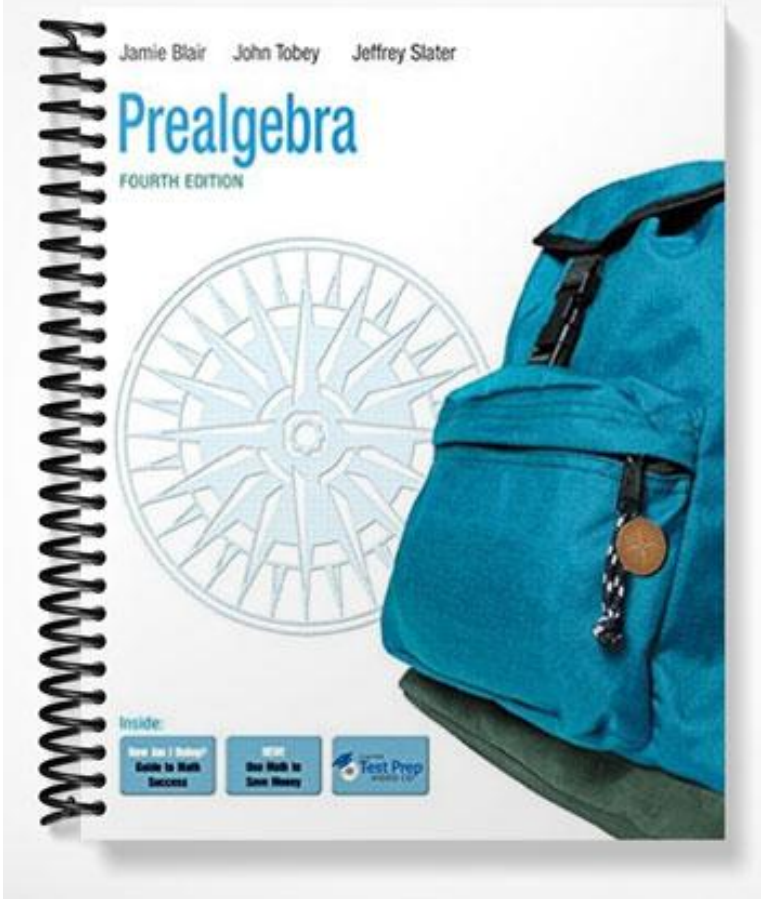
SOLUTIONS MANUAL



Chapter 2

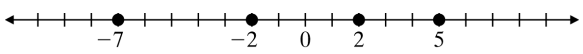
2.1 Exercises

2. $-|-4|$ is the opposite of the absolute value of negative four.

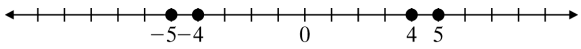
4. Five minus negative one: $5 - (-1)$

6. Numbers that are the same distance from zero but lie on opposite sides of zero on the number line are called opposites.

8. To graph −7, start at zero and count seven places in the negative direction.
To graph −2, start at zero and count two places in the negative direction.
To graph 2, start at zero and count two places in the positive direction.
To graph 5, start at zero and count five places in the positive direction.



10. To graph −5, start at zero and count five places in the negative direction.
To graph −4, start at zero and count four places in the negative direction.
To graph 5, start at zero and count five places in the positive direction.
To graph 4, start at zero and count four places in the positive direction.



12. The dot labeled *X* represents the larger number since it lies to the right of the dot labeled *Y* on the number line.

14. $-7 \; ? \; 4$
Negative numbers are always less than positive numbers.
$-7 < 4$

16. $6 \; ? \; -4$
Positive numbers are always greater than negative numbers.
$6 > -4$

18. $-6 \; ? \; 6$
Negative numbers are always less than positive numbers.
$-6 < 6$

20. $-6 \; ? \; -2$
−6 lies to the left of −2 on the number line.
$-6 < -2$

22. $-41 \; ? \; -6$
−41 lies to the left of −6 on the number line.
$-41 < -6$

24. $-765 \; ? \; -990$
−765 lies to the right of −990 on the number line.
$-765 > -990$

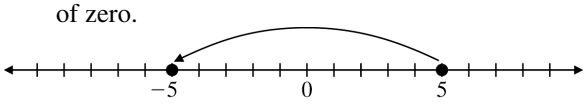
26. __−__ A plane descends 1000 ft.

28. __+__ Temperature rises 10°F.

30. __+__ A profit of $220

32. __−__ A tax decrease of $150

34. Start at 5. Locate the number that is the same distance from zero but lies on the opposite side of zero.



The opposite of 5 is −5.

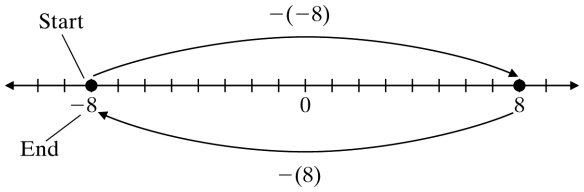
36. The opposite of −8 is __8__.

38. The opposite of 19 is __−19__.

40. The opposite of −9 is 9.
$-(-9) = 9$

42. The opposite of 1 is −1.
$-(1) = -1$

44. $-(-(-8)) = -(8) = -8$



46. $-(-(30)) = -(-30) = 30$

48. $-(-(-(-2))) = -(-(2)) = -(-2) = 2$

50. Place parentheses around y and then replace y with 13.
$-(-y) = -(-(y)) = -(-(13)) = -(-13) = 13$

52. Place parentheses around n and then replace n with -6.
$$\begin{aligned} -(-(-n)) &= -(-(-(n))) \\ &= -(-(-(-6))) \\ &= -(-(6)) \\ &= -(-6) \\ &= 6 \end{aligned}$$

54. Place parentheses around x and then replace y with -5.
$$\begin{aligned} -(-(-(-x))) &= -(-(-(-(x)))) \\ &= -(-(-(-(-5)))) \\ &= -(-(-(5))) \\ &= -(-(-5)) \\ &= -(5) \\ &= -5 \end{aligned}$$

56. The absolute value of a positive number is positive.
$|6| = 6$

58. The absolute value of a negative number is positive.
$|-7| = 7$

60. The absolute value of a negative number is positive.
$|-19| = 19$

62. The absolute value of a positive number is positive.
$|42| = 42$

64.
$$\begin{aligned} |-9| \;?\; |5| \\ 9 \;?\; 5 \\ 9 > 5 \\ |-9| > |5| \end{aligned}$$

66.
$$\begin{aligned} |6| \;?\; |-6| \\ 6 \;?\; 6 \\ 6 = 6 \\ |6| = |-6| \end{aligned}$$

68.
$$\begin{aligned} |19| \;?\; |-13| \\ 19 \;?\; 13 \\ 19 > 13 \\ |19| > |-13| \end{aligned}$$

70.
$$\begin{aligned} |-71| \;?\; |-6| \\ 71 \;?\; 6 \\ 71 > 6 \\ |-71| > |-6| \end{aligned}$$

72. $-|-10| = -(10) = -10$

74. $-|17| = -(17) = -17$

76. a. The dot on the graph for Anchorage is lower than the dot for Bismarck, so the temperature was colder in Anchorage.

b. The dot for Cleveland is the highest point on the graph, so Cleveland had the highest low temperature.
The dot for Fargo is the lowest point on the graph, so Fargo had the lowest low temperature.

78.
$$\begin{aligned} |-12| \;?\; -(-12) \\ 12 \;?\; 12 \\ 12 = 12 \\ |-12| = -(-12) \end{aligned}$$

80.
$$\begin{aligned} -(-(-1)) \;?\; |-1| \\ -(1) \;?\; 1 \\ -1 \;?\; 1 \\ -1 < 1 \\ -(-(-1)) < |-1| \end{aligned}$$

82. $-(-4) + |-9| = 4 + 9 = 13$

84. $-(-|5|) - |-2| = -(-5) - 2 = 5 - 2 = 3$

86. The number -43 has a larger absolute value than 40 because -43 is further from 0 on the number line.

88. The number 231 has a larger absolute value than -98 because 231 is further from 0 on the number line.

90. It is true that the numbers -2, -1, 0, 1, and 2 are called integers.

92. There are two numbers that are 3 units from 1 on the number line. One of these numbers is 4 and the other number is $\underline{-2}$.

Cumulative Review

93.
$$\begin{array}{r} 5009 \\ -\ 258 \\ \hline 4751 \end{array}$$

94.
$$\begin{array}{r} 5699 \\ +\ 351 \\ \hline 6050 \end{array}$$

95.
$$\begin{array}{r} 256 \\ \times\ 91 \\ \hline 256 \\ 23\ 04 \\ \hline 23,296 \end{array}$$

96. $456 \div 3 = 152$

$$\begin{array}{r} 152 \\ 3\overline{)456} \\ \underline{3} \\ 15 \\ \underline{15} \\ 06 \\ \underline{6} \\ 0 \end{array}$$

97. Add the expenses.

$$\begin{array}{r} 480 \\ 1200 \\ +\ 350 \\ \hline \$2030 \end{array}$$

Subtract the expenses from the budget.

$$\begin{array}{r} 2600 \\ -\ 2030 \\ \hline \$570 \end{array}$$

Wanda will have $570 left to spend.

98. Find the total cost.

$$\begin{array}{r} 780 \\ 520 \\ 450 \\ 1150 \\ 203 \\ +\ 45 \\ \hline \$3148 \end{array}$$

Subtract the down payment.

$$\begin{array}{r} 3148 \\ -\ 800 \\ \hline \$2348 \end{array}$$

Tran has to finance $2348.

Classroom Quiz 2.1

1. a. $-14 \ ? \ -10$
-14 lies to the left of -10 on the number line.
$-14 < -10$

b. $|20| \ ? \ |-15|$
$20 \ ? \ 15$
$20 > 15$
$|20| > |-15|$

2. $-(-(-(-1))) = -(-(1)) = -(-1) = 1$

3. a. $-|-7| = -(7) = -7$

b. $-|44| = -(44) = -44$

2.2 Exercises

2. The temperature dropped 2°F at midnight followed by another drop of 5°F the next hour.

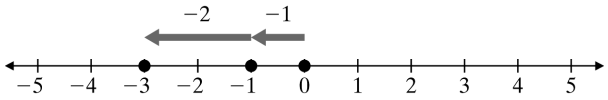
4. The sum of two positive numbers is a positive number. The sum of two negative numbers is a negative number.

6. a. $-4 + (-6) = -10$
Rule: When adding two numbers with the same sign, we use the common sign in the answer and add the absolute values of the numbers.

b. $4 + (-6) = -2$
Rule: When adding two numbers with different signs, we keep the sign of the larger absolute value and subtract the absolute values.

c. $-4 + 6 = +2$
Rule: When adding two numbers with different signs, we keep the sign of the larger absolute value and subtract the absolute values.

8. a.

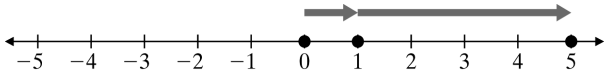


b. Negative

c. −1 + (−2)

d. From the number line, sum is −3.

10. a.



b. Positive

c. 1 + 4

d. 1 + 4 = 5

12. a. A discount of $4 followed by a discount of $2 results in a discount of $6.

b. −$4 + (−$2) = −$6

14. a. An increase of 120 units followed by an increase of 50 units results in an increase of 170 units.

b. 120 + 50 = 170 units

16. We are adding two numbers with the same sign, so we keep the common sign and add the absolute values.

a. −15 + (−19) = −34

b. 15 + 19 = 34

18. We are adding two numbers with the same sign, so we keep the common sign and add the absolute values.

a. −24 + (−44) = −68

b. 24 + 44 = 68

20. We are adding two numbers with the same sign, so we keep the common sign and add the absolute values.

a. −30 + (−10) = −40

b. 30 + 10 = 40

22. a. −4 + 2

b. Negative

c. −4 + 2 = −2

24. a. 3 + (−6)

b. Negative

c. 3 + (−6) = −3

26. −10 ft + (+2 ft) = −8 ft

28. +10 lb + (−5 lb) = 5 lb

30. a. The answer is negative since the negative number has the larger absolute value.
4 + (−9) = −5

b. The answer is positive since the positive number has the larger absolute value.
−4 + 9 = 5

32. a. The answer is positive since the positive number has the larger absolute value.
8 + (−3) = 5

b. The answer is negative since the negative number has the larger absolute value.
−8 + 3 = −5

34. a. The answer is negative since the negative number has the larger absolute value.
15 + (−24) = −9

b. The answer is positive since the positive number has the larger absolute value.
−15 + 24 = 9

36. a. The numbers have different signs. The answer is negative since the negative number has the larger absolute value.
5 + (−9) = −4

b. The numbers have the same sign, so we keep the common sign.
−5 + (−9) = −14

c. The numbers have different signs. The answer is positive since the positive number has the larger absolute value.
−5 + 9 = 4

38. a. The numbers have the same sign, so we keep the common sign.
−12 + (−3) = −15

b. The numbers have different signs. The answer is positive since the positive number has the larger absolute value.
12 + (−3) = 9

c. The numbers have different signs. The answer is negative since the negative number has the larger absolute value.
−12 + 3 = −9

40. Since 3 and −3 are additive inverses, their sum is 0.
3 + (−3) = 0

42. Since −5 and 5 are additive inverses, their sum is 0.
−5 + 5 = 0

44. Since −120 and 120 are additive inverses, their sum is 0.
−120 + 120 = 0

46. Since 786 and −786 are additive inverses, their sum is 0.
786 + (−786) = 0

48. $x + 23 = 0$
The sum of additive inverses is 0. Thus $x = -23$ since $-23 + 23 = 0$.

50. $-21 + x = 0$
The sum of additive inverses is 0. Thus $x = 21$ since $-21 + 21 = 0$.

52. The answer is positive since the positive number has the larger absolute value.
14 + (−13) = 1

54. The answer is negative since the negative number has the larger absolute value.
−8 + 5 = −3

56. The answer is positive since the positive number has the larger absolute value.
−4 + 9 = 5

58. The answer is positive since the positive number has the larger absolute value.
34 + (−14) = 20

60. The numbers have the same sign, so we keep the common sign.
−42 + (−12) = −54

62. The numbers have the same sign, so we keep the common sign.
−43 + (−23) = −66

64. Since −92 and 92 are additive inverses, their sum is 0.
−92 + 92 = 0

66. The answer is positive since the positive number has the larger absolute value.
−11 + 15 = 4

68. The answer is negative since the negative number has the larger absolute value.
$5 + (-7) = -2$

70. Since 13 and −13 are additive inverses, their sum is 0.
$13 + (-13) = 0$

72.
$$\begin{aligned} 4+(-7)+2+(-5) &= [4+2]+[(-7)+(-5)] \\ &= 6+[(-7)+(-5)] \\ &= 6+(-12) \\ &= -6 \end{aligned}$$

74.
$$\begin{aligned} -31+19+(-25) &= [-31+(-25)]+19 \\ &= -56+19 \\ &= -37 \end{aligned}$$

76.
$$\begin{aligned} &25+(-17)+(-28)+64 \\ &= [25+64]+[(-17)+(-28)] \\ &= 89+[(-17)+(-28)] \\ &= 89+(-45) \\ &= 44 \end{aligned}$$

78.
$$\begin{aligned} -12+4+(-8)+5 &= [-12+(-8)]+[4+5] \\ &= -20+[4+5] \\ &= -20+9 \\ &= -11 \end{aligned}$$

80. $x + 5$

a. Replace x with −1.
$(x) + 5 = (-1) + 5 = 4$

b. Replace x with −8.
$(x) + 5 = (-8) + 5 = -3$

82. $x + (-6)$

a. Replace x with 3.
$(x) + (-6) = (3) + (-6) = -3$

b. Replace x with −9.
$(x) + (-6) = (-9) + (-6) = -15$

84. $-9 + a + b$

a. Replace a with 7 and b with −3.
$$\begin{aligned} -9+(a)+(b) &= -9+(7)+(-3) \\ &= [-9+(-3)]+7 \\ &= -12+7 \\ &= -5 \end{aligned}$$

b. Replace a with −1 and b with 4.
$$\begin{aligned} -9+(a)+(b) &= -9+(-1)+(4) \\ &= -10+4 \\ &= -6 \end{aligned}$$

86. Replace x with −2 and y with −5.
$$\begin{aligned} -x+y+4 &= -(x)+(y)+4 \\ &= -(-2)+(-5)+4 \\ &= 2+(-5)+4 \\ &= [2+4]+(-5) \\ &= 6+(-5) \\ &= 1 \end{aligned}$$

88. Replace a with −5 and b with −1.
$$\begin{aligned} -a+b+(-6) &= -(a)+(b)+(-6) \\ &= -(-5)+(-1)+(-6) \\ &= 5+[(-1)+(-6)] \\ &= 5+(-7) \\ &= -2 \end{aligned}$$

90. 1st quarter gain: \$30,000
2nd quarter loss: −\$20,000
3rd quarter loss: −\$10,000
4th quarter gain: \$20,000
30,000 + (−20,000) + (−10,000) + 20,000
= [30,000 + 20,000] + [−20,000 + (−10,000)]
= 50,000 + (−30,000)
= 20,000
At the end of the fourth quarter, the company had a profit of \$20,000.

92. −97 + 150 = 53
The balance was \$53.

94. −2 + (−8) = −10
The temperature is −10°.

96. Replace a with 8, b with −4, and c with 4.
$$\begin{aligned} -2+a+b+6+c &= -2+(a)+(b)+6+(c) \\ &= -2+(8)+(-4)+6+(4) \\ &= -2+8+(-4)+6+4 \\ &= [-2+(-4)]+[8+6+4] \\ &= -6+18 \\ &= 12 \end{aligned}$$

98.
$$\begin{aligned} &9+(-42)+(-88)+10+(-13) \\ &= [9+10]+[(-42)+(-88)+(-13)] \\ &= 19+(-143) \\ &= -124 \end{aligned}$$

100. $2+(-72)+(-41)+11+(-33)$
$=[2+11]+[(-72)+(-41)+(-33)]$
$=13+(-146)$
$=-133$

102. $-6+\boxed{-1}=-7$

104. $4+\boxed{-7}=-3$

106. $-33+x=-30$, $x=3$

108. If $22+x+y=0$, then $22+(x+y)=0$.
The sum of additive inverses is 0. Thus $x+y$ is the additive inverse of 22 or $x+y=-22$ since $22+(-22)=0$. Since $-10+(-12)=-22$, possible values for x and y are -10 and -12.

110. There is one solution using eight squares.
$\boxed{3}+\boxed{-5}=-2$
$-2+\boxed{6}=4$
$4+\boxed{-4}=0$
$0+\boxed{4}=4$
$4+\boxed{-8}=-4$
$-4+\boxed{-1}=-5$
$-5+\boxed{7}=2$
The numbers are 3, –5, 6, –4, 4, –8, –1, 7.

Cumulative Review

111. $4x+6x=(4+6)x=10x$

112. $2(3x)=(2\cdot 3)x=6x$

113. $8x-3x=(8-3)x=5x$

114. $3(x-4)=3\cdot x-3\cdot 4=3x-12$

115. 110 mi + 150 mi = 260 mi
Vu drove 260 miles each way.
260 mi + 260 mi = 520 mi
Vu drove a total of 520 miles.
23,566 mi + 520 mi = 24,086 mi
The reading on the odometer was 24,086 miles.

116. Numbers exiting: –4, –7
Numbers boarding: 12, 8, 11, 15
[–4 + (–7)] + [12 + 8 + 11 + 15] = –11 + 46 = 35
There were 35 people on the bus after the third stop.

Classroom Quiz 2.2

1. a. The answer is positive since the positive number has the larger absolute value.
11 + (–2) = 9

b. The numbers have the same sign, so we keep the common sign.
–5 + (–4) = –9

c. $-8+2+(-3)+5=[-8+(-3)]+[2+5]$
$=-11+7$
$=-4$

2. Replace x with –2 and y with –5.
$-x+4+y=-(x)+4+(y)$
$=-(-2)+4+(-5)$
$=2+4+(-5)$
$=[2+4]+(-5)$
$=6+(-5)$
$=1$

3. 1st quarter loss: –$2000
2nd quarter profit: $4500
3rd quarter profit: $6000
4th quarter loss: –$6500
–2000 + 4500 + 6000 + (–6500)
= [–2000 + (–6500)] + [4500 + 6000]
= –8500 + 10,500
= 2000
At the end of the fourth quarter, the company had a profit of $2000.

2.3 Understanding the Concept
Another Approach to Subtracting Several Integers

1. a. $2-6-8-11=2+(-25)=-23$

b. $2-6-8-11=2+(-6)-8-11$
$=-4-8-11$
$=-4+(-8)-11$
$=12-11$
$=-12+(-11)$
$=-23$

c. Answers may vary.

2.3 Exercises

2. We cannot write 2 – 7 as 7 – 2 because subtraction is not commutative.

4. Writing a check for $20 when the balance in the account is $15 will result in a balance of –$5.

6. To subtract –9, we add 9.

8. To subtract 7, we add –7.

10. $-5 - 2 = -5 + \boxed{-2} = \boxed{-7}$

12. $3 - 8 = 3 + \boxed{-8} = \boxed{-5}$

14. $8 - (-2) = 8 \boxed{+} 2 = \boxed{10}$

16. $7 - (-2) = 7 \boxed{+} 2 = \boxed{9}$

18. a. $5 - 3 = 5 + (-3) = 2$

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

c. $7 - 1 = 7 + (-1) = 6$

20. $\$4 - \$6 = \$4 + (-\$6) = -\$2$

22. $\$4 - \$3 = \$4 + (-\$3) = \$1$

24. $-8 - 3 = -8 + (-3) = -11$

26. $-4 - 3 = -4 + (-3) = -7$

28. $8 - (-4) = 8 + 4 = 12$

30. $6 - (-7) = 6 + 7 = 13$

32. $-6 - (-3) = -6 + 3 = -3$

34. $-7 - (-7) = -7 + 7 = 0$

36. $8 - 11 = 8 + (-11) = -3$

38. $7 - 9 = 7 + (-9) = -2$

40. $70 - 80 = 70 + (-80) = -10$

42. $-77 - (-11) = -77 + 11 = -66$

44.
$$\begin{aligned} 5-2-6-10 &= 5+(-2)+(-6)+(-10) \\ &= 5+(-18) \\ &= -13 \end{aligned}$$

46.
$$\begin{aligned} 9-3-7-25 &= 9+(-3)+(-7)+(-25) \\ &= 9+(-35) \\ &= -26 \end{aligned}$$

48.
$$\begin{aligned} 8-11-4+7 &= 8+(-11)+(-4)+7 \\ &= 8+7+(-11)+(-4) \\ &= 15+(-15) \\ &= 0 \end{aligned}$$

50.
$$\begin{aligned} -5-(-2)+(-7) &= -5+2+(-7) \\ &= -5+(-7)+2 \\ &= -12+2 \\ &= -10 \end{aligned}$$

52. $-5-(-9)-(-4) = -5+9+4 = -5+13 = 8$

54.
$$\begin{aligned} -7-(-2)+(-9) &= -7+2+(-9) \\ &= -7+(-9)+2 \\ &= -16+2 \\ &= -14 \end{aligned}$$

56. $9 - 13 = 9 + (-13) = -4$

58. $-6 - (-6) = -6 + 6 = 0$

60. $-18 - 56 = -18 + (-56) = -74$

62. $39 - (-1) = 39 + 1 = 40$

64.
$$\begin{aligned} 3-7-5-16 &= 3+(-7)+(-5)+(-16) \\ &= 3+(-28) \\ &= -25 \end{aligned}$$

66.
$$\begin{aligned} 6+4-8-22 &= 6+4+(-8)+(-22) \\ &= 10+(-30) \\ &= -20 \end{aligned}$$

68.
$$\begin{aligned} -6-3+(-7)-2 &= -6+(-3)+(-7)+(-2) \\ &= -18 \end{aligned}$$

70. Replace x with –9.
$x - 12 = (x) - 12 = (-9) - 12 = -9 + (-12) = -21$

72. Replace x with –2.
$x - 10 = (x) - 10 = (-2) - 10 = -2 + (-10) = -12$

74. Replace y with –6.
$19 - y = 19 - (y) = 19 - (-6) = 19 + 6 = 25$

76. Replace y with –2 and x with 3.
$$\begin{aligned} 14-y+x &= 14-(y)+(x) \\ &= 14-(-2)+(3) \\ &= 14+2+3 \\ &= 19 \end{aligned}$$

78. Replace x with -3 and y with 4.

$$\begin{aligned} -7-x-y &= -7-(x)-(y) \\ &= -7-(-3)-(4) \\ &= -7+3+(-4) \\ &= -7+(-4)+3 \\ &= -11+3 \\ &= -8 \end{aligned}$$

80. Replace x with -5 and y with -3.

$$\begin{aligned} -2-x+y &= -2-(x)+(y) \\ &= -2-(-5)+(-3) \\ &= -2+5+(-3) \\ &= -2+(-3)+5 \\ &= -5+5 \\ &= 0 \end{aligned}$$

82. $5889 - (-175) = 5889 + 175 = 6064$
The difference in altitude is 6064 feet.

84. a. $8 - (-4) = 8 + 4 = 12$
The difference was 12°F.

b. $5 - (-6) = 5 + 6 = 11$
The difference was 11°F.

86. a. The lowest temperature in the chart is −18°F, which occurred in Presque Isle, Maine.

b. $84 - (-9) = 84 + 9 = 93$
The difference between the record high and record low on day 5 was 93°F.

88. $-14 - (-13) = -14 + 13 = -1$
The difference between Sandra's score and Tran's score was −1 points after the fifteenth hole.

90. $-22 + 18 - 34 - 11 + (-16) - 2$
$= -22 + 18 + (-34) + (-11) + (-16) + (-2)$
$= -22 + (-34) + (-11) + (-16) + (-2) + 18$
$= -85 + 18$
$= -67$

92. Replace x with -11, y with -2, and z with -8.

$$\begin{aligned} 9-x-y+z+4 &= 9-(x)-(y)+(z)+4 \\ &= 9-(-11)-(-2)+(-8)+4 \\ &= 9+11+2+(-8)+4 \\ &= 9+11+2+4+(-8) \\ &= 26+(-8) \\ &= 18 \end{aligned}$$

94. $-345 - 768 = -345 + (-768) = -1113$

96. $632 - (-1346) = 632 + 1346 = 1978$

98. a. $-3 + 6 = n$

b. $-3 + 6 = 3$; $n = 3$

100.

$$\begin{aligned} x-4 &= 6 \\ -1-4 &\stackrel{?}{=} 6 \\ -1+(-4) &\stackrel{?}{=} 6 \\ -5 &= 6, \text{ False} \end{aligned}$$

No, -1 is not a solution to $x - 4 = 6$.

102. $-1 - \boxed{1} = -2$

104. $-8, -3, 2, 7, 12, \ldots$
Each number is 5 more than the preceding number. The next number is $12 + 5 = 17$.

106. $2, -8, -18, -28, -38, \ldots$
Each number is 10 less than the preceding number. The next number is
$-38 - 10 = -38 + (-10) = -48$.

Cumulative Review

108. $2 + 3(5) = 2 + 15 = 17$

109. $12 - 3(4 - 1) = 12 - 3(3) = 12 - 9 = 3$

110.

$$\begin{aligned} 3^2+4(2)-5 &= 9+4(2)-5 \\ &= 9+8-5 \\ &= 17-5 \\ &= 12 \end{aligned}$$

111.

$$\begin{aligned} 3+[3+2(8-6)] &= 3+[3+2(2)] \\ &= 3+[3+4] \\ &= 3+7 \\ &= 10 \end{aligned}$$

112.

$$\begin{array}{r} 45 \\ 12\overline{)550} \\ \underline{48} \\ 70 \\ \underline{60} \\ 10 \end{array}$$

They will need 45 full boxes plus 10 more pencils. The school should order 46 boxes. There will be two extra pencils.

113. $8670 \div 85 = 102$ min $= 1$ hr 42 min

Classroom Quiz 2.3

1. a. $19 - 25 = 19 + (-25) = -6$

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

2. $-1+4-(-3)-7 = -1+4+3+(-7)$
$= -1+(-7)+4+3$
$= -8+7$
$= -1$

3. $4300 - (-320) = 4300 + 320 = 4620$
The difference in altitude is 4620 feet.

Putting Your Skills to Work
Use Math to Save Money

1. Teresa's deposits total the sum of the amounts: \$200, \$25, \$100, \$150, \$100, \$40.
\$615

2. Teresa's ATM debits total the sum of the amounts: \$40, \$20, \$60, \$30, \$40, \$50, \$40, \$40, \$20, \$30, \$50 and \$22 for ATM fees.
\$442

3. Deposits – debits $\stackrel{?}{>}$ \$175
\$615 – \$442 $\stackrel{?}{>}$ \$175
\$173 < \$175
Teresa did not meet her goal.

4. \$175 – \$173 = \$2
Teresa missed her goal by \$2.

5. If she had made fewer ATM withdrawals, she would have saved some of the \$2.00 fees.

6. On May 19th, Teresa's deposits = \$475, her debits and charges = \$294.
Deposits – debits $\stackrel{?}{>}$ \$155
\$475 – \$294 $\stackrel{?}{>}$ \$155
\$163 > \$155
Yes, she will have enough.

How Am I Doing? Sections 2.1–2.3

1. $-12 \;?\; -7$
−12 lies to the left of −7 on the number line.
$-12 < -7$

2. $|-11| \;?\; |8|$
$11 \;?\; 8$
$11 > 8$
$|-11| > |8|$

3. $-|-8| = -(8) = -8$

4. $-(-(-3)) = -(3) = -3$

5. Replace x with −6.
$-(-x) = -(-(x)) = -(-(-6)) = -(6) = -6$

6. We are adding two numbers with the same sign, so we keep the common sign and add the absolute values.
$-2 + (-14) = -16$

7. $-8+3+(-1)+4 = [-8+(-1)]+[3+4]$
$= -9+7$
$= -2$

8. Replace a with −9 and b with −5.
$a+b+12 = (a)+(b)+12$
$= (-9)+(-5)+12$
$= -14+12$
$= -2$

9. Replace x with −8 and y with −11.
$-x+y+7 = -(x)+(y)+7$
$= -(-8)+(-11)+7$
$= 8+(-11)+7$
$= 8+7+(-11)$
$= 15+(-11)$
$= 4$

10. 1st quarter loss: −\$20,000
2nd quarter profit: \$20,000
3rd quarter loss: −\$10,000
4th quarter profit: \$30,000
$-20,000+20,000+(-10,000)+30,000$
$= -20,000+(-10,000)+20,000+30,000$
$= -30,000+50,000$
$= 20,000$
At the end of the fourth quarter, the company's overall profit was \$20,000.

11. $7 - 19 = 7 + (-19) = -12$

12. $-3 - (-5) = -3 + 5 = 2$

13. $-8 - (-2) - (-1) = -8 + 2 + 1 = -8 + 3 = -5$

14. $-5-6+(-1)-(-7) = -5+(-6)+(-1)+7$
$= -12+7$
$= -5$

15. Replace x with -1 and y with -2.
$-5-x-y = -5-(x)-(y)$
$= -5-(-1)-(-2)$
$= -5+1+2$
$= -5+3$
$= -2$

16. $7622-(-161) = 7622+161 = 7783$
The difference in altitude is 7783 feet.

2.4 Exercises

2. $-3^2 \neq 9$ since we only raise 3 to the power of 2 because there are no parentheses around the 3 to indicate that we raise -3 to the power of 2.

4. If you multiply 7 negative numbers, the product will be a negative number.

6. The quotient of a negative number and a negative number is positive.

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

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

12. $3(-2) = (-2)+(-2)+(-2) = -6$

14. a. $5 \cdot \boxed{5} = 25$

b. $5 \cdot \boxed{-5} = -25$

c. $-5 \cdot \boxed{5} = -25$

d. $-5 \cdot \boxed{-5} = 25$

16. a. $\dfrac{18}{\boxed{2}} = 9$

b. $\dfrac{-18}{\boxed{-2}} = 9$

c. $\dfrac{18}{\boxed{-2}} = -9$

d. $\dfrac{-18}{\boxed{2}} = -9$

18. a. The number of negative signs, 0, is even, so the answer is positive.
$11(7) = 77$

b. The number of negative signs, 1, is odd, so the answer is negative.
$11(-7) = -77$

c. The number of negative signs, 1, is odd, so the answer is negative.
$-11(7)\text{l} = -77$

d. The number of negative signs, 2, is even, so the answer is positive.
$-11(-7) = 77$

20. a. The number of negative signs, 0, is even, so the answer is positive.
$1(8) = 8$

b. The number of negative signs, 2, is even, so the answer is positive.
$-1(-8) = 8$

c. The number of negative signs, 1, is odd, so the answer is negative.
$-1(8) = -8$

d. The number of negative signs, 1, is odd, so the answer is negative.
$1(-8) = -8$

22. The number of negative signs, 2, is even, so the answer is positive.
$-5(-4) = 20$

24. The number of negative signs, 2, is even, so the answer is positive.
$-4(-3) = 12$

26. The number of negative signs, 1, is odd, so the answer is negative.
$2(-11) = -22$

28. The number of negative signs, 1, is odd, so the answer is negative.
$-7(3) = -21$

30. $(-2)(-96)(-69)(-72)(-6)(68)$ is a negative number because it contains an odd number of negative factors.

32. $(-66)(-918)(-818)(-22)$ is a positive number because it contains an even number of negative factors.

34. $2(-4)(-6) = (-8)(-6) = 48$

36. $(-5)(-3)(-2)(-2) = (15)(4) = 60$

38. $9(-1)(2)(-3) = (-9)(-6) = 54$

40. $(-1)(-3)(2)(-4) = 3(-8) = -24$

42. $(-4)(5)(-2)(1)(-4) = (-20)(-2)(-4)$
$= (40)(-4)$
$= -160$

44. The value of $(-8)^{12}$ is a positive number because the exponent is even.

46. The value of $(-81)^{51}$ is a negative number because the exponent is odd.

48. The value of -81^{51} is a negative number because -81^{51} is the opposite of 81^{51}, which is positive.

50. $(-7)^2 = (-7)(-7) = 49$

52. $(-7)^3 = (-7)(-7)(-7) = -343$

54. a. $(-2)^2 = (-2)(-2) = 4$

b. $(-2)^3 = (-2)(-2)(-2) = -8$

56. a. $(-1)^{29} = -1$, 29 is odd.

b. $(-1)^{16} = 1$, 16 is even.

58. a. $-6^2 = -(6)(6) = -36$

b. $(-6)^2 = (-6)(-6) = 36$

60. a. $-5^3 = -(5)(5)(5) = -125$

b. $(-5)^3 = (-5)(-5)(-5) = -125$

62. a. $(-8)^2 = (-8)(-8) = 64$

b. $-8^2 = -8 \cdot 8 = -64$

64. a. $(-1)^{11} = -1$, 11 is odd.

b. $-1^{11} = -(1) = -1$

66. a. $50 \div 5 = 10$

b. $50 \div (-5) = -10$

c. $-50 \div 5 = -10$

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

68. a. $20 \div 4 = 5$

b. $20 \div (-4) = -5$

c. $-20 \div 4 = -5$

d. $-20 \div (-4) = 5$

70. $12 \div (-2) = -6$

72. $\dfrac{-24}{6} = -24 \div 6 = -4$

74. $-12 \div (-3) = 4$

76. $\dfrac{-70}{-10} = -70 \div (-10) = 7$

78. a. $18 \div (-3) = -6$

b. $18(-3) = -54$

80. a. $-8 \div (-4) = 2$

b. $-8(-4) = 32$

82. a. $-12 \div 3 = -4$

b. $-12(3) = -36$

84. a. $9 \div (-3) = -3$

b. $-9(3) = -27$

86. Replace x with -2.
$x^3 = (x)^3 = (-2)^3 = (-2)(-2)(-2) = -8$

88. Replace a with -12 and b with -4.
$\dfrac{-a}{b} = \dfrac{-(a)}{(b)} = \dfrac{-(-12)}{-4} = \dfrac{12}{-4} = -3$

90. Replace x with -15 and y with 5.

$$\frac{-x}{-y}=\frac{-(x)}{-(y)}=\frac{-(-15)}{-(5)}=\frac{15}{-5}=-3$$

92. a. Replace a with -1.

$$-a^8=-(a)^8=-(-1)^8=-(1)=-1$$

b. Replace a with -1.

$$-a^{10}=-(a)^{10}=-(-1)^{10}=-(1)=-1$$

94. Multiply the rate by the time to find the distance.

$-30(4) = -120$

The projectile travels 120 meters to the left in 4 seconds. Since the projectile starts at zero, it is 120 meters to the left of zero.

96. $4(-3) = -12$

The total drop in temperature can be represented by -12°F.

98. $\frac{x}{-5}=2$

$\frac{-10}{-5} \stackrel{?}{=} 2$

$2 = 2$, true

Yes, -10 is a solution.

100. $\frac{x}{2}=-10$

What number divided by 2 is equal to -10?

$\frac{-20}{2}=-20\div 2=-10$

The value of x is -20.

Cumulative Review

101. $2^2+3(5)-1=4+3(5)-1$

$=4+15-1$

$=19-1$

$=18$

102. $8 + 2(9 \div 3) = 8 + 2(3) = 8 + 6 = 14$

103. $2^3+(4\div 2+6)=2^3+(2+6)$

$=2^3+8$

$=8+8$

$=16$

104. $3^2+(6\div 2+8)=3^2+(3+8)$

$=3^2+11$

$=9+11$

$=20$

105. To find the time, divide the distance by the speed of the sound.

$$1087\overline{)3261}\quad 3$$

$$\underline{3261}$$

$$0$$

It took the sound 3 seconds to reach Kristina.

106. Since there are two 8-hour shifts, the company is manufacturing radios $2(8) = 16$ hours per day. Since they work 5 days per week, they work $5(16) = 80$ hours per week. Multiply the number of radios per hour by the number of hours to find the number of radios.

$$\begin{array}{r} 42 \\ \times\ 80 \\ \hline 3360 \end{array}$$

Thus 3360 radios can be manufactured in 5 days.

Classroom Quiz 2.4

1. a. The number of negative signs, 2, is even, so the answer is positive.

$(-4)(-2) = 8$

b. $36 \div (-6) = -6$

c. $\frac{35}{-5}=35\div(-5)=-7$

2. $(-4)(5)(-2)(2) = -20(-4) = 80$

3. a. Replace x with -2.

$$x^3=(x)^3=(-2)^3=(-2)(-2)(-2)=-8$$

b. Replace m with -12 and n with -3.

$$\frac{m}{-n}=\frac{(m)}{-(n)}=\frac{(-12)}{-(-3)}=\frac{-12}{3}=-4$$

2.5 Exercises

2. No, we must multiply $4(-2)$ before we add.

4. No, because $-2^4=-16$. Since there are no parentheses around -2, we only raise 2 to the fourth power.

6. $-6 + (10)(2) = -6 + 20 = 14$

8. $3 + 3(2 - 5) = 3 + 3(-3) = 3 + (-9) = -6$

10. $-1 + 4(7 - 2) = -1 + 4(5) = -1 + 20 = 19$

12. $15 - 3(5 - 7) = 15 - 3(-2) = 15 + 6 = 21$

14.
$$\begin{aligned} 6(-2)(3-9)+4 &= 6(-2)(-6)+4 \\ &= -12(-6)+4 \\ &= 72+4 \\ &= 76 \end{aligned}$$

16. $-7(8 \div 2) + 6 = -7(4) + 6 = -28 + 6 = -22$

18.
$$\begin{aligned} 5(-3)(5-2)-3 &= 5(-3)(3)-3 \\ &= -15(3)-3 \\ &= -45-3 \\ &= -48 \end{aligned}$$

20. $-36 \div 12 - 10 = -3 - 10 = -13$

22. $(-2)^2 + 4(-7) = 4 + 4(-7) = 4 + (-28) = -24$

24.
$$\begin{aligned} (-2)^3 - 6(2) &= -8 - 6(2) \\ &= -8 - 12 \\ &= -8 + (-12) \\ &= -20 \end{aligned}$$

26. $(-3)^3 + 6(-4) = -27 + 6(-4) = -27 + (-24) = -51$

28. $16 \div (-4) + (-4) = -4 + (-4) = -8$

30.
$$\begin{aligned} -15 - 50 \div 10(-3)^2 + 2 &= -15 - 50 \div 10(9) + 2 \\ &= -15 - 5(9) + 2 \\ &= -15 - 45 + 2 \\ &= -15 + (-45) + 2 \\ &= -60 + 2 \\ &= -58 \end{aligned}$$

32.
$$\begin{aligned} 7 - 3(11 - 3^2) + 1 &= 7 - 3(11 - 9) + 1 \\ &= 7 - 3(2) + 1 \\ &= 7 - 6 + 1 \\ &= 7 + (-6) + 1 \\ &= 1 + 1 \\ &= 2 \end{aligned}$$

34.
$$\begin{aligned} \frac{(-45 \div 5 + 1)}{[2-(-2)]} &= \frac{(-9+1)}{[2-(-2)]} \\ &= \frac{-8}{[2-(-2)]} \\ &= \frac{-8}{(2+2)} \\ &= \frac{-8}{4} \\ &= -2 \end{aligned}$$

36.
$$\begin{aligned} \frac{[2^2 + 6(-3)]}{[-2+(-5)]} &= \frac{[4+6(-3)]}{[-2+(-5)]} \\ &= \frac{[4+(-18)]}{[-2+(-5)]} \\ &= \frac{-14}{[-2+(-5)]} \\ &= \frac{-14}{-7} \\ &= 2 \end{aligned}$$

38.
$$\begin{aligned} \frac{[-10-4(-1)]}{(13-19)} &= \frac{[-10+4]}{(13-19)} \\ &= \frac{-6}{(13-19)} \\ &= \frac{-6}{[13+(-19)]} \\ &= \frac{-6}{-6} \\ &= 1 \end{aligned}$$

40.
$$\begin{aligned} 20 \div \{4 \cdot [15 \div (-3)]\} &= 20 \div [4 \cdot (-5)] \\ &= 20 \div (-20) \\ &= -1 \end{aligned}$$

42.
$$\begin{aligned} -36 \div \{2 \cdot [-3 \cdot (-9 \div 3)]\} &= -36 \div \{2 \cdot [-3 \cdot (-3)]\} \\ &= -36 \div [2 \cdot (9)] \\ &= -36 \div (18) \\ &= -2 \end{aligned}$$

44.
$$\begin{aligned} 8°\text{F} + 4(-2°\text{F}) + (-5°\text{F}) &= 8°\text{F} + (-8°\text{F}) + (-5°\text{F}) \\ &= -5°\text{F} \end{aligned}$$
The temperature was $-5°$F at 5 P.M.

46. $11(-1) + 2(+3) = -11 + 6 = -5$
The total charge is -5.

48. $15(+1) + 9(-3) + 8(-1) = 15 - 27 - 8 = -20$
The total charge is -20.

50. $1(5)+2(15)+2(5)+(2(-1)+2(-1))+2(-1)$
$+1(-5)$
$=5+30+10-4-2-5$
$=45-11$
$=34$ points for first baseman

$4(-1)+1(3)+1(5)+(2(-1)+2(-1))$
$=-4+3+5-4$
$=0$ points for second baseman
$34+0=34$
Megan's team receives a total of 34 points for the first and second basemen.

52. $1(20)+2(10)+1(3)+(2(-1)+2(-1))+3(5)$
$+2(-1)+1(-5)$
$=20+20+3-4+15-2-5$
$=47$ points for the catcher
$5(-1)+(2(-1)+2(-1))=-5-4=-9$ points for third baseman
$47+(-9)=38$
Ian's team receives a total of 38 points for the catcher and the third baseman.

54. $\dfrac{[(32-16\div 4)+(-6)]}{(7-9)}=\dfrac{[(32-4)+(-6)]}{(7-9)}$
$=\dfrac{[28+(-6)]}{(7-9)}$
$=\dfrac{22}{(7-9)}$
$=\dfrac{22}{-2}$
$=-11$

56. $[(-2+14)\div(-6)]\cdot[3+(-2)^3]$
$=[(-2+14)\div(-6)]\cdot[3+(-8)]$
$=[12\div(-6)]\cdot[3+(-8)]$
$=-2\cdot[3+(-8)]$
$=-2\cdot(-5)$
$=10$

58. Simplify each side of the equation.
$-2+x+3(-4)=-6+(-4)$
$-2+x+(-12)=-10$
$x+(-14)=-10$
What number plus -14 is equal to -10?
$4+(-14)=-10$
$x=4$

Cumulative Review

59. $2(x+3)=2\cdot x+2\cdot 3=2x+6$

60. $3(a+2)=3\cdot a+3\cdot 2=3a+6$

61. $4(x-2)=4\cdot x-4\cdot 2=4x-8$

62. $7(x-1)=7\cdot x-7\cdot 1=7x-7$

Classroom Quiz 2.5

1. $8+4\div(-4)\cdot 3^2-(-4)=8+4\div(-4)\cdot 9-(-4)$
$=8+(-1)\cdot 9-(-4)$
$=8+(-9)-(-4)$
$=-1-(-4)$
$=-1+4$
$=3$

2. $\dfrac{(3+9\div 3)}{(12-14)}=\dfrac{(3+3)}{(12-14)}$
$=\dfrac{6}{(12-14)}$
$=\dfrac{6}{[12+(-14)]}$
$=\dfrac{6}{-2}$
$=-3$

3. $35{,}000+2(-1000)+1500$
$=35{,}000+(-2000)+1500$
$=33{,}000+1500$
$=34{,}500$
The current altitude is 34,500 feet.

2.6 Exercises

2. No, $7x$ and $6y$ are not like terms so we cannot combine them.

4. $-4x+(-2x)=-6x$

6. $8a+4ab-4a+7ab=4a+11ab$

8. $4x+(-7y)=4x-7y$

10. $-3(x-2)=-3\cdot x-(-3)\cdot 2=-3x+6$

12. $-6x+2x=(-6+2)x=-4x$

14. $6y+(-5y)=[6+(-5)]y=1y=y$

16. $-5a-8a=-5a+(-8)a=[-5+(-8)]a=-13a$

18. $-9b-(-3b)=-9b+3b=(-9+3)b=-6b$

20. $6x+(-2x)=[6+(-2)]x=4x$

22. $-6y+(-8y)=[-6+(-8)]y=-14y$

24. $2x + (-6y) = 2x - 6y$

26. $-3a + (-9b) = -3a - 9b$

28. $11x + (-y) = 11x - y$

30. $-12m - (-6n) = -12m + 6n$

32. a. $4 - 9 + 2 = 4 + (-9) + 2 = -5 + 2 = -3$

b.
$$\begin{aligned} 4x - 9x + 2x &= 4x + (-9x) + 2x \\ &= -5x + 2x \\ &= -3x \end{aligned}$$

34. a. $6 - 10 + 3 = 6 + (-10) + 3 = -4 + 3 = -1$

b.
$$\begin{aligned} 6x - 10x + 3x &= 6x + (-10x) + 3x \\ &= -4x + 3x \\ &= -1x \\ &= -x \end{aligned}$$

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

b.
$$\begin{aligned} 3x - 8x + 1x &= 3x + (-8x) + 1x \\ &= -5x + 1x \\ &= -4x \end{aligned}$$

38.
$$\begin{aligned} -7x + 2y + 5x &= -7x + 5x + 2y \\ &= (-7 + 5)x + 2y \\ &= -2x + 2y \end{aligned}$$

40.
$$\begin{aligned} 9a + 4b + (-11a) &= 9a + (-11a) + 4b \\ &= [9 + (-11)]a + 4b \\ &= -2a + 4b \end{aligned}$$

42.
$$\begin{aligned} 10y + 2x + (-4y) &= 10y + (-4y) + 2x \\ &= [10 + (-4)]y + 2x \\ &= 6y + 2x \end{aligned}$$

44.
$$\begin{aligned} -7a - 2a + b &= -7a + (-2a) + b \\ &= [-7 + (-2)]a + b \\ &= -9a + b \end{aligned}$$

46.
$$\begin{aligned} 6x + 3y - 9x - 2y &= 6x + 3y + (-9x) + (-2y) \\ &= 6x + (-9x) + 3y + (-2y) \\ &= [6 + (-9)]x + [3 + (-2)]y \\ &= -3x + 1y \\ &= -3x + y \end{aligned}$$

48.
$$\begin{aligned} 8x + 4y - 11x - 9 &= 8x + 4y + (-11x) + (-9) \\ &= 8x + (-11x) + 4y + (-9) \\ &= [8 + (-11)]x + 4y + (-9) \\ &= -3x + 4y - 9 \end{aligned}$$

50.
$$\begin{aligned} 7 + 5xy + 9 - 8xy &= 7 + 5xy + 9 + (-8xy) \\ &= 7 + 9 + 5xy + (-8xy) \\ &= [7 + 9] + [5 + (-8)]xy \\ &= 16 + (-3xy) \\ &= 16 - 3xy \end{aligned}$$

52.
$$\begin{aligned} 5y + 8xy - 11y - xy &= 5y + 8xy + (-11y) + (-1xy) \\ &= 5y + (-11y) + 8xy + (-1xy) \\ &= [5 + (-11)]y + [8 + (-1)]xy \\ &= -6y + 7xy \end{aligned}$$

54.
$$\begin{aligned} &3x - 4xy - 7 - 9xy + 2x \\ &= 3x + (-4xy) + (-7) + (-9xy) + 2x \\ &= 3x + 2x + (-4xy) + (-9xy) + (-7) \\ &= (3 + 2)x + [(-4) + (-9)]xy + (-7) \\ &= 5x + (-13xy) + (-7) \\ &= 5x - 13xy - 7 \end{aligned}$$

56.
$$\begin{aligned} &5y + 4x - 8y + 3xy - x \\ &= 5y + 4x + (-8y) + 3xy + (-1x) \\ &= 5y + (-8y) + 4x + (-1x) + 3xy \\ &= [5 + (-8)]y + [4 + (-1)]x + 3xy \\ &= -3y + 3x + 3xy \end{aligned}$$

58.
$$\begin{aligned} &-2y + 5x - 4y + 9xy + 3x \\ &= -2y + 5x + (-4y) + 9xy + 3x \\ &= 5x + 3x + (-2y) + (-4y) + 9xy \\ &= (5 + 3)x + [(-2) + (-4)]y + 9xy \\ &= 8x + (-6y) + 9xy \\ &= 8x - 6y + 9xy \end{aligned}$$

60.
$$\begin{aligned} &2a + 7b - 4a + 3ab - 12b \\ &= 2a + 7b + (-4a) + 3ab + (-12b) \\ &= 2a + (-4a) + 7b + (-12b) + 3ab \\ &= [2 + (-4)]a + [7 + (-12)]b + 3ab \\ &= -2a + (-5b) + 3ab \\ &= -2a - 5b + 3ab \end{aligned}$$

62. Replace a with -1 and b with -3.
$$\begin{aligned} a + 3b &= (a) + 3(b) \\ &= (-1) + 3(-3) \\ &= -1 + (-9) \\ &= -10 \end{aligned}$$

64. Replace x with 4 and y with -1.
$$\begin{aligned} x - 3y &= (x) - 3(y) \\ &= (4) - 3(-1) \\ &= 4 - (-3) \\ &= 4 + 3 \\ &= 7 \end{aligned}$$

66. Replace m with -5 and n with 2.

$$\begin{aligned} m \cdot n - 8 &= (m)(n) - 8 \\ &= (-5)(2) - 8 \\ &= -10 - 8 \\ &= -10 + (-8) \\ &= -18 \end{aligned}$$

68. Replace m with -10 and n with 7.

$$\frac{(m+n)}{3} = \frac{[(m)+(n)]}{3} = \frac{[(-10)+(7)]}{3} = \frac{-3}{3} = -1$$

70. Replace a with -2.

$$7a^2 = 7(a)^2 = 7(-2)^2 = 7(4) = 28$$

72. Replace m with -3.

$$\begin{aligned} 9m - m^2 &= 9(m) - (m)^2 \\ &= 9(-3) - (-3)^2 \\ &= 9(-3) - (9) \\ &= -27 - 9 \\ &= -27 + (-9) \\ &= -36 \end{aligned}$$

74. Replace t with -3.

$$\begin{aligned} \frac{(t^2 - t)}{3} &= \frac{[(t)^2 - (t)]}{3} \\ &= \frac{[(-3)^2 - (-3)]}{3} \\ &= \frac{[9 - (-3)]}{3} \\ &= \frac{(9+3)}{3} \\ &= \frac{12}{3} \\ &= 4 \end{aligned}$$

76. Replace x with 30 and y with 5.

$$\begin{aligned} \frac{(x-y)^2)}{-5} &= \frac{[(x)-(y)^2]}{-5} \\ &= \frac{[(30)-(5)^2]}{-5} \\ &= \frac{(30-25)}{-5} \\ &= \frac{5}{-5} \\ &= -1 \end{aligned}$$

78. Replace a with 5 and b with -4.

$$\begin{aligned} \frac{(a^2 + 4b)}{-3} &= \frac{[(a)^2 + 4(b)]}{-3} \\ &= \frac{[(5)^2 + 4(-4)]}{-3} \\ &= \frac{[25 + 4(-4)]}{-3} \\ &= \frac{[25 + (-16)]}{-3} \\ &= \frac{9}{-3} \\ &= -3 \end{aligned}$$

80. $-5(x + 1) = -5x + (-5) = -5x - 5$

82. $-8(a-1) = -8a - (-8)(1) = -8a - (-8) = -8a + 8$

84. $$\begin{aligned} -3(x-9) &= -3x - (-3)(9) \\ &= -3x - (-27) \\ &= -3x + 27 \end{aligned}$$

86. $-1(a + 4) = -1a + (-1)4 = -a + (-4) = -a - 4$

88. $5(-3 + x) = 5(-3) + 5x = -15 + 5x$

90. $7(-1 + x) = 7(-1) + 7x = -7 + 7x$

92. Replace v with -7 and t with 3.

$s = v - 32t = -7 - 32(3) = -7 - 96 = -103$

The skydiver is falling 103 feet per second.

94. $$\begin{aligned} C &= \frac{(5F - 160)}{9} \\ &= \frac{[5(5) - 160]}{9} \\ &= \frac{(25 - 160)}{9} \\ &= \frac{-135}{9} \\ &= -15 \end{aligned}$$

The Celsius reading is $-15°$C.

96. $$\frac{x^3}{2} = 0$$

$$\frac{0^3}{2} \stackrel{?}{=} 0$$

$$\frac{0}{2} \stackrel{?}{=} 0$$

$0 = 0$, true

Yes, 0 is a solution.

Cumulative Review

98. 6 ft + 3 ft + 6 ft + 3 ft = 18 ft
The perimeter is 18 feet.

99. 7 in. + 7 in. + 7 in. + 7 in. = 28 in.
The perimeter is 28 inches.

100. If light travels 5,580,000 miles in 30 seconds, divide the number of miles by 30 to find out how far light travels in 1 second.
5,580,000 ÷ 30 = 186,000
Light travels 186,000 miles in 1 second.
Since 1 min = 60 sec = 30 sec + 30 sec, add the number of miles light travels in 30 seconds to itself to find how far light travels in 1 minute.
5,580,000 + 5,580,000 = 11,160,000
Light travels 11,160,000 miles in 1 minute.

101. Since the heart beats 73 times per minute and there are 60 minutes in one hour, multiply 73 by 60 to find the number of times the heart beats in one hour.
60(73) = 4380
The heart beats 4380 times per hour. Since there are 24 hours in one day, multiply 4380 by 24 to find the number of times the heart beats in one day.
24(4380) = 105,120
The heart beats 105,120 times per day.

Classroom Quiz 2.6

1. $3mn - 7n + 5 - 6mn - 2n$
$= 3mn + (-7n) + 5 + (-6mn) + (-2n)$
$= 3mn + (-6mn) + (-7n) + (-2n) + 5$
$= [3 + (-6)]mn + [-7 + (-2)]n + 5$
$= -3mn + (-9n) + 5$
$= -3mn - 9n + 5$

2. a. $-5(x - 2) = -5x - (-5)(2)$
$= -5x - (-10)$
$= -5x + 10$

b. $-3(5 + x) = -3(5) + (-3x)$
$= -15 - 3x$ or $-3x - 15$

3. Replace t with 4 and v with −6.
$s = v - 32t = -6 - 32(4) = -6 - 128 = -134$
The skydiver is falling 134 feet per second.

Chapter 2 Review Problems

1. Negative numbers are numbers that are less than zero.

2. Opposites are numbers that are the same distance from zero but lie on opposite sides of zero.

3. Integers are whole numbers and their opposites.

4. Absolute value is the value of the distance between a number and 0 on the number line.

5. −3 ? −1
−3 lies to the left of −3 on the number line.
−3 < −1

6. 7 ? −7
Positive numbers are always greater than negative numbers.
7 > −7

7. 5 ? −5
Positive numbers are always greater than negative numbers.
5 > −5

8. −9 ? −11
−9 lies to the right of −11 on the number line.
−9 > −11

9. __+__ A profit of $200

10. __−__ A drop in temperature of 18°

11. The opposite of −12 is __12__.

12. −(−(−6)) = −(6) = −6

13. −|−11| = −(11) = −11

14. The number −23 has a larger absolute value than 12 because −23 is further from 0 on the number line.

15. a. The highest point on the graph corresponds to May. Justin made the most money in May.

b. The lowest point on the graph corresponds to March. Justin lost the most money in March.

16. a. The points for January, February, and May are above the horizontal line indicating zero. Justin had a net gain in these three months.

b. The points for March and April are below the horizontal line indicating zero. Justin had a net loss in these three months.

17. $-\$600 + (-\$200) = -\$800$

18. $\$100 + \$200 = \$300$

19. a. $-43 + (-16) = -59$

b. $43 + 16 = 59$

20. a. $-27 + (-39) = -66$

b. $27 + 39 = 66$

21. $-\$25{,}000 + \$15{,}000 = -\$10{,}000$
The company had a net loss.

22. $-\$14 + \$25 = \$11$
Terry had a net profit.

23. a. $-10°\text{F} + 20°\text{F}$

b. Positive

c. $-10°\text{F} + 20°\text{F} = 10°\text{F}$

24. a. $2 + (-8) = -6$

b. $-2 + 8 = 6$

c. $-2 + (-8) = -10$

25. a. $27 + (-18) = 9$

b. $-27 + 18 = -9$

c. $-27 + (-18) = -45$

26. $3+(-5)+8+(-2) = 3+8+(-5)+(-2)$
$= 11+(-7)$
$= 4$

27. $24 + (-52) + (-12) + (-56) = 24 + (-120) = -96$

28. Replace x with -1.
$x + 6 = (x) + 6 = (-1) + 6 = 5$

29. Replace x with -3 and y with -11.
$-x+y+2 = -(x)+(y)+2$
$= -(-3)+(-11)+2$
$= 3+(-11)+2$
$= -11+3+2$
$= -11+5$
$= -6$

30. $-900 + (220) = -680$
The depth of the submarine can be expressed as -680 feet.

31. $-240+350+400+(-800)$
$= -240+(-800)+350+400$
$= -1040+750$
$= -290$
The plane is 290 feet below its initial position of 35,000 feet. This can be expressed as -290 feet.

32. $-7 - 5 = -7 + (-5) = -12$

33. $-9 - (-4) = -9 + 4 = -5$

34. $-4 - 4 = -4 + (-4) = -8$

35. $-6 - (-6) = -6 + 6 = 0$

36. $-3 - 8 + 6 = -3 + (-8) + 6 = -11 + 6 = -5$

37. $6 - (-4) + (-5) = 6 + 4 + (-5) = 10 + (-5) = 5$

38. $-4 - (-2) = -4 + 2 = -2$

39. $6-9-2-8 = 6+(-9)+(-2)+(-8)$
$= 6+(-19)$
$= -13$

40. $-6-(-9)+(-1) = -6+9+(-1)$
$= -6+(-1)+9$
$= (-7)+9$
$= 2$

41. Replace y with -2.
$y-15 = (y)-15 = (-2)-15 = -2+(-15) = -17$

42. Replace x with -4 and y with -2.
$-1-x+y = -1-(x)+(y)$
$= -1-(-4)+(-2)$
$= -1+4+(-2)$
$= -1+(-2)+4$
$= -3+4$
$= 1$

43. 4th quarter gain: \$30,000
3rd quarter loss: $-\$20{,}000$
$30{,}000 - (-20{,}000) = 30{,}000 + 20{,}000 = 50{,}000$
The difference between the fourth quarter gain and the third quarter loss is \$50,000.

44. 1st quarter gain: \$10,000
2nd quarter loss: $-\$30{,}000$
$10{,}000 - (-30{,}000) = 10{,}000 + 30{,}000 = 40{,}000$
The difference between the first quarter gain and the second quarter loss is \$40,000.

45. $2300 - (-1312) = 2300 + 1312 = 3612$
The difference in altitude is 3612 feet.

46. **a.** $6(3) = 18$

b. $6(-3) = -18$

c. $-6(3) = -18$

d. $-6(-3) = 18$

47. **a.** $5(2) = 10$

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

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

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

48. $-7(-2) = 14$

49. $-2(5) = -10$

50. $3(-4) = -12$

51. $-4(-1) = 4$

52. $(-2)(-5)(-9) = 10(-9) = -90$

53. $(-2)(-8)(-1)(-4) = 16(4) = 64$

54. $\begin{aligned}(-5)(1)(-2)(4)(-6) &= (-5)(-8)(-6)\\ &= 40(-6)\\ &= -240\end{aligned}$

55. $(-7)^2 = (-7)(-7) = 49$

56. $-9^2 = -(9)(9) = -81$

57. $(-6)^3 = (-6)(-6)(-6) = -216$

58. **a.** $49 \div 7 = 7$

b. $49 \div (-7) = -7$

59. **a.** $-30 \div 5 = -6$

b. $-30 \div (-5) = 6$

60. **a.** $-44 \div (-4) = 11$

b. $9(-5) = -45$

c. $(-11)(-3) = 33$

d. $\dfrac{25}{-5} = -5$

61. **a.** $12 \div (-4) = -3$

b. $5(-8) = -40$

c. $-12(-2) = 24$

d. $\dfrac{36}{-9} = -4$

62. Replace y with -1.
$y^4 = (y)^4 = (-1)^4 = (-1)(-1)(-1)(-1) = 1$

63. Replace x with -3.
$x^3 = (x)^3 = (-3)^3 = (-3)(-3)(-3) = -27$

64. Replace a with -20 and b with 5.
$\dfrac{-a}{b} = \dfrac{-(a)}{(b)} = \dfrac{-(-20)}{(5)} = \dfrac{20}{5} = 4$

65. replace m with 6 and n with -2.
$\dfrac{-m}{-n} = \dfrac{-(m)}{-(n)} = \dfrac{-(6)}{-(-2)} = \dfrac{-6}{2} = -3$

66. $\begin{aligned}4 - 1(6 - 9) &= 4 - 1[6 + (-9)]\\ &= 4 - 1(-3)\\ &= 4 - (-3)\\ &= 4 + 3\\ &= 7\end{aligned}$

67. $\begin{aligned}3(-5)(2 - 6) + 8 &= 3(-5)[2 + (-6)] + 8\\ &= 3(-5)(-4) + 8\\ &= -15(-4) + 8\\ &= 60 + 8\\ &= 68\end{aligned}$

68. $-2^2 + 3(-4) = -4 + 3(-4) = -4 + (-12) = -16$

69. $\dfrac{(-32 \div 8 + 4)}{(7 - 9)} = \dfrac{(-4 + 4)}{(7 - 9)} = \dfrac{0}{(7 - 9)} = \dfrac{0}{-2} = 0$

70. $\begin{aligned}12 + 3(-5) + (-2) &= 12 + (-15) + (-2)\\ &= 12 + (-17)\\ &= -5\end{aligned}$

71. $-4y + 7y = (-4 + 7)y = 3y$

72. $-4y+3x+9y=-4y+9y+3x$
$=(-4+9)y+3x$
$=5y+3x$
$=3x+5y$

73. $-6a-a=-6a-1a$
$=-6a+(-1a)$
$=[-6+(-1)]a$
$=-7a$

74. $7x+9y-6x-11y=7x+9y+(-6x)+(-11y)$
$=7x+(-6x)+9y+(-11y)$
$=[7+(-6)]x+[9+(-11)]y$
$=1x+(-2y)$
$=x-2y$

75. $3+5z-7+2yz-8z$
$=3+5z+(-7)+2yz+(-8z)$
$=3+(-7)+5z+(-8z)+2yz$
$=[3+(-7)]+[5+(-8)]z+2yz$
$=-4+(-3z)+2yz$
$=-4-3z+2yz$

76. $-8+7y+7-2y=-8+7y+7+(-2y)$
$=-8+7+7y+(-2y)$
$=[-8+7]+[7+(-2)]y$
$=-1+5y$

77. Replace a with 8 and b with -4.
$a+3b=(a)+3(b)=(8)+3(-4)=8+(-12)=-4$

78. Replace x with -2 and y with -1.
$2x-y=2(x)-(y)$
$=2(-2)-(-1)$
$=-4-(-1)$
$=-4+1$
$=-3$

79. Replace x with -1 and y with -7.
$\dfrac{(x^2-y)}{4}=\dfrac{[(x)^2-(y)]}{4}$
$=\dfrac{[(-1)^2-(-7)]}{4}$
$=\dfrac{[1-(-7)]}{4}$
$=\dfrac{(1+7)}{4}$
$=\dfrac{8}{4}$
$=2$

80. Replace a with -3 and b with 9.
$a^2-b=(a)^2-(b)$
$=(-3)^2-(9)$
$=9-9$
$=9+(-9)$
$=0$

81. $C=\dfrac{(5F-160)}{9}$
$=\dfrac{[5(41)-160]}{9}$
$=\dfrac{(205-160)}{9}$
$=\dfrac{45}{9}$
$=5$
The temperature is 5°C.

82. $C=\dfrac{(5F-160)}{9}$
$=\dfrac{[5(-4)-160]}{9}$
$=\dfrac{(-20-160)}{9}$
$=\dfrac{-180}{9}$
$=-20$
The temperature is −20°C.

83. $-6(x+1)=-6x+(-6)(1)$
$=-6x+(-6)$
$=-6x-6$

84. $-2(a-1)=-2a-(-2)(1)=-2a-(-2)=-2a+2$

85. $4(-2+x)=4(-2)+4x=-8+4x$

How Am I Doing? Chapter 2 Test

1. -234 ? -5
-234 lies to the left of -5 on the number line.
$-234<-5$

2. $|4|$? $|-18|$
4 ? 18
$4<18$
$|4|<|18|$

3. __−__ 14 points

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

5. the opposite of 10 is $\underline{\quad -10 \quad}$.

6. a. $|12| = 12$

b. $-|-3| = -(3) = -3$

7. a. $-10°\text{F} + 15°\text{F}$

b. $-10°\text{F} + 15°\text{F} = 5°\text{F}$

8. $-6 + 8 = 2$

9. $-6 + (-4) = -10$

10. $\begin{aligned} -20+5+(-1)+(-3) &= 5+(-20)+(-1)+(-3) \\ &= 5+(-24) \\ &= -19 \end{aligned}$

11. $12 - 18 = 12 + (-18) = -6$

12. $-1 - 11 = -1 + (-11) = -12$

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

14. $\begin{aligned} -14-3+(-6)-1 &= -14+(-3)+(-6)+(-1) \\ &= -24 \end{aligned}$

15. $(7)(-3) = -21$

16. $(-8)(-4) = 32$

17. $(-5)(-2)(-1)(3) = 10(-3) = -30$

18. a. $(-5)^2 = (-5)(-5) = 25$

b. $(-5)^3 = (-5)(-5)(-5) = -125$

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

19. a. $-8 \div 2 = -4$

b. $-8 \div (-2) = 4$

20. $\dfrac{-22}{11} = -22 \div 11 = -2$

21. $\begin{aligned} 2-35\div 5(-3)^2-6 &= 2-35\div 5(9)-6 \\ &= 2-7(9)-6 \\ &= 2-63-6 \\ &= 2+(-63)+(-6) \\ &= 2+(-69) \\ &= -67 \end{aligned}$

22. $\begin{aligned} \dfrac{[-8+2(-3)]}{(14-21)} &= \dfrac{[-8+(-6)]}{(14-21)} \\ &= \dfrac{-14}{(14-21)} \\ &= \dfrac{-14}{-7} \\ &= 2 \end{aligned}$

23. a. Replace x with -6 and y with -3.

$\begin{aligned} -7-x+y &= -7-(x)+(y) \\ &= -7-(-6)+(-3) \\ &= -7+6+(-3) \\ &= -7+(-3)+6 \\ &= -10+6 \\ &= -4 \end{aligned}$

b. Replace x with -7 and y with 6.

$\begin{aligned} -7-x+y &= -7-(x)+(y) \\ &= -7-(-7)+(6) \\ &= -7+7+6 \\ &= -7+13 \\ &= 6 \end{aligned}$

24. Replace x with -1 and y with -4.

$\begin{aligned} \dfrac{(2x-y^2)}{-9} &= \dfrac{[2(x)-(y)^2]}{-9} \\ &= \dfrac{[2(-1)-(-4)^2]}{-9} \\ &= \dfrac{[2(-1)-16]}{-9} \\ &= \dfrac{(-2-16)}{-9} \\ &= \dfrac{[-2+(-16)]}{-9} \\ &= \dfrac{-18}{-9} \\ &= 2 \end{aligned}$

25. a. Replace x with -1.

$x^4 = (x)^4 = (-1)^4 = (-1)(-1)(-1)(-1) = 1$

b. Replace a with -2.

$a^3 = (a)^3 = (-2)^3 = (-2)(-2)(-2) = -8$

26. Replace x with -6 and y with -2.

$\dfrac{-x}{y} = \dfrac{-(x)}{(y)} = \dfrac{-(-6)}{(-2)} = \dfrac{6}{(-2)} = 6 \div (-2) = -3$

27. $5x+2y-8x-6y = 5x+2y+(-8x)+(-6y)$
$= 5x+(-8x)+2y+(-6y)$
$= [5+(-8)]x+[2+(-6)]y$
$= -3x+(-4y)$
$= -3x-4y$

28. $-3x+7xy+8y-12x-11y$
$= -3x+7xy+8y+(-12x)+(-11y)$
$= -3x+(-12x)+8y+(-11y)+7xy$
$= [-3+(-12)]x+[8+(-11)]y+7xy$
$= -15x+(-3y)+7xy$
$= -15x-3y+7xy$

29. $-6(a+7) = -6a+(-6)(7)$
$= -6a+(-42)$
$= -6a-42$

30. $-2(x-1) = -2x-(-2)(1)$
$= -2x-(-2)$
$= -2x+2$

31. 1st quarter gain: \$20,000
2nd quarter loss: –\$5000
20,000 + (–5000) = 15,000
The company's overall profit at the second quarter loss was \$15,000.

32. 3700 – (–529) = 3700 + 592 = 4292
The difference in altitude is 4292 feet.

33. Replace t with 5 and v with –7.
$s = v - 32t = -7 - 32(5) = -7 - 160 = -167$
The skydiver is falling 167 feet per second.

Cumulative Test for Chapters 1–2

1. 5280
The number to the right of the hundreds place is 5 or more. We add 1 in the hundreds place and replace the digits to the right with zeros.
5300

2.
$$\begin{array}{r} 1650 \\ -\ 1475 \\ \hline 175 \end{array}$$
Early Modern English was used for 175 years.

3. a. Subtract the expenses from the income.
$$\begin{array}{r} 167{,}350 \\ -\ 86{,}000 \\ \hline 81{,}350 \end{array}$$
The profit was 81,350.

b. Divide the profit by 2.
$$\begin{array}{r} 40675 \\ 2\overline{)81350} \\ \underline{8} \\ 013 \\ \underline{12} \\ 15 \\ \underline{14} \\ 10 \\ \underline{10} \\ 0 \end{array}$$
Each owner received \$40,675.

4. $6(7x) = (6 \cdot 7)x = 42x$

5. $3(y \cdot 8) = 3(8y) = (3 \cdot 8)y = 24y$

6. $400(7n) = (400 \cdot 7)n = 2800n$

7.
$$\begin{array}{r} 209 \\ \times\ \ 67 \\ \hline 1\,463 \\ 12\,54 \\ \hline 14{,}003 \end{array}$$

8. 2844 ÷ 14 = 203 R 2
$$\begin{array}{r} 203 \\ 14\overline{)2844} \\ \underline{28} \\ 044 \\ \underline{42} \\ 2 \end{array}$$

9. Replace x with 10.
$3 + x = 3 + 10 = 13$

10. $\dfrac{16}{x} = 8$
Sixteen divided by what number is equal to eight?
$\dfrac{16}{2} = 8$
The solution is $x = 2$.
Check: $\dfrac{16}{x} = 8$
$\dfrac{16}{2} \stackrel{?}{=} 8$
$8 = 8$ ✓

11. $5 + x = 8$
Five plus what number is equal to eight?
$5 + 3 = 8$
The solution is $x = 3$.
Check: $5 + x = 8$
$5 + 3 \stackrel{?}{=} 8$
$8 = 8$

12. Double some number equals 28: $2x = 28$

13. $-8 \; ? \; -617$
-8 lies to the right of -617 on the number line.
$-8 > -617$

14. $|-17| \; ? \; |-2|$
$17 \; ? \; 2$
$17 > 2$
$|-17| > |-2|$

15. $-(-(-(-6))) = -(-(6)) = -(-6) = 6$

16. $-|-1| = -(1) = -1$

17. $5 + (-6) = -1$

18. $-10 - 8 = -10 + (-8) = -18$

19. $-7 - 6 - 4 - 8 = -7 + (-6) + (-4) + (-8) = -25$

20. $(-18) \div (-9) = 2$

21. $(-2)^5 = (-2)(-2)(-2)(-2)(-2) = -32$

22. $(-2)(-1)(4)(3)(-2) = 2(12)(-2) = 24(-2) = -48$

23.
$$\begin{aligned} -4 + 15 \div 5(-3)^2 - 1 &= -4 + 15 \div 5(9) - 1 \\ &= -4 + 3(9) - 1 \\ &= -4 + 27 - 1 \\ &= -4 + 27 + (-1) \\ &= -4 + (-1) + 27 \\ &= -5 + 27 \\ &= 22 \end{aligned}$$

24.
$$\begin{aligned} 3mn - 7mn + 4m &= 3mn + (-7mn) + 4m \\ &= [3 + (-7)]mn + 4m \\ &= -4mn + 4m \end{aligned}$$

25. Replace x with -1 and y with -3.
$$\begin{aligned} x - 2y^3 + 1 &= (x) - 2(y)^3 + 1 \\ &= (-1) - 2(-3)^3 + 1 \\ &= -1 - 2(-27) + 1 \\ &= -1 - (-54) + 1 \\ &= -1 + 54 + 1 \\ &= -1 + 55 \\ &= 54 \end{aligned}$$