Investigation 1 Additional Practice

1. a. 36 fractions: $\frac{1}{1}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}.

b. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{3}{5}, \frac{4}{6}, \frac{5}{6}.$

c. $\frac{3}{5}, \frac{6}{1}, \frac{2}{3}.$

d. $\frac{3}{8} + \frac{1}{2} = \frac{5}{8}$, because each fraction is $\frac{1}{2}$.

2. a. $\frac{3}{8} + \frac{1}{2} < 1$, because each fraction is $\leq \frac{1}{2}$.

b. $\frac{5}{10} + \frac{1}{2} > 1$, because each fraction is $\leq \frac{1}{2}$.

c. $\frac{3}{12} + \frac{1}{6} < 1$, because each fraction is $\leq \frac{1}{2}$.

d. $\frac{1}{2} + \frac{1}{2} = 1$, because each fraction is $\leq \frac{1}{2}$.

e. $\frac{4}{7} + \frac{7}{12} > 1$, because each fraction is $\frac{1}{2}$.

f. $\frac{4}{3} + \frac{1}{100} > 1$, because the first fraction is $> 1$.

g. $\frac{1}{4} + \frac{2}{5} < 1$, because $\frac{1}{4} < \frac{1}{3}$.

h. $\frac{9}{20} + \frac{5}{11} < 1$, because each fraction is $<\frac{1}{2}$.

3. a. $\frac{1}{2}$; since $\frac{1}{5}$ is less than $\frac{1}{2}$, adding $\frac{1}{2}$ will keep the sum less than 1. The other two options are less than $\frac{1}{2}$, so those sums would not be as close to 1 as the sum $\frac{1}{3} + \frac{1}{2}$.

b. $\frac{1}{8} + \frac{1}{4} > 1$ and $\frac{3}{4} + \frac{1}{2}$ is greater than 1. Since $\frac{1}{8}$ is less than $\frac{1}{4}$, the sum $\frac{3}{4} + \frac{1}{8}$ would be less than 1.

c. $\frac{1}{2} + \frac{3}{4}$ is greater than 1. Both $\frac{1}{4}$ and $\frac{1}{2}$, when added to $\frac{2}{5}$, will be less than 1 but $\frac{1}{2} + \frac{2}{5}$ will be closest to one without going over one.

d. No solution. Since all the fractions are greater than $\frac{1}{2}$, all of the sums are greater than 1.

e. $\frac{1}{4}$; all of the fractions can be added to $\frac{1}{10}$ so that the sum is less than 1. Since $\frac{1}{4}$ is the greatest of the options, it will give the largest sum that is less than 1.

f. $\frac{4}{9}$ is less than $\frac{1}{2}$ and $\frac{2}{9}$ is less than $\frac{1}{2}$ so $\frac{3}{8} + \frac{4}{9}$ is less than 1. The other two choices would give a sum greater than 1.

4. a. $\frac{1}{5}$ and $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{7}{8}$

b. $\frac{1}{5}$ and $\frac{9}{10}$

c. None; all sums are too great.

d. $\frac{1}{2}$ and $\frac{3}{5}$

e. $\frac{1}{10}$ and $\frac{1}{4}$

f. $\frac{1}{5}$ and $\frac{3}{10}$, $\frac{1}{2}$, $\frac{7}{10}, \frac{3}{10}$ and $\frac{7}{10}$

5. a. $\$25$

b. It would be better to overestimate to make sure they have enough money.

6. a. $\frac{1}{8}$ cups

b. i. $\frac{1}{2}$ ii. $\frac{2}{4}$ iii. $\frac{1}{8}$ iv. $\frac{7}{8}$

c. $\frac{4}{8}$

7. a. $\frac{1}{2}$

b. $\frac{3}{8}$

c. Yes, there are enough seats, and $\frac{1}{8}$ are left for open seating.

8. a. $\frac{1}{4}, \frac{1}{2}, \frac{3}{8}, \frac{8}{3}$

b. i. $\frac{3}{4}$ ii. $\frac{1}{4}$ iii. $\frac{1}{8}$ iv. $\frac{5}{8}$

c. $\frac{1}{3}$; it takes 3 of the shaded grey regions to fill the entire rectangle.

9. a. $\frac{5}{6}$ b. $\frac{7}{12}$ c. $\frac{9}{20}$ d. $\frac{11}{30}$ e. $\frac{13}{42}$ f. $\frac{15}{56}$

For the sum of two unit fractions whose denominators are consecutive integers, the numerator of the sum is the sum of the two denominators. The denominator of the sum is the product of the two denominators.

10. a. $\frac{5}{6}$ b. $\frac{21}{3}$

11. $\frac{5}{4}, \frac{1}{4}$

12. Sum Greater than 1: $\frac{1}{2} - \frac{3}{5}$, $\frac{1}{5}$

Sum Less than 1: $\frac{3}{10} + \frac{1}{2} + \frac{2}{7}$, $\frac{1}{6} + \frac{3}{2} + \frac{2}{9}$
Skill: Estimating With Fractions
1. $\frac{5}{8}$ 2. $\frac{9}{10}$ 3. $\frac{1}{2}$ 4. 2 5. $\frac{1}{2}$
6. $\frac{11}{2}$ 7. $\frac{1}{2}$ 8. 1 9. $\frac{1}{2}$ 10. 1
11. 2 12. 1 13. 2 14. 1
15. Sample answer: $\frac{3}{2}$, $\frac{1}{2}$
16. Sample answer: $\frac{9}{8}$, $\frac{11}{12}$

Skill: Estimating With Mixed Numbers
1. 9 2. 13 3. 7 4. 25 5. 8
6. 7 7. 4 8. 10 9. 7 10. 3
11. 4 12. 3 13. 48 14. 8 15. 40
16. 6 17. 3 18. 9 19. 6 20. 2
21. $\frac{34}{8}$ or $\frac{34}{4}$

Skill: Adding and Subtracting Fractions
1. $\frac{3}{4}$ 2. $\frac{3}{10}$ 3. $\frac{1}{4}$ 4. $\frac{3}{4}$ 5. $\frac{7}{8}$
6. $\frac{9}{10}$ 7. $\frac{3}{5}$ 8. $\frac{3}{8}$ 9. $\frac{1}{10}$ 10. $\frac{5}{16}$
11. $\frac{1}{2}$ 12. $\frac{3}{10}$ 13. $\frac{1}{5}$ 14. $\frac{1}{5}$ 15. $\frac{1}{5}$

16. $\frac{5}{9}$ yd

Skill: Adding and Subtracting Mixed Numbers
1. $\frac{9}{10}$ 2. $\frac{6}{8}$ 3. $\frac{11}{12}$ 4. $\frac{9}{4}$ 5. $\frac{4}{4}$
6. $\frac{19}{7}$ 7. $\frac{13}{4}$ 8. $\frac{15}{7}$ 9. $\frac{7}{12}$ 10. $\frac{6}{12}$
11. $\frac{23}{24}$ 12. $\frac{5}{3}$ 13. $\frac{13}{16}$ 14. $\frac{4}{30}$ 15. $\frac{4}{2}$
16. $\frac{5}{8}$ 17. $\frac{1}{6}$ 18. $\frac{5}{6}$ 19. $\frac{7}{15}$ 20. $\frac{15}{16}$ pounds
21. About $204$

Investigation 2 Additional Practice
1. a. Sample answer: 2 miles
   b. Diagrams may vary. The exact answer is $2\frac{1}{2}$ miles.
   c. Sample answer: $3\frac{1}{4} \times \frac{2}{3} = 2\frac{1}{6}$
2. a. 110, because $\frac{1}{4}$ of 440 is 110.
   b. 176
   c. $\frac{7}{20}$, I subtracted $\frac{1}{2}$ and $\frac{3}{5}$ from 1, which represents all the people surveyed.
   d. 154
3. a. $A = \frac{1}{5}$, $B = \frac{1}{6}$, $C = \frac{1}{24}$
   $D = \frac{1}{8}$, $E = \frac{1}{12}$, $F = \frac{1}{4}$
   b. $\$80$ c. $\$30$ d. $\$60$
   e. i. $\$70$ ii. $\frac{17}{24}$
4. a. $\frac{3}{4}$ cup, $\frac{1}{2}$ of $\frac{1}{2} = \frac{3}{4}$
   b. $\frac{1}{8}$ cup, $\frac{1}{4}$ of $\frac{1}{4} = \frac{3}{8}$
   c. No; Jane is increasing and decreasing different numbers by half ($\frac{1}{2}$ and $\frac{1}{2}$), so the new sum will be different.
5. a. $\frac{3}{20}$
   b. Possible Answers: Since Paul's sister used $\frac{1}{4}$ of the roll, there is $\frac{3}{4}$ of a roll left, so $\frac{3}{4} \times \frac{3}{4} = \frac{9}{20}$. Also, since $\frac{3}{20}$ of a whole roll was used and there was $\frac{3}{5}$ of a whole roll initially, $\frac{3}{5} - \frac{3}{20} = \frac{9}{20}$
6. a. Equal; both products are $\frac{2}{15}$
   b. Equal; both products are $\frac{42}{40}$ or $\frac{11}{20}$
   c. Equal; both products are $\frac{15}{56}$
   d. Equal; both products are $\frac{15}{56}$
   The numbers in the numerators and the denominators are the same in each problem, but the placement of the numbers is different. Since you are multiplying the same numbers, the products are equal.
7. About 1,338 pounds
8. 

9. a. $\frac{4}{15}$ b. $\frac{27}{24}$ c. $\frac{3}{3}$
10. $=, >, >, <$
Skill: Multiplying Fractions

1.  \[
\begin{array}{|c|c|c|c|}
\hline
\text{1st Fraction} & \text{2nd Fraction} \\
\hline
\frac{1}{2} & \frac{1}{3} \\
\hline
\end{array}
\]

2.  \[
\begin{array}{|c|c|c|c|}
\hline
\text{1st Fraction} & \text{2nd Fraction} \\
\hline
\frac{3}{4} & \frac{2}{3} \\
\hline
\end{array}
\]

3. 6 4. 3 5. 4 6. \(\frac{1}{2}\)
7. \(\frac{5}{16}\) 8. \(\frac{3}{10}\) 9. 9 10. 6
11. \(\frac{9}{20}\) 12. \(\frac{1}{6}\) 13. \(\frac{3}{32}\) 14. \(\frac{14}{55}\)
15. \(\frac{1}{6}\) 16. \(\frac{1}{3}\) 17. \(\frac{1}{3}\) 18. \(\frac{1}{3}\)
19. \(1\frac{1}{2}\) cups

Skill: Multiplying Mixed Numbers

1. \(4\frac{23}{24}\) 2. \(24\frac{15}{32}\) 3. \(15\frac{29}{64}\) 4. \(1\frac{7}{20}\) 5. 8
6. \(1\frac{1}{5}\) 7. 11 8. \(2\frac{1}{3}\) 9. \(6\frac{1}{4}\) 10. \(7\frac{1}{2}\) ft
11. \(4\frac{1}{2}\) cups; \(3\frac{1}{2}\) cups; 3 cups; \(1\frac{1}{2}\) cups

Investigation 5 Additional Practice

1. a. \(6\frac{1}{2}\) ounces; Sample answer: There are 6 sets of 4 ounces, which is 6 ounces for each loaf. This leaves two ounces left for the four loaves, which is \(\frac{1}{2}\) ounce for each. So, Deb can use \(6\frac{1}{2}\) ounces per loaf.

2. \(26 + 4 = 6\frac{1}{2}\)

2. milkshake: \(3 \div \frac{1}{8} = 24\) shakes
double milkshake: \(3 \div \frac{1}{4} = 12\) double shakes
triple milkshake: \(3 \div \frac{3}{8} = 8\) triple shakes

3. Group 3; the 4 students who share \(\frac{2}{3}\) of a pizza \(\left(\frac{2}{3} + 4\right)\) will each get \(\frac{1}{6}\) of the pizza. If you divide the amount of leftover pizza by the number of students in the other groups, you get: Group 1: \(\frac{3}{4} \div 6 = \frac{1}{8}\) of the pizza for each student. Group 2: \(\frac{1}{3} + 3 = \frac{1}{9}\) of the pizza for each student.
4. a. 24  b. 36

c. \(4\frac{1}{2}\)  d. \(\frac{7}{32}\)

5. When you divide fractions with common denominators, you only have to divide the numerators. The denominator is the size of the fraction you are working with. The numerator is the number of those size parts. For example, with \(\frac{6}{8}\) divided by \(\frac{3}{8}\), eighths are the size of the fractional parts that you have. You are trying to find out how many times three-eighths will go into six-eighths. This is the same as asking how many times 3 goes into 6.
6. a. Sam: 5 complete signs.
   Trish: 6 complete signs.
   Shanti: 6 complete signs.

b. Shanti has the most time remaining.
   Possible explanation: Shanti has \(\frac{2}{3}\) of \(\frac{3}{5}\) of an hour left over. This is \(\frac{2}{3} \times \frac{3}{5} = \frac{2}{5}\) hour or 24 minutes left over. Sam has \(\frac{1}{3}\) of \(\frac{3}{4}\) hour left over or \(\frac{1}{3} \times \frac{3}{4} = \frac{1}{4}\) of an hour or 15 minutes left over. Trish has no time left over.

7. 20 bows

8. a. \(\frac{3}{5}\)  b. \(2\frac{1}{7}\)  c. \(1\frac{8}{11}\)

9. \(50 \div \frac{2}{3}\)

10. \(\frac{5}{5} \div \frac{2}{9} = \frac{2}{9} \div \frac{9}{7} \div \frac{7}{6} \div \frac{3}{5} \div \frac{2}{4} \div \frac{15}{8}\)

Skill: Dividing Fractions

1. 
\[
\begin{array}{|c|c|c|c|c|}
\hline
\frac{1}{2} & \frac{1}{3} & \frac{1}{4} & \frac{1}{5} & \frac{1}{6} \\
\hline
\end{array}
\]

2. \(\frac{1}{10}\) 3. 12 4. 8 5. \(\frac{5}{9}\) 6. 12
7. \(\frac{2}{5}\) 8. \(\frac{7}{24}\) 9. \(\frac{1}{6}\) 10. \(\frac{1}{18}\) 11. 3
12. \(3\frac{1}{2}\) 13. 10 14. 8 servings
Let's Be Rational Practice Answers

15. 

Skill: Dividing Mixed Numbers

1. \(2\frac{1}{2}\)  2. 1  3. \(\frac{9}{16}\)  4. 2  5. \(1\frac{1}{2}\)
6. \(2\frac{1}{3}\)  7. \(3\frac{2}{5}\)  8. \(2\frac{7}{16}\)  9. \(1\frac{4}{5}\)  10. \(1\frac{11}{19}\)
11. \(5\frac{3}{7}\)  12. \(4\frac{3}{8}\)  13. \(7\frac{1}{2}\) servings
14. 40 times  15. 24 min

Investigation 4 Additional Practice

1. a. \(\frac{3}{7} \div \frac{1}{3} = \frac{16}{21} \div \frac{3}{7} = \frac{16}{21}; \)
   \(\frac{16}{21} - \frac{3}{7} = \frac{3}{7} - \frac{3}{7} = \frac{3}{7}\)
   b. \(\frac{11}{12} - \frac{3}{8} = \frac{13}{24} \div \frac{11}{12} - \frac{3}{14} \div \frac{8}{12} = \frac{3}{8}\)
   c. \(\frac{1}{6} + N = \frac{11}{12}; N + \frac{1}{6} = \frac{11}{12}; \)
   \(\frac{11}{12} - \frac{1}{6} = N; \frac{11}{12} - \frac{N}{6} = \frac{1}{6}\)
   d. \(\frac{13}{15} - N = \frac{1}{15}; \frac{13}{15} - \frac{1}{6} = N; \)
   \(N + \frac{1}{6} = \frac{13}{15}; N = \frac{13}{15}\)
   e. \(N + 1\frac{1}{4} = 3\frac{5}{8}; \frac{11}{4} + N = 3\frac{5}{8}; \)
   \(3\frac{5}{8} - N = 1\frac{1}{4}; 3\frac{5}{8} - 1\frac{1}{4} = N\)
   f. \(N - \frac{5}{2} = \frac{7}{6}; N - \frac{7}{6} = \frac{5}{2}; \)
   \(\frac{5}{2} + \frac{7}{6} = N; \frac{7}{6} + \frac{5}{2} = N\)
2. a. \(\frac{3}{10}\)  3. \(\frac{21}{24} \div \frac{7}{8}\)  4. \(\frac{10}{9} \div \frac{11}{19}\)  5. \(\frac{13}{12} \div 1\frac{1}{12}\)  6. \(\frac{9}{10} \div \frac{3}{4}\)  7. \(\frac{3}{10} \div \frac{2}{5}\)  8. \(\frac{4}{10} \div \frac{3}{4}\)  9. \(\frac{3}{40} \div \frac{2}{5}\)  10. \(\frac{3}{10} \div \frac{2}{5}\)

Skill: Writing Number Sentences

Sample number sentences for 1–8
1. \(\frac{1}{2} \times N = \frac{4}{7}; \frac{N}{8} = \frac{7}{7}\)
2. \(1\frac{1}{2} - N = \frac{1}{2}; \frac{N}{4} = \frac{3}{4}\) quart
3. \(\frac{3}{8} \times N = 3\frac{3}{4}; N = 10\) bags

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Let’s Be Rational Practice Answers

4. $1\frac{2}{3} + N = 4\frac{1}{2}; N = 2\frac{5}{6}$ miles
5. $N = \frac{2}{3}(10); N = 4$ gallons
6. $\frac{2}{3}N = 7\frac{3}{4}; N = 11\frac{5}{8}$ pounds
7. $3\frac{1}{3} - 2\frac{1}{4} = N; N = 1\frac{1}{12}$ cups
8. $20 ÷ \frac{3}{2} = N; N = 13\frac{1}{3}$; The number of whole sections is 13.