \leftarrow 2 \times 71 \\ \hline 1846 \end{array}$$
5. Multiply 359 and 48.

$$\begin{array}{r} 23 \\ \cancel{4}7 \\ 359 \\ \times 48 \\ \hline 2872 \leftarrow 8 \times 359 \\ 1436 \leftarrow 4 \times 359 \\ \hline 17,232 \end{array}$$

6. 853×609

$$\begin{array}{r} 531 \\ \cancel{7}4\cancel{2} \\ 853 \\ \times 609 \\ \hline 7677 \leftarrow 9 \times 853 \\ 51180 \leftarrow 60 \times 853 \\ \hline 519,477 \end{array}$$

Dividing Whole Numbers

1.
$$\begin{array}{r} 2\ 3 \\ 3\overline{)69} \\ \underline{6} \\ 9 \\ \underline{9} \\ 0 \end{array}$$

2 Pretest: Whole Numbers Computation

2. $12 \div 0$ is undefined; you can't divide by 0.

3.
$$\begin{array}{r} 25,036 \\ 4 \overline{) 6259} \\ \underline{24} \\ 10 \\ \underline{8} \\ 23 \\ \underline{20} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

4.
$$\begin{array}{r} 807 \\ 7 \overline{) 5655} \\ \underline{56} \\ 5 \\ \underline{0} \\ 55 \\ \underline{49} \\ 6 \end{array}$$

Answer: 807 **R6**

5.
$$\begin{array}{r} 34 \\ 52 \overline{) 1768} \\ \underline{156} \\ 208 \\ \underline{208} \\ 0 \end{array}$$

6. $45,000 \div 900$

$$\begin{array}{r} 50 \\ 900 \overline{) 45,000} \\ \underline{4500} \\ 00 \end{array}$$

7.
$$\begin{array}{r} 60 \\ 38 \overline{) 2300} \\ \underline{228} \\ 20 \\ \underline{0} \\ 20 \end{array}$$

Answer: 60 **R20**

8.
$$\begin{array}{r} 539 \\ 83 \overline{) 44,799} \\ \underline{415} \\ 329 \\ \underline{249} \\ 809 \\ \underline{747} \\ 62 \end{array}$$

Answer: 539 **R62**

CHAPTER 1 INTRODUCTION TO ALGEBRA: INTEGERS

1.1 Place Value

1.1 Margin Exercises

- The whole numbers are: 502; 3; 14; 0; 60,005
 - The 8 in 45,628,665 is in the thousands place.
 - The 8 in 800,503,622 is in the hundred-millions place.
 - The 8 in 428,000,000,000 is in the billions place.
 - The 8 in 2,835,071 is in the hundred-thousands place.
 - 23,605 in words: twenty-three thousand, six hundred five.
 - 400,033,007 in words: four hundred *million*, thirty-three *thousand*, seven.
 - 193,080,102,000,000 in words: one hundred ninety-three *trillion*, eighty *billion*, one hundred two *million*.
 - Eighteen million, two thousand, three hundred five
The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{018}, \underline{002}, \underline{305} = 18,002,305$
 - Two hundred billion, fifty million, six hundred sixteen
The first group name is *billion*, so you need to fill *four groups* of three digits.
 $\underline{200}, \underline{050}, \underline{000}, \underline{616} = 200,050,000,616$
 - Five trillion, forty-two billion, nine million
The first group name is *trillion*, so you need to fill *five groups* of three digits.
 $\underline{005}, \underline{042}, \underline{009}, \underline{000}, \underline{000} = 5,042,009,000,000$
 - Three hundred six million, seven hundred thousand, nine hundred fifty-nine
The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{306}, \underline{700}, \underline{959} = 306,700,959$
- #### 1.1 Section Exercises
- False; we can also use the digit 0.
 - True; 16,565, 2, 0, and 400 are whole numbers.
 - True; none of the numbers are whole numbers.
 - False; the left-most 7 has a value of 7 ten-thousands; the right-most 7 has a value of 7 tens.
 - The whole numbers are: 15; 0; 83,001
 - The whole numbers are: 457; 0; 6
 - The whole numbers are: 7; 362,049
 - The whole numbers are: 75,039; 4
 - The 2 in 61,284 is in the hundreds place.
 - The 2 in 82,110 is in the thousands place.
 - The 2 in 284,100 is in the hundred-thousands place.
 - The 2 in 823,415 is in the ten-thousands place.
 - The 2 in 725,837,166 is in the ten-millions place.
 - The 2 in 442,653,199 is in the millions place.
 - The 2 in 253,045,701,000 is in the hundred-billions place.
 - The 2 in 823,000,419,567 is in the ten-billions place.
 - Name the place value for each zero in
302,016,450,098,570.
From left to right: ten-trillions, hundred-billions, millions, hundred-thousands, and ones.
 - Name the place value for each zero in
810,704,069,809,035.
From left to right: trillions, ten-billions, hundred-millions, ten-thousands, and hundreds.
 - 8421 in words: eight thousand, four hundred twenty-one.
 - 1936 in words: one thousand, nine hundred thirty-six.
 - 46,205 in words: forty-six thousand, two hundred five.
 - 75,089 in words: seventy-five thousand, eighty-nine.
 - To write 3,064,801 in words, start at the left: three million, sixty-four thousand, eight hundred one. Do **not** write "eight hundred *and* one" at the end. Use "and" only when there is a decimal point in the number.

4 Chapter 1 Introduction to Algebra: Integers

24. 7,900,408 in words: seven million, nine hundred thousand, four hundred eight.
 The first group name is *billion*, so you need to fill *four groups* of three digits.
 $\underline{012}, \underline{417}, \underline{625}, \underline{310} = 12,417,625,310$
25. 840,111,003 in words: eight hundred forty million, one hundred eleven thousand, three.
26. 304,008,401 in words: three hundred four million, eight thousand, four hundred one.
27. 51,006,888,321 in words: fifty-one billion, six million, eight hundred eighty-eight thousand, three hundred twenty-one.
 The first group name is *billion*, so you need to fill *four groups* of three digits.
 $\underline{075}, \underline{869}, \underline{488}, \underline{506} = 75,869,488,506$
28. 99,046,733,214 in words: ninety-nine billion, forty-six million, seven hundred thirty-three thousand, two hundred fourteen.
29. 3,000,712,000,000 in words: three trillion, seven hundred twelve million.
 The first group name is *trillion*, so you need to fill *five groups* of three digits:
 trillions, billions, millions, thousands, and ones.
 $\underline{600}, \underline{000}, \underline{071}, \underline{000}, \underline{400}$
 There are no billions or thousands, so fill those groups with zeros.
 The number is 600,000,071,000,400.
30. 50,918,000,000,600 in words: fifty trillion, nine hundred eighteen billion, six hundred.
31. Forty-six thousand, eight hundred five
 The first group name is *thousand*, so you need to fill *two groups* of three digits.
 $\underline{046}, \underline{805} = 46,805$
32. Seventy-nine thousand, forty-six
 The first group name is *thousand*, so you need to fill *two groups* of three digits.
 $\underline{079}, \underline{046} = 79,046$
33. Five million, six hundred thousand, eighty-two
 The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{005}, \underline{600}, \underline{082} = 5,600,082$
34. One million, thirty thousand, five
 The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{001}, \underline{030}, \underline{005} = 1,030,005$
35. Two hundred seventy-one million, nine hundred thousand
 The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{271}, \underline{900}, \underline{000} = 271,900,000$
36. Three hundred eleven million, four hundred
 The first group name is *million*, so you need to fill *three groups* of three digits.
 $\underline{311}, \underline{000}, \underline{400} = 311,000,400$
37. Twelve billion, four hundred seventeen million, six hundred twenty-five thousand, three hundred ten
 The first group name is *billion*, so you need to fill *four groups* of three digits.
 $\underline{012}, \underline{417}, \underline{625}, \underline{310} = 12,417,625,310$
38. Seventy-five billion, eight hundred sixty-nine million, four hundred eighty-eight thousand, five hundred six
 The first group name is *billion*, so you need to fill *four groups* of three digits.
 $\underline{075}, \underline{869}, \underline{488}, \underline{506} = 75,869,488,506$
39. Six hundred trillion, seventy-one million, four hundred
 The first group name is *trillion*, so you need to fill *five groups* of three digits:
 trillions, billions, millions, thousands, and ones.
 $\underline{600}, \underline{000}, \underline{071}, \underline{000}, \underline{400}$
 There are no billions or thousands, so fill those groups with zeros.
 The number is 600,000,071,000,400.
40. Four hundred forty trillion, thirty-six thousand, one hundred two
 The first group name is *trillion*, so you need to fill *five groups* of three digits.
 $\underline{440}, \underline{000}, \underline{000}, \underline{036}, \underline{102} = 440,000,000,036,102$
41. 9641 in words: nine thousand, six hundred forty-one
42. 2367 in words: two thousand, three hundred sixty-seven
43. \$130,100,000 in words: one hundred thirty million, one hundred thousand
44. 669,360,000 in words: six hundred sixty-nine million, three hundred sixty thousand
45. \$79,200,000,000 in words: seventy-nine billion, two hundred million
46. \$33,400,000,000 in words: thirty-three billion, four hundred million
47. Seventy-four million, fifty-nine thousand: The first group is *millions*, so you need to fill *three groups* of three digits.
 $\underline{074}, \underline{059}, \underline{000}$
 There are no ones, so fill the ones group with zeros.
 The number is 74,059,000.
48. Four million, one hundred sixty-seven thousand, thirty-four is 4,167,034.

- 49. 3,005,000 in words: three million, five thousand
- 50. 2,401,333 in words: two million, four hundred one thousand, three hundred thirty-three
- 51. Fifteen million is 15,000,000.
Five billion, four hundred seventy-five million is 5,475,000,000.
- 52. Four hundred million is 400,000,000.
One hundred forty-six billion is 146,000,000,000.

Relating Concepts (Exercises 53–56)

- 53. To make the largest possible whole number, arrange the digits from largest to smallest.
97651100 → 97,651,100
In words: ninety-seven million, six hundred fifty-one thousand, one hundred.
To make the smallest possible whole number, arrange the numbers from smallest to largest with one exception: because we must use all the digits, start with the smallest nonzero digit.
10015679 → 10,015,679
In words: ten million, fifteen thousand, six hundred seventy-nine.

54. Answers will vary.

55.

sixty-fours	thirty-twos	sixteens	eights	fours	twos	ones
1	1	1	1	1	1	1

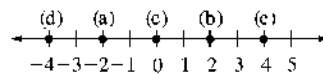
- (a) $5 = 4 + 1 =$ binary 101
 - (b) $10 = 8 + 2 =$ binary 1010
 - (c) $15 = 8 + 4 + 2 + 1 =$ binary 1111
56. (a) Answers will vary but should mention that the location or place in which a digit is written gives it a different value.
- (b) $8 = 5 + 3 =$ VIII
 $38 = 30 + 5 + 3 =$ XXXVIII
 $275 = 200 + 50 + 20 + 5 =$ CCLXXV
 $3322 = 3000 + 300 + 20 + 2 =$ MMMCCCXXII
 - (c) The Roman system is *not* a place value system because no matter what place it's in, M = 1000, C = 100, etc. One disadvantage is that it takes much more space to write many large numbers; another is that there is no symbol for zero.

1.2 Introduction to Integers

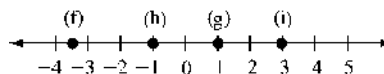
1.2 Margin Exercises

- 1. (a) "Below zero" implies a negative number:
 $-5\frac{1}{2}$ degrees
- (b) "Lost 12 pounds" implies a negative number:
 -12 pounds
- (c) "Deposit" implies a positive number:
 $+\$210.35$ or $\$210.35$
- (d) "Overdrawn" implies a negative number:
 $-\$65$
- (e) "Below the surface of the sea" implies a negative number: -100 feet
- (f) "Won 50 points" implies a positive number:
 $+50$ points or 50 points

- 2. (a) -2 (b) 2 (c) 0 (d) -4 (e) 4





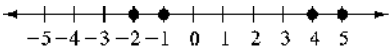
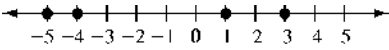
- (f) $-3\frac{1}{2}$ (g) 1 (h) -1 (i) 3



- 3. (a) 5 is to the right of 4 on the number line, so 5 is greater than 4. Write $5 > 4$.
 - (b) 0 is to the left of 2 on the number line, so 0 is less than 2. Write $0 < 2$.
 - (c) -3 is to the left of -2 on the number line, so -3 is less than -2 . Write $-3 < -2$.
 - (d) -1 is to the right of -4 on the number line, so -1 is greater than -4 . Write $-1 > -4$.
 - (e) 2 is to the right of -2 on the number line, so 2 is greater than -2 . Write $2 > -2$.
 - (f) -5 is to the left of 1 on the number line, so -5 is less than 1. Write $-5 < 1$.
- 4. (a) $|13| = 13$ because the distance from 0 to 13 on the number line is 13 spaces.
 - (b) $|-7| = 7$ because the distance from 0 to -7 on the number line is 7 spaces.
 - (c) $|0| = 0$ because the distance from 0 to 0 on the number line is 0 spaces.
 - (d) $|-350| = 350$ because the distance from 0 to -350 on the number line is 350 spaces.
 - (e) $|6000| = 6000$ because the distance from 0 to 6000 on the number line is 6000 spaces.

6 Chapter 1 Introduction to Algebra: Integers

1.2 Section Exercises

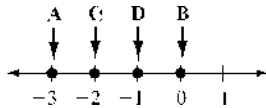
- "Above sea level" implies a positive number.
+29,029 feet or 29,029 feet
- "Below the surface" implies a negative number.
-5353 feet
- "Below zero" implies a negative number.
-135.8 degrees
- +98.6 degrees or 98.6 degrees
- "Lost a total of 18 yards" implies a negative number: -18 yards
- "Gained 25 yards" implies a positive number.
+25 yards or 25 yards
- "Won \$100" implies a positive number.
+\$100 or \$100
- Overdrawn bank account implies a negative number: -\$37
- "Lost $6\frac{1}{2}$ pounds" implies a negative number.
 $-6\frac{1}{2}$ pounds
- "Gained $2\frac{1}{2}$ ounces" implies a positive number.
 $+2\frac{1}{2}$ ounces or $2\frac{1}{2}$ ounces
- Graph -3, 3, 0, -5

- Graph -2, 2, 0, 5

- Graph -1, 4, -2, 5

- Graph 3, -4, 1, -5

- (a) $0 < 5$ in words: zero is less than five, or, zero is less than positive five
 (b) $-10 > -17$ in words: negative ten is greater than negative seventeen
- (a) $3 > -7$ in words: three is greater than negative seven, or, positive three is greater than negative seven
 (b) $12 < 22$ in words: twelve is less than twenty-two, or, positive twelve is less than positive twenty-two
- 10 is to the *right* of 2 on the number line, so 10 is *greater than* 2. Write $10 > 2$.

- 6 is to the *right* of 0 on the number line, so 6 is *greater than* 0. Write $6 > 0$.
- 1 is to the *left* of 0 on the number line, so -1 is *less than* 0. Write $-1 < 0$.
- 3 is to the *left* of -1 on the number line, so -3 is *less than* -1. Write $-3 < -1$.
- 10 is to the *left* of 2 on the number line, so -10 is *less than* 2. Write $-10 < 2$.
- 9 is to the *left* of 7 on the number line, so -9 is *less than* 7. Write $-9 < 7$.
- 3 is to the *right* of -6 on the number line, so -3 is *greater than* -6. Write $-3 > -6$.
- 0 is to the *right* of -1 on the number line, so 0 is *greater than* -1. Write $0 > -1$.
- 10 is to the *left* of -2 on the number line, so -10 is *less than* -2. Write $-10 < -2$.
- 1 is to the *right* of -5 on the number line, so -1 is *greater than* -5. Write $-1 > -5$.
- 0 is to the *right* of -8 on the number line, so 0 is *greater than* -8. Write $0 > -8$.
- 6 is to the *right* of -4 on the number line, so 6 is *greater than* -4. Write $6 > -4$.
- 10 is to the *right* of -2 on the number line, so 10 is *greater than* -2. Write $10 > -2$.
- 2 is to the *left* of 1 on the number line, so -2 is *less than* 1. Write $-2 < 1$.
- 4 is to the *left* of 4 on the number line, so -4 is *less than* 4. Write $-4 < 4$.
- 9 is to the *right* of -9 on the number line, so 9 is *greater than* -9. Write $9 > -9$.
- $|15| = 15$ because the distance from 0 to 15 on the number line is 15 spaces.
- $|10| = 10$ because the distance from 0 to 10 on the number line is 10 spaces.
- $|-3| = 3$ because the distance between 0 and -3 on the number line is 3 spaces.
- $|-8| = 8$ because the distance from 0 to -8 on the number line is 8 spaces.
- $|0| = 0$ because the distance from 0 to 0 on the number line is 0 spaces.
- $|100| = 100$ because the distance from 0 to 100 on the number line is 100 spaces.

39. $|200| = 200$ because the distance between 0 and 200 on the number line is 200 spaces.
40. $|-99| = 99$ because the distance from 0 to -99 on the number line is 99 spaces.
41. $|-75| = 75$ because the distance between 0 and -75 on the number line is 75 spaces.
42. $|-6320| = 6320$ because the distance from 0 to -6320 on the number line is 6320 spaces.
43. $|-8042| = 8042$ because the distance between 0 and -8042 on the number line is 8042 spaces.
44. $|0| = 0$ because the distance from 0 to 0 on the number line is 0 spaces.

Relating Concepts (Exercises 45–48)

45. Graph -3 as A, 0 as B, -2 as C, and -1 as D.



46. From Exercise 45, in order from lowest to highest: $-3, -2, -1, 0$
47. A: -3 is in the Below -2.5 range. This patient has osteoporosis.
 B: 0 is in the Above -1 range. This patient is normal.
 C: -2 is in the -1 to -2.5 range. This patient is at risk for developing osteoporosis.
 D: -1 is in the -1 to -2.5 range. This patient is at risk for developing osteoporosis.
48. (a) A patient who did not understand the importance of the negative sign would think the interpretation of -3 was "above normal" (range Above -1) and wouldn't get treatment.
 (b) For Patient B's score of 0 , the sign plays no role. Zero is neither positive nor negative.

1.3 Adding Integers

1.3 Margin Exercises

1. (a) $-2 + (-2) = -4$
 (b) $2 + 2 = 4$
 (c) $-10 + (-1) = -11$
 (d) $10 + 1 = 11$
 (e) $-3 + (-7) = -10$
 (f) $3 + 7 = 10$

2. (a) $-6 + (-6)$ Adding *like* signed integers
Step 1 $|-6| = 6; |-6| = 6$; Add $6 + 6 = 12$
Step 2 Both numbers are negative, so the sum is negative.

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

- (b) $9 + 7$ Adding *like* signed integers
Step 1 $|9| = 9; |7| = 7$; Add $9 + 7 = 16$
Step 2 Both numbers are positive, so the sum is positive.

$$9 + 7 = 16$$

- (c) $-5 + (-10)$ Adding *like* signed integers
Step 1 $|-5| = 5; |-10| = 10$; Add $5 + 10 = 15$
Step 2 Both numbers are negative, so the sum is negative.

$$-5 + (-10) = -15$$

- (d) $-12 + (-4)$ Adding *like* signed integers
Step 1 $|-12| = 12; |-4| = 4$; Add $12 + 4 = 16$
Step 2 Both numbers are negative, so the sum is negative.

$$-12 + (-4) = -16$$

- (e) $13 + 2$ Adding *like* signed integers
Step 1 $|13| = 13; |2| = 2$; Add $13 + 2 = 15$
Step 2 Both numbers are positive, so the sum is positive.

$$13 + 2 = 15$$

3. (a) $-3 + 7$ Adding *unlike* signed integers
Step 1 $|-3| = \underline{3}; |7| = \underline{7}$; Subtract $7 - 3 = \underline{4}$
Step 2 7 has the larger absolute value and is positive, so the sum is positive.

$$-3 + 7 = +4 \text{ or } \underline{4}$$

- (b) $6 + (-12)$ Adding *unlike* signed integers
Step 1 $|6| = 6; |-12| = 12$; Subtract $12 - 6 = 6$
Step 2 -12 has the larger absolute value and is negative, so the sum is negative.

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

- (c) $12 + (-7)$ Adding *unlike* signed integers
Step 1 $|12| = 12; |-7| = 7$; Subtract $12 - 7 = 5$
Step 2 12 has the larger absolute value and is positive, so the sum is positive.

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

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(d) $-10 + 2$ Adding *unlike* signed integers

Step 1 $|-10| = 10$; $|2| = 2$; Subtract
 $10 - 2 = 8$

Step 2 -10 has the larger absolute value and is negative, so the sum is negative.

$$-10 + 2 = -8$$

(e) $5 + (-9)$ Adding *unlike* signed integers

Step 1 $|5| = 5$; $|-9| = 9$; Subtract $9 - 5 = 4$

Step 2 -9 has the larger absolute value and is negative, so the sum is negative.

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

4. (a) Starting temperature in the morning is -15 degrees. A rise of 21 degrees implies a positive number. A drop of 10 degrees implies a negative number.

$$\begin{aligned} -15 + 21 + (-10) \\ = 6 + (-10) \quad \text{Add left to right.} \\ = -4 \end{aligned}$$

The new temperature is 4 degrees below zero or -4 degrees.

(b) The beginning balance is \$60. Deposits imply positive numbers and payments imply negative numbers.

$$\begin{aligned} 60 + 85 + (-20) + (-75) \\ = 145 + (-20) + (-75) \quad \text{Add left to right.} \\ = 125 + (-75) \\ = 50 \end{aligned}$$

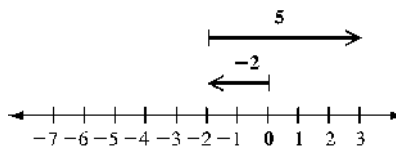
His account balance is \$50.

5. (a) $175 + 25 = 25 + 175$
Both sums are 200.
- (b) $7 + (-37) = -37 + 7$
Both sums are -30.
- (c) $-16 + 16 = 16 + (-16)$
Both sums are 0.
- (d) $-9 + (-41) = -41 + (-9)$
Both sums are -50.
6. (a) $-12 + 12 + (-19) = (-12 + 12) + (-19)$
 $= 0 + (-19)$
 $= -19$
- (b) $31 + (-75) + 75 = 31 + (-75 + 75)$
 $= 31 + 0$
 $= 31$
- (c) $1 + 9 + (-16) = (1 + 9) + (-16)$
 $= 10 + (-16)$
 $= -6$

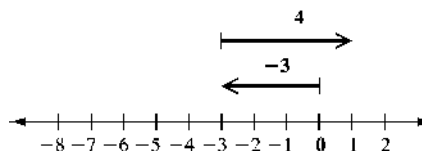
(d) $-38 + 5 + 25 = -38 + (5 + 25)$
 $= -38 + 30$
 $= -8$

1.3 Section Exercises

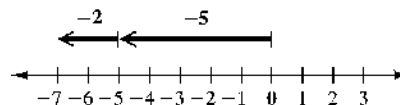
1. $-2 + 5 = +3$ or 3



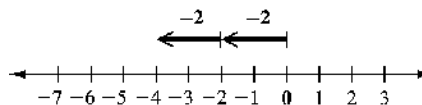
2. $-3 + 4 = +1$ or 1



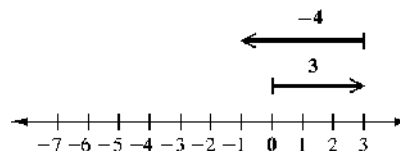
3. $-5 + (-2) = -7$



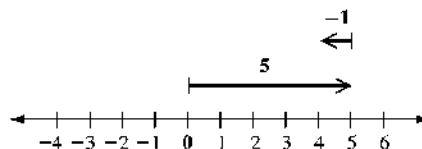
4. $-2 + (-2) = -4$



5. $3 + (-4) = -1$



6. $5 + (-1) = +4$ or 4



7. (a) $-5 + (-5)$
Adding *like* signed integers

Step 1 Add the absolute values.

$$|-5| = 5$$

Add $5 + 5$ to get 10.

Step 2 Both integers are negative, so the sum is negative.

$$-5 + (-5) = -10$$

(b) $5 + 5 = 10$ Adding *like* signed integers
Both addends are positive, so the sum is positive.

8. (a) $-9 + (-9) = -18$ (Both addends are negative, so the sum is negative.)
 (b) $9 + 9 = 18$
9. (a) $7 + 5 = 12$
 Adding *like* signed integers
 Both addends are positive, so the sum is positive.
 (b) $-7 + (-5) = -12$ Adding *like* signed integers
Step 1 Add the absolute values.
 $|-7| = 7$; $|-5| = 5$
 Add $7 + 5$ to get 12.
Step 2 Both integers are negative, so the sum is negative.
 $-7 + (-5) = -12$
10. (a) $3 + 6 = 9$
 (b) $-3 + (-6) = -9$ (Both addends are negative, so the sum is negative.)
11. (a) $-25 + (-25) = -50$
 Adding *like* signed integers
Step 1 Add the absolute values.
 $|-25| = 25$
 Add $25 + 25$ to get 50.
Step 2 Both integers are negative, so the sum is negative.
 $-25 + (-25) = -50$
 (b) $25 + 25 = 50$ Adding *like* signed integers
 Both addends are positive, so the sum is positive.
12. (a) $-30 + (-30) = -60$ (Both addends are negative, so the sum is negative.)
 (b) $30 + 30 = 60$
13. (a) $48 + 110 = 158$
 Adding *like* signed integers Both addends are positive, so the sum is positive.
 (b) $-48 + (-110) = -158$ Adding *like* signed integers
Step 1 Add the absolute values.
 $|-48| = 48$; $|-110| = 110$
 Add $48 + 110$ to get 158.
Step 2 Both numbers are negative, so the sum is negative.
 $-48 + (-110) = -158$
14. (a) $235 + 21 = 256$
 (b) $-235 + (-21) = -256$ (Both addends are negative, so the sum is negative.)
15. The absolute values are the same in each pair of answers, so the only difference in the sums is the common sign.
16. Add the absolute values and use the common sign as the sign of the sum.
17. (a) $-6 + 8$ Adding *unlike* signed integers
Step 1 $|-6| = 6$; $|8| = 8$
 Subtract $8 - 6$ to get 2.
Step 2 8 has the larger absolute value and is positive, so the sum is positive.
 $-6 + 8 = +2$ or 2
 (b) $6 + (-8)$ Adding *unlike* signed integers
Step 1 $|6| = 6$; $|-8| = 8$
 Subtract $8 - 6$ to get 2.
Step 2 -8 has the larger absolute value and is negative, so the sum is negative.
 $6 + (-8) = -2$
18. (a) $-3 + 7$ Adding *unlike* signed integers
Step 1 $|-3| = 3$; $|7| = 7$
 Subtract $7 - 3$ to get 4.
Step 2 7 has the larger absolute value and is positive, so the sum is positive.
 $-3 + 7 = +4$ or 4
 (b) $3 + (-7)$ Adding *unlike* signed integers
Step 1 $|3| = 3$; $|-7| = 7$
 Subtract $7 - 3$ to get 4.
Step 2 -7 has the larger absolute value and is negative, so the sum is negative.
 $3 + (-7) = -4$
19. (a) $-9 + 2$ Adding *unlike* signed integers
Step 1 $|-9| = 9$; $|2| = 2$
 Subtract $9 - 2$ to get 7.
Step 2 -9 has the larger absolute value and is negative, so the sum is negative.
 $-9 + 2 = -7$
 (b) $9 + (-2)$ Adding *unlike* signed integers
Step 1 $|9| = 9$; $|-2| = 2$
 Subtract $9 - 2$ to get 7.
Step 2 9 has the larger absolute value and is positive, so the sum is positive.
 $9 + (-2) = +7$ or 7

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20. (a) $-8 + 7$ Adding *unlike* signed integers

Step 1 $|-8| = 8$; $|7| = 7$
Subtract $8 - 7$ to get 1.

Step 2 -8 has the larger absolute value and is negative, so the sum is negative.
 $-8 + 7 = -1$

- (b) $8 + (-7)$ Adding *unlike* signed integers

Step 1 $|8| = 8$; $|-7| = 7$
Subtract $8 - 7$ to get 1.

Step 2 8 has the larger absolute value and is positive, so the sum is positive.
 $8 + (-7) = +1$ or 1

21. (a) $20 + (-25)$ Adding *unlike* signed integers

Step 1 $|20| = 20$; $|-25| = 25$
Subtract $25 - 20$ to get 5.

Step 2 -25 has the larger absolute value and is negative, so the sum is negative.
 $20 + (-25) = -5$

- (b) $-20 + 25$ Adding *unlike* signed integers

Step 1 $|-20| = 20$; $|25| = 25$
Subtract $25 - 20$ to get 5.

Step 2 25 has the larger absolute value and is positive, so the sum is positive.
 $-20 + 25 = +5$ or 5

22. (a) $30 + (-40)$ Adding *unlike* signed integers

Step 1 $|30| = 30$; $|-40| = 40$
Subtract $40 - 30$ to get 10.

Step 2 -40 has the larger absolute value and is negative, so the sum is negative.
 $30 + (-40) = -10$

- (b) $-30 + 40$ Adding *unlike* signed integers

Step 1 $|-30| = 30$; $|40| = 40$
Subtract $40 - 30$ to get 10.

Step 2 40 has the larger absolute value and is positive, so the sum is positive.
 $-30 + 40 = +10$ or 10

23. (a) $200 + (-50)$ Adding *unlike* signed integers

Step 1 $|200| = 200$; $|-50| = 50$
Subtract $200 - 50$ to get 150.

Step 2 200 has the larger absolute value and is positive, so the sum is positive.
 $200 + (-50) = +150$ or 150

- (b) $-200 + 50$ Adding *unlike* signed integers

Step 1 $|-200| = 200$; $|50| = 50$
Subtract $200 - 50$ to get 150.

Step 2 -200 has the larger absolute value and is negative, so the sum is negative.
 $-200 + 50 = -150$

24. (a) $150 + (-100)$ Adding *unlike* signed integers

Step 1 $|150| = 150$; $|-100| = 100$
Subtract $150 - 100$ to get 50.

Step 2 150 has the larger absolute value and is positive, so the sum is positive.
 $150 + (-100) = +50$ or 50

- (b) $-150 + 100$ Adding *unlike* signed integers

Step 1 $|-150| = 150$; $|100| = 100$
Subtract $150 - 100$ to get 50.

Step 2 -150 has the larger absolute value and is negative, so the sum is negative.
 $-150 + 100 = -50$

25. Each pair of answers differs only in the sign of the answer. This occurs because the signs of the addends are reversed.

26. Subtract the lesser absolute value from the greater absolute value. Use the sign of the number with the greater absolute value as the sign of the sum.

27. $-8 + 5$ Adding *unlike* signed integers

Step 1 $|-8| = 8$; $|5| = 5$
Subtract $8 - 5$ to get 3.

Step 2 -8 has the larger absolute value and is negative, so the sum is negative.
 $-8 + 5 = -3$

28. $-3 + 2 = -1$

29. $-1 + 8$ Adding *unlike* signed integers

Step 1 $|-1| = 1$; $|8| = 8$
Subtract $8 - 1$ to get 7.

Step 2 8 has the larger absolute value and is positive, so the sum is positive.
 $-1 + 8 = +7$ or 7

30. $-4 + 10 = +6$ or 6

31. $-2 + (-5)$ Adding *like* signed integers

Step 1 $|-2| = 2$; $|-5| = 5$

Add $2 + 5$ to get 7.**Step 2** Both integers are negative, so the sum is negative.

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

32. $-7 + (-3) = -10$

33. $6 + (-5)$ Adding *unlike* signed integers

Step 1 $|6| = 6$; $|-5| = 5$

Subtract $6 - 5$ to get 1.**Step 2** 6 has the larger absolute value and is positive, so the sum is positive.

$$6 + (-5) = +1 \text{ or } 1$$

34. $11 + (-3) = +8$ or 8

35. $4 + (-12)$ Adding *unlike* signed integers

Step 1 $|4| = 4$; $|-12| = 12$

Subtract $12 - 4$ to get 8.**Step 2** -12 has the larger absolute value and is negative, so the sum is negative.

$$4 + (-12) = -8$$

36. $9 + (-10) = -1$

37. $-10 + (-10)$ Adding *like* signed integers

Step 1 $|-10| = 10$; $|-10| = 10$

Add $10 + 10$ to get 20.**Step 2** Both integers are negative, so the sum is negative.

$$-10 + (-10) = -20$$

38. $-5 + (-20) = -25$

39. $-17 + 0 = -17$

Adding zero to any number leaves the number unchanged.

40. $0 + (-11) = -11$

41. $1 + (-23)$ Adding *unlike* signed integers

Step 1 $|1| = 1$; $|-23| = 23$

Subtract $23 - 1$ to get 22.**Step 2** -23 has the larger absolute value and is negative, so the sum is negative.

$$1 + (-23) = -22$$

42. $13 + (-1) = +12$ or 12

43.
$$\begin{aligned} & \underbrace{-2 + (-12)} + (-5) \\ &= \underbrace{-14 + (-5)} \quad \text{Add left to right.} \\ &= \underline{-19} \end{aligned}$$

44.
$$\begin{aligned} & \underbrace{-16 + (-1)} + (-3) \\ &= \underbrace{-17 + (-3)} \quad \text{Add left to right.} \\ &= \underline{-20} \end{aligned}$$

45.
$$\begin{aligned} & 8 + 6 + (-8) \\ &= 8 + (-8) + 6 \quad \text{Commute addends.} \\ &= 0 + 6 \quad \text{Add left to right.} \\ &= 6 \end{aligned}$$

46.
$$\begin{aligned} & -5 + 2 + 5 \\ &= -5 + 5 + 2 \quad \text{Commute addends.} \\ &= 0 + 2 \quad \text{Add left to right.} \\ &= 2 \end{aligned}$$

47.
$$\begin{aligned} & -7 + 6 + (-4) \\ &= -1 + (-4) \quad \text{Add left to right.} \\ &= -5 \end{aligned}$$

48.
$$\begin{aligned} & -9 + 8 + (-2) \\ &= -1 + (-2) \quad \text{Add left to right.} \\ &= -3 \end{aligned}$$

49. Add from left to right.
$$\begin{aligned} & -3 + (-11) + 14 \\ &= -14 + 14 \quad \text{First add } -3 + (-11). \\ &= 0 \quad \text{Add } -14 + 14. \end{aligned}$$

50.
$$\begin{aligned} & 15 + (-7) + (-8) \\ &= 8 + (-8) \quad \text{Add left to right.} \\ &= 0 \end{aligned}$$

51.
$$\begin{aligned} & 10 + (-6) + (-3) + 4 \\ &= 4 + (-3) + 4 \quad \text{Add left to right.} \\ &= 1 + 4 \\ &= 5 \end{aligned}$$

52.
$$\begin{aligned} & 2 + (-1) + (-9) + 12 \\ &= 1 + (-9) + 12 \quad \text{Add left to right.} \\ &= -8 + 12 \\ &= 4 \end{aligned}$$

53. Add from left to right.
$$\begin{aligned} & -7 + 28 + (-56) + 3 \\ &= 21 + (-56) + 3 \quad \text{First add } -7 + 28. \\ &= -35 + 3 \quad \text{Add } 21 + (-56). \\ &= -32 \quad \text{Add } -35 + 3. \end{aligned}$$

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54. $4 + (-37) + 29 + (-5)$
 $= -33 + 29 + (-5)$ *Add left to right.*
 $= -4 + (-5)$
 $= -9$

55. "Yards gained" are positive (+13), and "yards lost" are negative (-17).
 $13 + (-17) = -4$ yards
 The team lost 4 yards.

56. Temperature on Antarctic islands: -15°C .
 Temperature may "drop" another 60°C implies a negative change in temperature, -60°C .
 $-15 + (-60) = -75^{\circ}\text{C}$
 The interior temperature is -75°C .

57. The overdrawn amount is negative ($-\$62$), and the deposit amount is positive ($+\$50$).
 $-\$62 + \$50 = \underline{-\$12}$
 Nick is \$12 overdrawn.

58. Account Balance: $+\$100$
 Check written: $-\$73$
 Overdrawn charge: $-\$27$
 $\$100 + (-\$73) + (-\$27) = \$27 + (-\$27)$
 $= \$0$
 Her account balance is \$0.

59. \$88 stolen implies a loss of money or $-\$88$.
 Jay received \$35 back implies a gain of money or $+\$35$.
 $-\$88 + \$35 = -\$53$
 Jay's net loss was \$53.

60. Losing weight implies a negative and gaining weight implies a positive.
 $-4 + 2 + 3 = 1$
 Overall, Marion gained 1 pound.

61. First write Jeff's scores as a sum of integers. Then add from left to right.
 Jeff: $-20 + 75 + (-55)$
 $= 55 + (-55)$ *First add $-20 + 75$.*
 $= 0$ points *Add $55 + (-55)$.*
 Write Terry's scores as a sum of integers. Then add from left to right.
 Terry: $42 + (-15) + 20$
 $= 27 + 20$ *First add $42 + (-15)$.*
 $= 47$ points *Add $27 + 20$.*

62. Red River: $8 + (-3) + (-5)$
 $= 5 + (-5)$ *Add left to right.*
 $= 0$ feet

Mississippi: $4 + 7 + (-13)$
 $= 11 + (-13)$ *Add left to right.*
 $= -2$ feet

63. $-2 + 0 + 5 + (-5)$
 $= -2 + 5 + (-5)$ *Add left to right.*
 $= 3 + (-5)$
 $= -2$

Angela lost 2 pounds.

64. $-1 + 2 + (-6) + 0$
 $= 1 + (-6) + 0$ *Add left to right.*
 $= -5 + 0$
 $= -5$

Syshe lost 5 pounds.

65. $3 + (-2) + (-2) + 3$
 $= 1 + (-2) + 3$ *Add left to right.*
 $= -1 + 3$
 $= 2$

Brittany gained 2 pounds.

66. $1 + 1 + (-4) + 2$
 $= 2 + (-4) + 2$ *Add left to right.*
 $= -2 + 2$
 $= 0$

Nicole's weight was the same.

67. $\underbrace{-18 + (-5)}_{-23} = \underbrace{-5 + (-18)}_{-23}$ *Commutative property*

Both sums are -23 .

68. $\underbrace{-12 + 20}_{+8} = \underbrace{20 + (-12)}_{+8}$ *Commutative property*

Both sums are $+8$ or 8 .

69. $\underbrace{-4 + 15}_{+11} = \underbrace{15 + (-4)}_{+11}$ *Commutative property*

Both sums are $+11$ or 11 .

70. $\underbrace{17 + 1}_{+18} = \underbrace{1 + 17}_{+18}$ *Commutative property*

Both sums are $+18$ or 18 .

71. $6 + (-14) + 14$
 Option 1: $(6 + (-14)) + 14 = -8 + 14$
 $= 6$

Option 2: $6 + (-14 + 14) = 6 + 0$
 $= 6$

Option 2 is easier.

72. $-9 + 9 + (-8) = (-9 + 9) + (-8)$
 $= 0 + (-8)$
 $= -8$

73. $14 + 6 + (-7)$
 Option 1: $(14 + 6) + (-7) = 20 + (-7)$
 $= 13$

Option 2: $14 + (6 + (-7)) = 14 + (-1)$
 $= 13$

Option 1 might seem easier.

74. $-18 + 3 + 7 = -18 + (3 + 7)$
 $= -18 + 10$
 $= -8$

75. Answers will vary. Some possibilities are:
 $-6 + 0 = -6$; $10 + 0 = 10$; $0 + 3 = 3$

76. Answers will vary. Some possibilities are:
 $(1 + 2) + 3 = 1 + (2 + 3)$
 Both sums are 6.
 $(-5 + 0) + 4 = -5 + (0 + 4)$
 Both sums are -1.
 $(-15 + 6) + 9 = -15 + (6 + 9)$
 Both sums are 0.

77. Be sure to use the *negative* key as opposed to the *subtraction* key.

$$-7081 + 2965 = -4116$$

78. $-1398 + 3802 = 2404$

79. $-179 + (-61) + 8926 = 8686$

80. $36 + (-6215) + 428 = -5751$

81. When entering $-99,000$ on your calculator, be sure to use the *negative* key as opposed to the *subtraction* key.

$$86 + (-99,000) + 0 + 2837 = -96,077$$

82. $-16,719 + 0 + 8878 + (-14) = -7855$

1.4 Subtracting Integers

1.4 Margin Exercises

1. (a) The opposite of 5 is -5 . $5 + (-5) = 0$
- (b) The opposite of 48 is -48 . $48 + (-48) = 0$
- (c) The opposite of 0 is 0. $0 + 0 = 0$
- (d) The opposite of -1 is 1. $-1 + 1 = 0$
- (e) The opposite of -24 is 24. $-24 + 24 = 0$

2. (a) $-6 - 5$
 $= -6 + (-5)$
 $= -11$

Change subtraction to addition.
 Change 5 to -5 .

(b) $3 - (-10)$
 $= 3 + (+10)$
 $= 13$

Change subtraction to addition.
 Change -10 to $+10$.

(c) $-8 - (-2)$
 $= -8 + (+2)$
 $= -6$

Change subtraction to addition.
 Change -2 to $+2$.

(d) $0 - 10$
 $= 0 + (-10)$
 $= -10$

Change subtraction to addition.
 Change 10 to -10 .

(e) $-4 - (-12)$
 $= -4 + (+12)$
 $= 8$

Change subtraction to addition.
 Change -12 to $+12$.

(f) $9 - 7$
 $= 9 + (-7)$
 $= 2$

Change subtraction to addition.
 Change 7 to -7 .

3. (a) $6 - 7 + (-3)$
 $= \underbrace{6 + (-7)} + (-3)$
 $= \underbrace{-1} + (-3)$
 $= -4$

Change subt. to addition.
 Change 7 to -7 .
 Add left to right.

(b) $-2 + (-3) - (-5)$
 $= -2 + (-3) + (+5)$
 $= -5 + 5$
 $= 0$

Change subt. to addition.
 Change -5 to $+5$.
 Add left to right.

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(c) $7 - 7 - 7$

$$= 7 + (-7) + (-7)$$

Change all subtractions to additions.

$$= 0 + (-7)$$

Change 7 to -7.

$$= -7$$

Add left to right.

(d) $-3 - 9 + 4 - (-20)$

$$= -3 + (-9) + 4 + (+20)$$

$$= -12 + 4 + (+20)$$

$$= -8 + (+20)$$

$$= 12$$

1.4 Section Exercises

1. The opposite of 6 is -6 . $6 + (-6) = 0$

2. The opposite of -3 is 3. $-3 + 3 = 0$

3. The opposite of -13 is 13. $-13 + 13 = 0$

4. The opposite of 0 is 0. $0 + 0 = 0$

5. Valerie did not change the second number, 6, to its opposite, -6 .

Correct Method:

$$-6 - 6$$

$$= -6 + (-6)$$

Change subtraction to addition. Change 6 to -6 .

$$= -12$$

Add.

6. Victor changed the first number, -9 , to its opposite, but it should be left as it is. The correct answer is $-9 + (-5) = -14$.

7. $19 - 5$

$$= 19 + (-5)$$

Change subtraction to addition. Change 5 to -5 .

$$= \underline{14}$$

8. $24 - 11$

$$= 24 + (-11)$$

Change subtraction to addition. Change 11 to -11 .

$$= \underline{13}$$

9. $10 - 12$

$$= 10 + (-12)$$

Change subtraction to addition. Change 12 to -12 .

$$= -2$$

10. $1 - 8$

$$= 1 + (-8)$$

Change subtraction to addition. Change 8 to -8 .

$$= -7$$

11. $7 - 19$

$$= 7 + (-19)$$

Change subtraction to addition. Change 19 to -19 .

$$= -12$$

12. $2 - 17$

$$= 2 + (-17)$$

Change subtraction to addition. Change 17 to -17 .

$$= -15$$

13. $-15 - 10$

$$= -15 + (-10)$$

Change subtraction to addition.

$$= -25$$

Change 10 to -10 .

14. $-10 - 4$

$$= -10 + (-4)$$

Change subtraction to addition. Change 4 to -4 .

$$= -14$$

15. $-9 - 14$

$$= -9 + (-14)$$

Change subtraction to addition.

$$= -23$$

Change 14 to -14 .

16. $-3 - 11$

$$= -3 + (-11)$$

Change subtraction to addition. Change 11 to -11 .

$$= -14$$

17. $-3 - (-8)$

$$= -3 + (\underline{+8})$$

$$= \underline{5}$$

Change subtraction to addition. Change -8 to $+8$.

18. $-1 - (-4)$

$$= -1 + (\underline{+4})$$

Change subtraction to addition. Change -4 to $+4$.

$$= \underline{3}$$

19. $6 - (-14)$

$$= 6 + (+14)$$

Change subtraction to addition.

$$= 20$$

Change -14 to $+14$.

20. $8 - (-1)$

$$= 8 + (+1)$$

Change subtraction to addition. Change -1 to $+1$.

$$= 9$$

21. $1 - (-10)$
 $= 1 + (+10)$ *Change subtraction to addition. Change -10 to $+10$.*
 $= 11$
22. $6 - (-1)$
 $= 6 + (+1)$ *Change subtraction to addition. Change -1 to $+1$.*
 $= 7$
23. $-30 - 30$
 $= -30 + (-30)$ *Change subtraction to addition. Change 30 to -30 .*
 $= -60$
24. $-25 - 25$
 $= -25 + (-25)$ *Change subtraction to addition. Change 25 to -25 .*
 $= -50$
25. $-16 - (-16)$
 $= -16 + (+16)$ *Change subtraction to addition. Change -16 to $+16$.*
 $= 0$
26. $-20 - (-20)$
 $= -20 + (+20)$ *Change subtraction to addition. Change -20 to $+20$.*
 $= 0$
27. $13 - 13$
 $= 13 + (-13)$ *Change subtraction to addition. Change 13 to -13 .*
 $= 0$
28. $19 - 19$
 $= 19 + (-19)$ *Change subtraction to addition. Change 19 to -19 .*
 $= 0$
29. $0 - 6$
 $= 0 + (-6)$ *Change subtraction to addition. Change 6 to -6 .*
 $= -6$
30. $0 - 12$
 $= 0 + (-12)$ *Change subtraction to addition. Change 12 to -12 .*
 $= -12$
31. (a) $3 - (-5)$
 $= 3 + (+5)$ *Change subtraction to addition. Change -5 to $+5$.*
 $= 8$
- (b) $3 - 5$
 $= 3 + (-5)$ *Change subtraction to addition. Change 5 to -5 .*
 $= -2$
- (c) $-3 - (-5)$
 $= -3 + (+5)$ *Change subtraction to addition. Change -5 to $+5$.*
 $= 2$
- (d) $-3 - 5$
 $= -3 + (-5)$ *Change subtraction to addition. Change 5 to -5 .*
 $= -8$
32. (a) $9 - 6$
 $= 9 + (-6)$ *Change subtraction to addition. Change 6 to -6 .*
 $= 3$
- (b) $-9 - 6$
 $= -9 + (-6)$ *Change subtraction to addition. Change 6 to -6 .*
 $= -15$
- (c) $9 - (-6)$
 $= 9 + (+6)$ *Change subtraction to addition. Change -6 to $+6$.*
 $= 15$
- (d) $-9 - (-6)$
 $= -9 + (+6)$ *Change subtraction to addition. Change -6 to $+6$.*
 $= -3$
33. (a) $4 - 7$
 $= 4 + (-7)$ *Change subtraction to addition. Change 7 to -7 .*
 $= -3$

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- (b) $4 - (-7)$
 $= 4 + (+7)$ *Change subtraction to addition.*
 $= 11$ *Change -7 to $+7$.*
- (c) $-4 - 7$
 $= -4 + (-7)$ *Change subtraction to addition.*
 $= -11$ *Change 7 to -7 .*
- (d) $-4 - (-7)$
 $= -4 + (+7)$ *Change subtraction to addition.*
 $= 3$ *Change -7 to $+7$.*
34. (a) $8 - (-2)$
 $= 8 + (+2)$ *Change subtraction to addition.*
 $= 10$ *Change -2 to $+2$.*
- (b) $-8 - (-2)$
 $= -8 + (+2)$ *Change subtraction to addition.*
 $= -6$ *Change -2 to $+2$.*
- (c) $8 - 2$
 $= 8 + (-2)$ *Change subtraction to addition.*
 $= 6$ *Change 2 to -2 .*
- (d) $-8 - 2$
 $= -8 + (-2)$ *Change subtraction to addition.*
 $= -10$ *Change 2 to -2 .*
35. $-2 - 2 - 2$
 $= \underbrace{-2 + (-2)} + (-2)$ *Change all subtractions to additions. Change 2 to -2 and 2 to -2 .*
 $= -4 + (-2)$ *Add left to right.*
 $= \underline{-6}$
36. $-8 - 4 - 8$
 $= \underbrace{-8 + (-4)} + (-8)$ *Change all subtractions to additions. Change 4 to -4 and 8 to -8 .*
 $= -12 + (-8)$ *Add left to right.*
 $= \underline{-20}$
37. $9 - 6 - 3 - 5$
 $= 9 + (-6) + (-3) + (-5)$ *Change all subtractions to additions.*
 $= 3 + (-3) + (-5)$ *Change 6 to -6 , 3 to -3 , and 5 to -5 .*
 $= 0 + (-5)$ *Add left to right.*
 $= -5$
38. $12 - 7 - 5 - 4$
 $= 12 + (-7) + (-5) + (-4)$ *Change all subtractions to additions.*
 $= 5 + (-5) + (-4)$ *Change 7 to -7 , 5 to -5 , and 4 to -4 .*
 $= 0 + (-4)$ *Add left to right.*
 $= -4$
39. $3 - (-3) - 10 - (-7)$
 $= 3 + (+3) + (-10) + (+7)$ *Change all subtractions to additions.*
 $= 6 + (-10) + (+7)$ *Change -3 to $+3$, 10 to -10 , and -7 to $+7$.*
 $= 6 + (-10) + (+7)$ *Add left to right.*
 $= -4 + (+7)$ *First add $3 + 3$.*
 $= 3$ *Add $6 + (-10)$.*
Finally, add $-4 + 7$.
40. $1 - 9 - (-2) - (-6)$
 $= 1 + (-9) + (+2) + (+6)$ *Change all subtractions to additions.*
 $= -8 + 2 + 6$ *Change 9 to -9 , -2 to $+2$, and -6 to $+6$.*
 $= -6 + 6$ *Add left to right.*
 $= 0$

41. $-2 + (-11) - (-3)$
 $= -2 + (-11) + (+3)$
 $= -13 + (+3)$
 $= -10$

*Change subtraction to addition.
 Change -3 to $+3$.
 Add left to right.*

42. $-5 - (-2) + (-6)$
 $= -5 + (+2) + (-6)$
 $= -3 + (-6)$
 $= -9$

*Change subtraction to addition.
 Change -2 to $+2$.
 Add left to right.*

43. $4 - (-13) + (-5)$
 $= 4 + (+13) + (-5)$
 $= 17 + (-5)$
 $= 12$

*Change subtraction to addition.
 Change -13 to $+13$.
 Add left to right.*

44. $6 - (-1) + (-10)$
 $= 6 + (+1) + (-10)$
 $= 7 + (-10)$
 $= -3$

*Change subtraction to addition.
 Change -1 to $+1$.
 Add left to right.*

45. $6 + 0 - 12 + 1$
 $= 6 + 0 + (-12) + 1$
 $= 6 + (-12) + 1$
 $= -6 + 1$
 $= -5$

*Change subtraction to addition.
 Change 12 to -12 .
 Add left to right.*

46. $-10 - 4 + 0 + 18$
 $= -10 + (-4) + 0 + 18$
 $= -14 + 0 + 18$
 $= -14 + 18$
 $= 4$

*Change subtraction to addition.
 Change 4 to -4 .
 Add left to right.*

47. (a) The 30°F column and the 10 mph wind row intersect at 21°F . The difference between the actual temperature and the wind chill temperature is $30 - 21 = 30 + (-21) = 9$ degrees.

(b) The 15°F column and the 15 mph wind row intersect at 0°F . The difference between the actual temperature and the wind chill temperature is $15 - 0 = 15$ degrees.

(c) The 5°F column and the 25 mph wind row intersect at -17°F . The difference between the actual temperature and the wind chill temperature is $5 - (-17) = 5 + (+17) = 22$ degrees.

(d) The -10°F column and the 35 mph wind row intersect at -41°F . The difference between the actual temperature and the wind chill temperature is $-10 - (-41) = -10 + (+41) = 31$ degrees.

48. (a) The 40°F column and the 20 mph wind row intersect at 30°F . The difference between the actual temperature and the wind chill temperature is $40 - 30 = 40 + (-30) = 10$ degrees.

(b) The 20°F column and the 35 mph wind row intersect at 0°F . The difference between the actual temperature and the wind chill temperature is $20 - 0 = 20$ degrees.

(c) The 10°F column and the 15 mph wind row intersect at -7°F . The difference between the actual temperature and the wind chill temperature is $10 - (-7) = 10 + (+7) = 17$ degrees.

(d) The -5°F column and the 30 mph wind row intersect at -33°F . The difference between the actual temperature and the wind chill temperature is $-5 - (-33) = -5 + (+33) = 28$ degrees.

49. $-2 + (-11) + |-2|$
 $= -2 + (-11) + 2$
 $= -13 + 2$
 $= -11$

*$|-2| = 2$ because the distance from 0 to -2 is 2 units.
 Add left to right.*

50. $5 - |-3| + 3$
 $= 5 - 3 + 3$
 $= 5 + (-3) + 3$
 $= 2 + 3$
 $= 5$

*$|-3| = 3$ because the distance from 0 to -3 is 3 units.
 Change subtraction to addition.
 Add left to right.*

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51. $0 - |-7 + 2|$
 $= 0 - |-5|$
 $= 0 - 5$
 $= 0 + (-5)$
 $= -5$
- Simplify the sum within the absolute value bars first.*
 $-7 + 2 = -5$
 $|-5| = 5$ because the distance from 0 to -5 is 5 units.
 Change subtraction to addition. Change 5 to -5 .
 Add.
52. $|1 - 8| - |0|$
 $= |1 + (-8)| - |0|$
 $= |-7| - |0|$
 $= 7 - 0$
 $= 7$
- Change subtraction to addition.*
Simplify the sum within the absolute value bars first.
 $|-7| = 7$ because the distance from 0 to -7 is 7 units.
 Subtract.
54. $-3 - (-2 + 4) + (-5)$
 $= -3 - 2 + (-5)$
 $= -3 + (-2) + (-5)$
 $= -5 + (-5)$
 $= -10$
- Simplify the sum within the parentheses first.*
Change subtraction to addition and change 2 to -2 .
Add left to right.
54. $5 - 8 - (6 - 7) + 1$
 $= 5 - 8 - [6 + (-7)] + 1$
 $= 5 - 8 - (-1) + 1$
 $= 5 + (-8) + (+1) + 1$
 $= -3 + 1 + 1$
 $= -2 + 1$
 $= -1$
- Change subtraction to addition within the parentheses and change 7 to -7 .*
Simplify the sum within the brackets.
Change subtraction to addition and change -1 to $+1$ and 8 to -8 .
Add left to right.

Relating Concepts (Exercises 55–56)

55. $-3 - 5 = -3 + (-5) = -8$
 $5 - (-3) = 5 + (+3) = 5 + 3 = 8$
 $-4 - (-3) = -4 + (+3) = -4 + 3 = -1$
 $-3 - (-4) = -3 + 4 = 1$

Subtraction is *not* commutative; the absolute value of the answer is the same, but the sign changes.

56. Subtracting 0 from a number does *not* change the number. For example, $-5 - 0 = -5$. But subtracting a number from 0 *does* change the number to its opposite. For example, $0 - (-5) = 5$.

1.5 Problem Solving: Rounding and Estimating

1.5 Margin Exercises

1. (a) -746 (nearest ten)
 Draw a line under the 4 (tens place): $-7\mathbf{4}6$
 -746 is closer to $-7\mathbf{5}0$.
- (b) 2412 (nearest thousand)
 Draw a line under the leading 2 (thousands place): $\mathbf{2}412$
 2412 is closer to $\mathbf{2}000$.
- (c) $-89,512$ (nearest hundred)
 Draw a line under the 5 (hundreds place): $-89,\mathbf{5}12$
 $-89,512$ is closer to $-89,\mathbf{5}00$.
- (d) $546,325$ (nearest ten-thousand)
 Draw a line under the 4 (ten-thousands place): $5\mathbf{4}6,325$
 $546,325$ is closer to $5\mathbf{5}0,000$.
2. (a) $\mathbf{3}4 \approx 30$
 Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 4 or less, do not change the digit in the underlined place. Change all digits to the right of the underlined place to zeros.
- (b) $-\mathbf{6}1 \approx -60$
 Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 4 or less, do not change the digit in the underlined place. Change all digits to the right of the underlined place to zeros.
- (c) $-\mathbf{68}3 \approx -680$
 Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 4 or less, do not change the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

(d) $17\text{9}2 \approx 1790$

Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 4 or less, do not change the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

3. (a) $1\text{7}25 \approx 2000$

Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 5 or more, add 1 to the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

(b) $-6\text{5}11 \approx -7000$

Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 5 or more, add 1 to the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

(c) $58,\text{8}29 \approx 59,000$

Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 5 or more, add 1 to the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

(d) $-8\text{3},\text{9}04 \approx -84,000$

Locate the place to which the number is being rounded. Draw a line under that place. Because the next digit to the right of the underlined place is 5 or more, add 1 to the digit in the underlined place. Change all digits to the right of the underlined place to zeros.

4. (a) $-60\text{3}6 \approx -6040$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the tens place. Next digit is 5 or more. Tens place changes. Add 1 to 3. Change all digits to the right of the underlined place to zeros.

(b) $34,\text{9}68 \approx 35,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the hundreds place. Next digit is 5 or more. Hundreds place changes. Change 9 to 10 and regroup 1 into the thousands place. $4 +$ regrouped 1 is 5. Change all digits to the right of the underlined place to zero.

(c) $-7\text{3},\text{0}77 \approx -73,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the thousands place. Next digit is 4 or less. Leave 3 as 3. Change all digits to the right of the underlined place to zeros.

(d) $9\text{8}52 \approx 10,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the thousands place. Next digit is 5 or more. Thousands place changes. Change 9 to 10. Write 0 and regroup 1 into the ten-thousands place. Change all digits to the right of the underlined place to zeros.

(e) $85,\text{9}49 \approx 85,900$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the hundreds place. Next digit is 4 or less. Leave 9 as 9. Change all digits to the right of the underlined place to zeros.

(f) $40,\text{3}87 \approx 40,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the thousands place. Next digit is 4 or less. Leave 0 as 0. Change all digits to the right of the underlined place to zeros.

5. (a) $-1\text{4},\text{6}79 \approx -10,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the ten-thousands place. Next digit is 4 or less. Leave 1 as 1. Change all digits to the right of the underlined place to zeros.

(b) $72\text{4},\text{5}18,715 \approx 725,000,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the millions place. Next digit is 5 or more. Add 1 to 4. Change all digits to the right of the underlined place to zeros.

(c) $-4\text{9},\text{9}00,700 \approx -50,000,000$

Locate the place to which the number is being rounded. Draw a line under that place. Underline the millions place. Next digit is 5 or more. Change 9 to 10. Write 0 and regroup 1 into the ten millions place. $4 +$ regrouped 1 is 5. Change all digits to the right of the underlined place to zeros.

- (d) $\underline{3}06,779,000 \approx 300,000,000$
Locate the place to which the number is being rounded. Draw a line under that place. Underline the hundred-millions place. Next digit is 4 or less. Leave 3 as 3. Change all digits to the right of the underlined place to zeros.
6. (a) $\underline{-9}4 \approx -90$
Underline the first digit. Next digit is 4 or less. Leave 9 as 9. Change 4 to 0.
- (b) $\underline{5}08 \approx 500$
Underline the first digit. Next digit is 4 or less. Leave 5 as 5. Change 8 to 0.
- (c) $\underline{-2}522 \approx -3000$
Underline the first digit. Next digit is 5 or more. Add 1 to 2. Change all digits to the right of the underlined place to zeros.
- (d) $\underline{9}700 \approx 10,000$
Underline the first digit. Next digit is 5 or more. Add 1 to 9. Write 0 and carry 1 to the ten thousands place. Change all digits to the right of the underlined place to zeros.
- (e) $\underline{6}1,888 \approx 60,000$
Underline the first digit. Next digit is 4 or less. Leave 6 as 6. Change all digits to the right to zeros.
- (f) $\underline{-9}63,369 \approx -1,000,000$
Underline the first digit. Next digit is 5 or more. Add 1 to 9. Write 0 and carry 1 to the millions place. Change all digits to the right to zeros.
7. "Overdrawn" implies a negative number, $-\$3881$
"Deposit" implies a positive number, $+\$2090$
Estimate: $-\$3881 \approx -\4000
 $+\$2090 \approx +\2000
 $\text{Balance} = -\$4000 + \$2000 = -\$2000$
Approximately \$2000 overdrawn.
Exact:
 $\text{Balance} = -\$3881 + \$2090 = -\$1791$
Pao Xiong is overdrawn by \$1791.
The estimate of \$2000 overdrawn is fairly close to the exact amount.
- 1.5 Section Exercises
1. (a) 3702 (nearest ten)
Draw a line under 0. $\underline{37}02$
Next digit is 4 or less, so leave 0 as 0 in the tens place.
- (b) 908,546 (nearest thousand)
Draw a line under 8. $\underline{908},546$
Next digit is 5 or more, so change 8 to 9 in the thousands place.
2. (a) 65,081 (nearest hundred)
Draw a line under 0. $\underline{65},\underline{0}81$
Next digit is 5 or more, so change 0 to 1 in the hundreds place.
- (b) 723,900 (nearest ten-thousand)
Draw a line under 2. $\underline{723},900$
Next digit is 4 or less, so leave 2 as 2 in the ten-thousands place.
3. $\underline{6}25 \approx 630$ (nearest ten)
Next digit is 5 or more. Tens place changes. Add 1 to 2. Change 5 to 0.
4. $\underline{2}06 \approx 210$ (nearest ten)
Next digit is 5 or more. Tens place changes. Add 1 to 0. Change 6 to 0.
5. $-\underline{10}83 \approx -1080$ (nearest ten)
Next digit is 4 or less. Tens place remains 8. Change 3 to 0.
6. $-\underline{24}39 \approx -2440$ (nearest ten)
Next digit is 5 or more. Tens place changes. Add 1 to 3. All digits to the right of the underlined place change to 0.
7. $\underline{78}62 \approx 7900$ (nearest hundred)
Next digit is 5 or more. Hundreds place changes. Add 1 to 8. All digits to the right of the underlined place change to 0.
8. $\underline{67}46 \approx 6700$ (nearest hundred)
Next digit is 4 or less. Hundreds place does not change. All digits to the right of the underlined place change to 0.
9. $-\underline{86},813 \approx -86,800$ (nearest hundred)
Next digit is 4 or less. Hundreds place remains 8. All digits to the right of the underlined place change to 0.
10. $-\underline{17},211 \approx -17,200$ (nearest hundred)
Next digit is 4 or less. Hundreds place does not change. All digits to the right of the underlined place change to 0.
11. $\underline{42},495 \approx 42,500$ (nearest hundred)
Next digit is 5 or more. Hundreds place changes. Add 1 to 4. All digits to the right of the underlined place change to 0.

12. $18,\underline{2}73 \approx 18,300$ (nearest hundred)
Next digit is 5 or more. Hundreds place changes. Add 1 to 2. All digits to the right of the underlined place change to 0.
13. $-5996 \approx -6000$ (nearest hundred)
Next digit is 5 or more. Hundreds place changes. Add 1 to 9 and regroup 1 into the thousands place. All digits to the right of the underlined place change to 0.
14. $-8\underline{4}51 \approx -8500$ (nearest hundred)
Next digit is 5 or more. Hundreds place changes. Add 1 to 4. All digits to the right of the underlined place change to 0.
15. $-7\underline{8},499 \approx -78,000$ (nearest thousand)
Next digit is 4 or less. Thousands place remains 8. All digits to the right of the underlined place change to 0.
16. $-14,\underline{3}14 \approx -14,000$ (nearest thousand)
Next digit is 4 or less. Thousands place does not change. All digits to the right of the underlined place change to 0.
17. $\underline{5}847 \approx 6000$ (nearest thousand)
Next digit is 5 or more. Thousands place changes. Add 1 to 5. All digits to the right of the underlined place change to 0.
18. $\underline{4}9,706 \approx 50,000$ (nearest thousand)
Next digit is 5 or more. Thousands place changes. Add 1 to 9. Write 0 and regroup 1 into ten-thousands place. All digits to the right of the underlined place change to 0.
19. $\underline{5}95,008 \approx 600,000$ (nearest ten-thousand)
Next digit is 5 or more. Ten-thousands place changes. Add 1 to 9, write 0, and regroup 1 into the hundred-thousands place. All digits to the right of the underlined place change to 0.
20. $7\underline{2}5,182 \approx 730,000$ (nearest ten-thousand)
Next digit is 5 or more. Ten-thousands place changes. Add 1 to 2. All digits to the right of the underlined place change to 0.
21. $-\underline{8},906,422 \approx -9,000,000$ (nearest million)
Next digit is 5 or more. Millions place changes. Add 1 to 8. Change other digits to 0.
22. $-\underline{13},713,409 \approx -14,000,000$ (nearest million)
Next digit is 5 or more. Millions place changes. Add 1 to 3. All digits to the right of the underlined place change to 0.
23. $13\underline{9},610,000 \approx 140,000,000$ (nearest million)
Next digit is 5 or more. Millions place changes. Add 1 to 9. Regroup 1 into the ten-millions place. All digits to the right of the underlined place change to 0.
24. $60\underline{9},845,500 \approx 610,000,000$ (nearest million)
Next digit is 5 or more. Millions place changes. Add 1 to 9. Write 0 and regroup 1 into the ten-millions place. All digits to the right of the underlined place change to 0.
25. $19,\underline{9}51,880,500 \approx 20,000,000,000$ (nearest hundred-million)
Next digit is 5 or more. Hundred-millions place changes from 9 to 10. Write 0 and regroup 1 into the billions place. In the billions place, $9 +$ regrouped 1 is 10. Write the 0 and regroup 1 to ten-billions. All digits to the right of the underlined place change to 0.
26. $5,\underline{9}93,505,000 \approx 6,000,000,000$ (nearest hundred-million)
Next digit is 5 or more. Hundred-millions place changes. Add 1 to 9. Write 0 and regroup 1 into the billions place. All digits to the right of the underlined place change to 0.
27. $\underline{8},608,200,000 \approx 9,000,000,000$ (nearest billion)
Next digit is 5 or more. Billions place changes. Add 1 to 8. All digits to the right of the underlined place change to 0.
28. $703,\underline{7}50,678,005 \approx 704,000,000,000$ (nearest billion)
Next digit is 5 or more. Billions place changes. Add 1 to 3. All digits to the right of the underlined place change to 0.
29. Mateo forgot to regroup 1 into the hundred-thousands place.
 $8\underline{9}7,005$
Next digit is 5 or more. Add 1 to 9. Write 0 and regroup 1 into the hundred-thousands place. $8 +$ regrouped 1 is 9. All digits to the right of the underlined place change to 0. The correct answer is 900,000.
30. Gabriela forgot to change the digits to the right of the millions place to zeros.
 $99,\underline{5}33,187$
Next digit is 5 or more. Add 1 to 9. Write 0 and regroup 1 into the ten-millions place. $9 +$ regrouped 1 is 10. All digits to the right of the underlined place change to 0. The correct answer is 100,000,000.

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31. $\underline{3}1,500 \approx 30,000$ miles
Next digit is 4 or less. Leave 3 as 3. All digits to the right of the underlined place change to 0. 31,500 is closer to 30,000 than 40,000.
32. $\underline{5}7,300 \approx 60,000$ miles
Next digit is 5 or more. Ten-thousands place changes. Add 1 to 5. All digits to the right of the underlined place change to 0.
33. $-\underline{5}6 \approx -60$ degrees
Next digit is 5 or more. Change 5 to 6 and change 6 to 0. -56 is closer to -60 than -50 .
34. $-\underline{4}2 \approx -40$ inches
Next digit is 4 or less. Tens place does not change. Change all other digits to 0.
35. $\$99\underline{4}2 \approx \$10,000$
Round to the nearest thousand since the leftmost digit is in the thousands place. Next digit is 5 or more, so the thousands place changes from 9 to 10. Write 0 and regroup 1 into the ten-thousands place. All digits to the right of the underlined place change to 0. So, $\$9942$ is closer to $\$10,000$ than $\$9000$.
36. $\$2\underline{8}5 \approx \300
Next digit is 5 or more. Hundreds place changes. Add 1 to 2. Change all other digits to 0.
37. $\underline{2},485,000,000 \approx 2,000,000,000$ Internet users
Next digit is 4 or less. Leave 2 as 2. All digits to the right of the underlined place change to 0.
38. $\underline{4}0,030,000 \approx 40,000,000$ Twitter accounts
Next digit is 4 or less. Leave 4 as 4. All digits to the right of the underlined place change to 0.
39. $\underline{7}36,732 \approx 700,000$ people in Alaska
Next digit is 3 or less. Leave 7 to 7. All digits to the right of the underlined place change to 0.
 $\underline{3}8,802,500 \approx 40,000,000$ people in California
Next digit is 5 or more. Change 3 to 4. All digits to the right of the underlined place change to 0.
40. $\underline{3}98,328,349 \approx 400,000,000$ people in the United States
Next digit is 9 or more. Add 1 to 3 and regroup 1 into the hundred-millions place. $3 +$ regrouped 1 is 4. All digits to the right of the underlined place change to 0.
 $\underline{4}1,135,648 \approx 40,000,000$ people in Canada
Next digit is 4 or less. Ten-millions place does not change. All digits to the right of the underlined place change to 0.
41. $-42 + 89$
 $-\underline{4}2$ is closer to -40 than -50 .
 $\underline{8}9$ is closer to 90 than 80.
Estimate: $-\underline{4}0 + \underline{90} = \underline{50}$;
Exact: $-42 + 89 = 47$
42. $-66 + 25$
 $-\underline{6}6$ is closer to -70 than -60 .
 $\underline{2}5$ is as close to 30 as it is to 20, so we'll round 25 up to 30 for our estimate.
Estimate: $-\underline{70} + \underline{30} = \underline{-40}$;
Exact: $-66 + 25 = -41$
43. $16 + (-97)$
Because the leftmost digit is in the tens place, round 16 and -97 to the nearest ten.
 $\underline{1}6$ is closer to 20 than 10.
 $-\underline{9}7$ is closer to -100 than -90 .
Estimate: $20 + (-100) = -80$;
Exact: $16 + (-97) = -81$
44. $58 + (-19)$
 $\underline{5}8$ is closer to 60 than 50.
 $-\underline{1}9$ is closer to -20 than -10 .
Estimate: $60 + (-20) = 40$;
Exact: $58 + (-19) = 39$
45. $-273 + (-399)$
 $-\underline{2}73$ is closer to -300 than -200 .
 $-\underline{3}99$ is closer to -400 than -300 .
Estimate: $-300 + (-400) = -700$;
Exact: $-273 + (-399) = -672$
46. $-311 + (-582)$
 $-\underline{3}11$ is closer to -300 than -400 .
 $-\underline{5}82$ is closer to -600 than -500 .
Estimate: $-300 + (-600) = -900$;
Exact: $-311 + (-582) = -893$
47. $3081 + 6826$
 $\underline{3}081$ is closer to 3000 than 4000.
 $\underline{6}826$ is closer to 7000 than 6000.
Estimate: $3000 + 7000 = 10,000$;
Exact: $3081 + 6826 = 9907$
48. $4904 + 1181$
 $\underline{4}904$ is closer to 5000 than 4000.
 $\underline{1}181$ is closer to 1000 than 2000.
Estimate: $5000 + 1000 = 6000$;
Exact: $4904 + 1181 = 6085$

49. $23 - 81$
 $23 + (-81)$ *Change subtraction to addition.*
Change 81 to -81.

23 is closer to 20 than 30.
 -8 1 is closer to -80 than -90.

Estimate: $20 + (-80) = -60$;
Exact: $23 - 81 = 23 + (-81) = -58$

50. $72 - 84$
 $72 + (-84)$ *Change subtraction to addition.*
Change 84 to -84.

72 is closer to 70 than 80.
 -8 4 is closer to -80 than -90.

Estimate: $70 + (-80) = -10$;
Exact: $72 - 84 = 72 + (-84) = -12$

51. $-39 - 39$
 $-39 + (-39)$ *Change subtraction to addition.*
Change 39 to -39.

-3 9 is closer to -40 than -30.

Estimate: $-40 + (-40) = -80$;
Exact: $-39 - 39 = -39 + (-39) = -78$

52. $-91 - 91$
 $-91 + (-91)$ *Change subtraction to addition.*
Change 91 to -91.

-9 1 is closer to -90 than -100.

Estimate: $-90 + (-90) = -180$;
Exact: $-91 - 91 = -91 + (-91) = -182$

53. $-106 + 34 - (-72)$
 $-106 + 34 + (+72)$ *Change subtraction to*
addition of the opposite.

Because the leftmost digit is in the hundreds place, round -106 to the nearest hundred:
 $-106 \approx -100$

Because the leftmost digit is in the tens place, round 34 and 72 to the nearest ten:

$34 \approx 30$; $72 \approx 70$

Estimate: $-100 + 30 + (+70) = 0$;
Exact: $-106 + 34 - (-72)$
 $= -106 + 34 + (+72) = 0$

54. $52 - (-87) - 139$
 $52 + (+87) + (-139)$ *Change subtraction to*
addition of the opposite.

5 2 \approx 50; 8 7 \approx 90; -1 39 \approx -100

Estimate: $50 + (+90) + (-100) = 40$;
Exact: $52 - (-87) - 139$
 $= 52 + (+87) + (-139) = 0$

55. Already raised: $\$52,882 \approx \$50,000$
 Amount needed: $\$78,650 \approx \$80,000$
 Amount that still needs to be collected:
Estimate: $80,000 - 50,000 = \$30,000$;
Exact: $78,650 - 52,882 = \$25,768$

56. $9250 \approx 9000$ pounds
 $21,375 \approx 20,000$ pounds
 To find the weight of the firewood subtract the truck's weight from the total weight.
Estimate: $20,000 - 9000 = 11,000$ pounds
Exact: $21,375 - 9250 = 12,125$ pounds

57. Estimate Dorene's expenses.
 Rent: $\$845 \approx \800
 Food: $\$425 \approx \400
 Childcare: $\$365 \approx \400
 Transportation: $\$182 \approx \200
 Other: $\$240 \approx \200
Estimate: Dorene's total expenses:
 $\$800 + \$400 + \$400 + \$200 + \$200 = \2000 .
 Estimate Dorene's monthly take home pay.
 $\$2120 \approx \2000
 Subtract Dorene's expenses from her take home pay to estimate her monthly savings.
 $\$2000 - \$2000 = \$0$.

Exact:
 Total Expenses = $\$845 + \$425 + \$365$
 $+ \$182 + \240
 $= \$2057$
 Monthly savings = $\$2120 - \$2057 = \$63$.

58. Using front end rounding:
 $\$2874 \approx \3000
 $-\$308 \approx -\300
 $-\$580 \approx -\600
 $-\$778 \approx -\800

Amount of money remaining in Jared's account:

Estimate: $3000 - 300 - 600 - 800 = \1300
Exact: $2874 - 308 - 580 - 778 = \1208

59. The final temperature equals the initial temperature plus the two increases.
 $-102 \approx -100$; $37 \approx 40$; $52 \approx 50$
Estimate: $-100 + 40 + 50 = -10$ degrees
Exact: $-102 + 37 + 52 = -13$ degrees

60. Using front end rounding:
 $-65 \text{ feet} \approx -70 \text{ feet}$
 $24 \text{ feet} \approx 20 \text{ feet}$
 $-49 \text{ feet} \approx -50 \text{ feet}$
 The scuba diver's final depth:
Estimate: $-70 + 20 + (-50) = -100 \text{ feet}$
Exact: $-65 + 24 + (-49) = -90 \text{ feet}$
61. $\underline{4}12 \approx 400 \text{ doors}$
 $\underline{1}47 \approx 100 \text{ windows}$
 Total number of doors and windows:
Estimate: $400 + 100 = 500 \text{ doors and windows}$
Exact: $412 + 147 = 559 \text{ doors and windows}$
62. $\underline{36},258 \approx 40,000 \text{ McDonald's restaurants}$
 $\underline{12},997 \approx 10,000 \text{ Burger King restaurants}$
 Total number of restaurants:
Estimate: $40,000 + 10,000 = 50,000 \text{ restaurants}$
Exact: $36,258 + 12,997 = 49,255 \text{ restaurants}$

1.6 Multiplying Integers

1.6 Margin Exercises

1. (a) $\underline{100} \times \underline{6} = \underline{600}$
 Factor Factor Product
 Equivalent forms: $100(6) = 600$
 $100 \cdot 6 = 600$
 $(100)(6) = 600$
- (b) $\underline{7} \times \underline{12} = \underline{84}$
 Factor Factor Product
 Equivalent forms: $7(12) = 84$
 $7 \cdot 12 = 84$
 $(7)(12) = 84$
2. (a) $7(-2) = -14$
 The factors have *different* signs, so the product is *negative*.
- (b) $-5 \cdot (-5) = 25$
(same signs, product is positive)
- (c) $-1(14) = -14$
(different signs, product is negative)
- (d) $10 \cdot 6 = 60$
(same signs, product is positive)
- (e) $(-4)(-9) = 36$
(same signs, product is positive)
3. (a) $-5 \cdot (10 \cdot 2)$ *Work within parentheses first.*
 $= -5 \cdot \underline{(20)}$ *(same signs, product is positive)*
 $= \underline{-100}$ *(different signs, product is negative)*

- (b) $-1 \cdot 8 \cdot (-5)$ *No parentheses. Multiply from left to right.*
 $= -8 \cdot (-5)$ *(different signs, product is negative)*
 $= 40$ *(same signs, product is positive)*
- (c) $-3(-2)(-4)$ *Multiply from left to right.*
 $= \underline{(6)}(-4)$ *(same signs, product is positive)*
 $= \underline{-24}$ *(different signs, product is negative)*
- (d) $-2(7)(-3)$ *Multiply from left to right.*
 $= (-14)(-3)$ *(different signs, product is negative)*
 $= 42$ *(same signs, product is positive)*
- (e) $(-1)(-1)(-1)$ *Multiply from left to right.*
 $= 1(-1)$ *(same signs, product is positive)*
 $= -1$ *(different signs, product is negative)*

4. (a) $819 \cdot 0 = 0$; multiplication property of 0
 (b) $1(-90) = -90$; multiplication property of 1
 (c) $25 \cdot 1 = 25$; multiplication property of 1
 (d) $(0)(-75) = 0$; multiplication property of 0
5. (a) $\underline{(3 \cdot 3)} \cdot 2 = 3 \cdot \underline{(3 \cdot 2)}$
 $\underline{9} \cdot 2 = 3 \cdot \underline{6}$
 $\underline{18} = \underline{18}$

This illustrates the associative property of multiplication.

- (b) $11 \cdot 8 = 8 \cdot 11$
 $88 = 88$
 Commutative property of multiplication
- (c) $2 \cdot (-15) = -15 \cdot 2$
 $-30 = -30$
 Commutative property of multiplication
- (d) $-4 \cdot (2 \cdot 5) = (-4 \cdot 2) \cdot 5$
 $-4 \cdot 10 = -8 \cdot 5$
 $-40 = -40$
 Associative property of multiplication
6. (a) $3(8 + 7) = 3 \cdot 8 + \underline{3 \cdot 7}$
 $3(\underline{15}) = \underline{24} + \underline{21}$
 $\underline{45} = \underline{45}$ *Both results are 45.*

