Applications

1. a. In 10 s, it will be at 100 m
(10 m/s × 10 s = 100 m). It will
reach the east terminal in 150 s
(1,500 m ÷ 10 m/s = 150 s).

b. 15 s ago, it was at −150 m or
150 m to the west of the main terminal
(10 m/s × (−15 s) = −150 m). It was
at the west terminal about 100 s ago
(−1,000 m ÷ 10 m/s = −100 s).

c. In 20 s, it will be at −200 m or 200 m
to the west (−10 m/s × 20 s = −200 m).
It will reach the west terminal in 100 s
(−1,000 m ÷ (−10 m/s) = 100 s).

d. It was at the east terminal 150 s ago or
−150 s (1,500 m ÷ (−10 m/s) = −150 s).
20 s ago, it was at 200 m or 200 m
to the east of the main terminal
(−10 m/s × (−20 s) = 200 m).

2. There are eight red chips each with a
value of −5. Thus the total value of the
board, by adding, is −40. This means
8 × (−5) = −40 or −40 ÷ 8 = −5.

3. 10 × (−5) = −50 (add 10 terms, each of
which is −5).

4. 4 × (−15) = −60 =
(−15) + (−15) + (−15) + (−15)

5. 3 × (−5) = −15 = −5 + (−5) + (−5)

6. −14 ÷ 2 = −7 since 2 × (−7) = −14
= −7 + (−7)

7. −14 ÷ 7 = −2 since (−2) × 7 = −14

8. −35 ÷ 7 = −5 since (−5) × 7 = −35

9. a. 7 × 2 = 14
    b. −7 × (−2) = 14
    c. 7 × (−2) = −14
    d. −7 × 2 = −14
    e. 8 × 2.5 = 20
    f. −9 × (−4) = 36
    g. 12 × (−3) = −36
    h. −1.5 × 4 = −6
    i. 3.5 × 7 = 24.5

j. −8.1 × (−1) = 8.1

k. 1 × (−6) = −6

l. −2 1/2 × 1 = −2 1/2

10. a. <
    b. <
    c. <
    d. <
    e. <
    f. <
    g. >
    h. >
    i. >
    j. <

11. 9 + 5 = 5 + 9

12. 4 × 5 = 5 × 4

13. a. −12 and −12
    b. −8 and −8
    c. 6 and 6
    d. −4 4/5 and −4 4/5
    e. All the answers are equal, so
    multiplication with negative numbers is
    commutative.

14. a. True. You can either distribute the
    negative sign (that is out front) to the
    numerator or denominator. In either
    of the forms, it will still be a negative
    answer. −3/2 = −1 1/2
    b. False. −(1/2) = −0.5, but −1/2 = 0.5. In
    −1/2, both numbers are negative, and a
    negative divided by a negative equals a
    positive.
    −1 ÷ (−2) = 0.5

15. a. 12
    b. 12
    c. −2
16. \[7 \cdot (-3) = -21; \quad -3 \cdot 7 = -21; \quad -21 ÷ 7 = -3; \quad -21 ÷ (-3) = 7\]
17. \[-4 \cdot (-5) = 20; \quad -5 \cdot (-4) = 20; \quad 20 ÷ (-4) = -5; \quad 20 ÷ (-5) = -4\]
18. \[1.5 \cdot (-3) = -4.5; \quad -3 \cdot 1.5 = -4.5; \quad -4.5 ÷ 1.5 = -3; \quad -4.5 ÷ (-3) = 1.5\]
19. Less than 0 (A negative number divided by a positive number will always be a negative number.)
20. 0 (Any number multiplied by 0 is 0.)
21. Greater than 0 (A negative multiplied by a negative results in a positive.)
22. 0 (0 divided by any nonzero number, regardless of sign, is 0.)
23. Greater than 0 (A negative divided by a negative results in a positive.)
24. Less than 0 (The product of a negative and a positive is a negative.)
25. a. 108
   b. -125
c. 4.4
d. -8
e. -7
f. \(\frac{8}{15}\)

g. -3
h. 9
i. -180
j. -7.5
k. \(\frac{5}{3}\) or \(1\frac{2}{3}\)
l. 1.8
m. 450
n. -4
o. 9
p. -1
q. -5
r. -5.5 or \(-5\frac{1}{2}\)
26. B
27. J
28. 9; Inverse Property of Multiplication; Identity Property of Multiplication
29. -14; Commutative Property of Multiplication; multiplicative inverse
30. 7.8; Commutative Property of Multiplication, multiplicative inverse
31. 5.8; Identity Property of Multiplication
32. repeat; -0.5
33. terminate; -0.875
34. repeat; -0.36
35. terminate; 0.3125
36. -5, -3, -2, 2, 3, 5

Connections
37. a. Answers will vary based on students’ estimates of the thermometer reading. Sample: There are 4 h between noon and 4:00 p.m. In 4 h, the temperature changes \(4 \cdot (-2) = -8\)°F, so the temperature at 4:00 p.m. was \(69 + (-8) = 61\)°F.
b. Answers will vary based on students’ estimates of the thermometer reading. Sample: There are 21 h between noon and 9:00 a.m. In 21 h, the temperature changes \(21 \cdot (-2) = -42\)°F, so the temperature at 9:00 a.m. was \(69 + (-42) = 27\)°F.
38. $-500$ points; $-300 + [4 \cdot (-50)] = -500$ or
$-300 - (4 \cdot 50) = -500$

39. $500$ points; $X - (3 \cdot 100) = 200$;
$X = 200 + 300; X = 500$

40. 13-yd line; $25 - (3 \cdot 4) = 13$ or
$25 + [3 \cdot (-4)] = 13$

41. lost $\$1,437.50$;
$5,750 \cdot (-0.25) = -1,437.50$

42. a. $52 \cdot 75 = 3,900$
b. $52 \cdot (-75) = -3,900$
c. $-2,262 \div (-58) = 39$
d. $\frac{2}{3} - \frac{4}{5} = \frac{8}{15}$
e. $-9,908 + 89 = -111.326$
f. $-7.77 + (-0.37) = 21$
g. $-34 \cdot 15 = 510$
h. $53.2 \div (-7) = -7.6$
i. $-\frac{2}{3} \cdot \frac{6}{8} = -\frac{1}{2}$
j. $90 \div 50 = 1.8$
k. $-90 \cdot (-50) = 4,500$
l. $-108 \div 24 = -4.5$
m. $19.5 \div (-3) = -6.5$

43. a. The temperatures measured in °C from the lowest to highest are: $-25, -23, -20, -16, -13, -4, -2, 7, 9, 14, 15, 17$. The median falls between the sixth and seventh temperatures, or between $-2$ and $-4$, which is a median of $-3°C$.
b. The temperature goes from $-25°C$ to $17°C$, giving a range of $42°C$.
c. The sum of all the temperatures is $\frac{-41}{12}°C$, giving a mean temperature of $\frac{-41}{12}°C \div 12 = -3.4°C$.

d. Average Temperature in Alaska

44. a. $-5 - 18 = -23$
b. $-23 + 48 = 25$
c. $\frac{3}{2} \cdot \left(-\frac{5}{6}\right) = -\frac{5}{12}$
d. $119 + (-19.3) = 99.7$
e. $-1.5 - (-32.8) = 31.3$
f. $12 \div 15 = 0.8$ or $\frac{4}{5}$
g. $-169 + (-13) = 130$
h. $0.47 - 1.56 = -1.09$
i. $6 \cdot (3.5) = 21$
j. $\frac{2}{3} + \frac{5}{6} = -\frac{4}{5}$
k. $\frac{7}{12} - \left(-\frac{2}{3}\right) = \frac{5}{4}$ or $1\frac{1}{4}$
l. $-\frac{3}{4} \div (-\frac{1}{4}) = 16 \frac{2}{5}$ or $3\frac{1}{5}$

45. a. about $57$
b. about $-150 [-42 + (-108)]$
c. about $-1.5 [3 \cdot (-\frac{1}{2})]$d. about $55 [80 + (-25)]$
e. about $25 (-12.5 + 37.5)$
f. about $6 (90 \div 15)$
g. about $13$
h. about $4.1 (6 - 1.9)$
i. about $-240 [60 \cdot (-4)]$
j. about $-\frac{1}{2} \left(-\frac{3}{2} \div 2\right)$
k. about $6\frac{1}{2} (5\frac{1}{2} + 1)$
l. about $4 \left[-1 \div (-\frac{1}{4})\right]$
46. Answers will vary. Possible answers: $-6$, $-5$ or $-10$, $-3$

47. Answers will vary. Possible answers: $6$, $-5$ or $-10$, $3$

**Extensions**

49. **Always.** The sum of two positive rational numbers is positive.

50. **Always.** The sum of two negative rational numbers is negative.

51. **Sometimes.** The sign of the sum of a positive and negative rational number is the same as the sign of the number with the greatest absolute value.

52. **Always.** The product of two positive rational numbers is positive.

53. **Never.** The product of two negative rational numbers is positive.

54. **a.** $-9 \cdot 4 = -36$ and $3 \cdot (-12) = -36$

**b.** $-20 \cdot (-3) = 60$ and $-5 \cdot (-12) = 60$

**c.** $6 \cdot (-5) = -30$ and $-2 \cdot 15 = -30$

**d.** $12 \cdot (-5) = -60$ and $3 \cdot (-20) = -60$

**e.** $0 + 4 = 4$ and $3 + 1 = 4$

**f.** $-1 + (-3) = -4$ and $-5 + 1 = -4$

**g.** $-5 + (-5) = -10$ and $-2 + (-8) = -10$

**h.** $7 + (-5) = 2$ and $3 + (-1) = 2$

**i.** The Associative Property does work for addition and multiplication of integers.

48. Answers will vary. Possible answers: $8$, $-3$ or $-6$, $4$

55. True. Zero added to any number, positive or negative, will not change the value of the number.

56. False. $-3 \frac{3}{8} = -27 \frac{7}{8}$

57. True. $\frac{3}{4}$ is equivalent to $-0.75$. Adding $-6$ and $0.75$ gives $-6.25$.

58. The temperature dropped 4°F every hour, until it had dropped 24°F. For how many hours did the temperature drop 4°F?

$-4n = -24$; $n = 6$ hours

59. When Jayne and Stewart split their earnings from yard work on Saturday, they each received $16. How much did they earn together from the yard work?

$\frac{2}{3} = 16$; $n = 32$

60. $-12$, $-10$, $-8$, $-4$, $-2$, $0$, $1$, $3$, $7$, $9$, $11$