

Math 303

p. 375

$$\begin{aligned} \#1. (a) \quad \frac{1}{2} + \frac{2}{3} &= \frac{1 \cdot 3}{2 \cdot 3} + \frac{2 \cdot 2}{3 \cdot 2} \\ &= \frac{3}{6} + \frac{4}{6} \\ &= \frac{7}{6} = 1\frac{1}{6} \end{aligned}$$

$$\begin{aligned} (b) \quad \frac{4}{12} - \frac{2}{3} &= \frac{4 \cdot 1}{4 \cdot 3} - \frac{2}{3} \\ &= \frac{1}{3} - \frac{2}{3} \\ &= -\frac{1}{3} \end{aligned}$$

$$\begin{aligned} (c) \quad \frac{5}{x} + \left(-\frac{3}{y}\right) &= \frac{5y}{xy} - \frac{3x}{yx} \\ &= \frac{5y-3x}{xy} \end{aligned}$$

$$\begin{aligned} (d) \quad \frac{-3}{2x^2y} + \frac{5}{2xy^2} + \frac{7}{x^2} &= \frac{-3y}{2x^2y \cdot y} + \frac{5x}{2xy^2 \cdot x} + \frac{7 \cdot 2y^2}{x^2 \cdot 2y^2} \\ &= \frac{-3y}{2x^2y^2} + \frac{5x}{2x^2y^2} + \frac{14y^2}{2x^2y^2} \\ &= \frac{-3y + 5x + 14y^2}{2x^2y^2} \end{aligned}$$

$$\begin{aligned} (e) \quad \frac{5}{6} + 2\frac{1}{8} &= \frac{5 \cdot 4}{6 \cdot 4} + 2\frac{1 \cdot 3}{8 \cdot 3} \\ &= \frac{20}{24} + 2\frac{3}{24} \\ &= 2\frac{23}{24} \end{aligned}$$

$$\begin{aligned} (f) \quad -4\frac{1}{2} - 3\frac{1}{6} &= -4\frac{3}{6} - 3\frac{1}{6} \\ &= -7\frac{4}{6} = -7\frac{2}{3} \\ &= -7\frac{2}{3} \end{aligned}$$

$$\#2. (a) \quad \frac{56}{3} = \frac{54}{3} + \frac{2}{3} = 18\frac{2}{3}$$

$$(b) \quad -\frac{293}{100} = -\frac{200}{100} + \frac{-93}{100} = -2\frac{93}{100}$$

$$\#3. (a) \quad 6\frac{3}{4} = \frac{24}{4} + \frac{3}{4} = \frac{27}{4}$$

$$(b) \quad -3\frac{5}{8} = -\frac{24}{8} + \frac{-5}{8} = -\frac{29}{8}$$

$$\begin{aligned} \#4. (a) \quad \frac{1}{3} \text{ high} \\ \text{since } \frac{1}{3} = \frac{15}{45} > \frac{15}{46}. \end{aligned}$$

$$\begin{aligned} (b) \quad \frac{1}{6} \text{ low} \\ \text{since } \frac{1}{6} = \frac{7}{42} < \frac{7}{41} \end{aligned}$$

$$\begin{aligned} (c) \quad \frac{3}{4} \text{ low} \\ \text{since } \frac{3}{4} = \frac{60}{80} < \frac{62}{80} \end{aligned}$$

$$\begin{aligned} (d) \quad \frac{1}{2} \text{ high} \\ \text{since } \frac{1}{2} = \frac{9}{18} > \frac{9}{19} \end{aligned}$$

$$\#7. (a) \quad \frac{19}{39} < \frac{1}{2} \quad (b) \quad \frac{3}{197} > 0 \quad (c) \quad \frac{150}{201} < \frac{3}{4} \quad (d) \quad \frac{8}{9} < 1$$

$$\#8. (a) \quad \frac{6}{13} + \frac{7}{15} + \frac{11}{23} + \frac{17}{35} \approx \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 2$$

$$(b) \quad \frac{30}{41} + \frac{1}{1000} + \frac{3}{2000} \approx \frac{3}{4} + 0 + 0 = \frac{3}{4}$$

$$\#11. \quad 3\frac{1}{3} + 3\frac{1}{5} + 2\frac{7}{8} + 2\frac{2}{9} \approx 4.3 = 12$$

$$\begin{aligned} \text{or} \\ (3\frac{1}{3} + 2\frac{2}{9}) + (3\frac{1}{5} + 2\frac{7}{8}) &= 5\frac{1}{2} + 6 = 11\frac{1}{2} \end{aligned}$$

$$\begin{aligned} \#12. \quad 1 - \left(\frac{2}{5} + \frac{1}{4} + \frac{1}{10}\right) &= 1 - \left(\frac{8}{20} + \frac{5}{20} + \frac{2}{20}\right) \\ &= 1 - \frac{15}{20} = 1 - \frac{3}{4} = \frac{1}{4} \end{aligned}$$

One-fourth of the class is seniors.

$$\begin{aligned} \#13. \quad \frac{1}{3} + 2\frac{3}{4} + 3\frac{1}{2} &= \frac{4}{12} + 2\frac{9}{12} + 3\frac{6}{12} \\ &= 5\frac{19}{12} = 6\frac{7}{12} \end{aligned}$$

The clerk sold $6\frac{7}{12}$ yards of the ribbon.

$$\begin{aligned} \#14. \quad 8\frac{3}{4} - \left(1\frac{7}{8} + 2\frac{3}{8} + 1\frac{2}{3}\right) &= 8\frac{18}{24} - \left(1\frac{21}{24} + 2\frac{9}{24} + 1\frac{16}{24}\right) \\ &= 8\frac{18}{24} - 4\frac{46}{24} \\ &= 8\frac{18}{24} - 5\frac{22}{24} \\ &= 7\frac{42}{24} - 5\frac{22}{24} \\ &\quad - 2\frac{20}{24} = 2\frac{5}{6} \end{aligned}$$

Martine will have $2\frac{5}{6}$ yards of fabric left over.

$$\#15. \quad (a) \text{ Team 1: } 28\frac{3}{4} + 33\frac{1}{3} < 29 + 33 = 62$$

$$\text{Team 2: } 32\frac{7}{8} + 28\frac{5}{12} < 33 + 29 = 62$$

$$\text{Team 3: } 28\frac{1}{2} + 25\frac{3}{4} < 29 + 26 = 55$$

$$\text{Team 4: } 35\frac{3}{16} + 41\frac{1}{2} = 35\frac{3}{16} + 41\frac{8}{16} = 76\frac{11}{16}$$

Team 4 collected the most. They collected $76\frac{11}{16}$ pounds.

$$\begin{aligned} (b) \quad &\left(28\frac{3}{4} + 32\frac{7}{8} + 28\frac{1}{2} + 35\frac{3}{16}\right) - \left(33\frac{1}{3} + 28\frac{5}{12} + 25\frac{3}{4} + 41\frac{1}{2}\right) \\ &= \left(28\frac{12}{16} + 32\frac{14}{16} + 28\frac{8}{16} + 35\frac{3}{16}\right) - \left(33\frac{4}{12} + 28\frac{5}{12} + 25\frac{9}{12} + 41\frac{6}{12}\right) \\ &= 123\frac{37}{16} - 127\frac{24}{12} = 125\frac{5}{16} - 129 \\ &= 125\frac{5}{16} - 128\frac{16}{16} = -3\frac{11}{16} \end{aligned}$$

The students collected $3\frac{11}{16}$ pounds more in May than in April.

#16. (Answers will vary)

$$(a) \quad \frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

is a unique rational number.

$$(b) \quad \frac{1}{2} + \frac{1}{4} = \frac{3}{4} = \frac{1}{4} + \frac{1}{2}$$

$$(c) \quad \left(\frac{1}{2} + \frac{1}{4}\right) + \frac{3}{4} = \frac{1}{2} + \left(\frac{1}{4} + \frac{3}{4}\right)$$

$$\frac{3}{4} + \frac{3}{4} = \frac{1}{2} + 1$$

$$\frac{6}{4} = 1\frac{1}{2}$$

$$1\frac{1}{2} = 1\frac{1}{2}$$

p. 377

#20. (a)(i) $f(0) = 0 + \frac{3}{4}$
 $= \frac{3}{4}$

(ii) $f(\frac{4}{3}) = \frac{4}{3} + \frac{3}{4}$
 $= \frac{16}{12} + \frac{9}{12}$
 $= \frac{25}{12} = 2\frac{1}{12}$

(iii) $f(-\frac{3}{4}) = -\frac{3}{4} + \frac{3}{4}$
 $= 0$

(b)(i) $x + \frac{3}{4} = 1$
 $x = \frac{1}{4}$

(ii) $x + \frac{3}{4} = -1$
 $x = -1\frac{3}{4}$

(iii) $x + \frac{3}{4} = \frac{1}{2}$
 $x = -\frac{1}{4}$

#23. (a) $x + 2\frac{1}{2} = 3\frac{1}{3}$
 $x = 3\frac{2}{6} - 2\frac{3}{6}$
 $= 2\frac{8}{6} - 2\frac{3}{6}$
 $= \frac{5}{6}$

(b) $x - 2\frac{2}{3} = \frac{5}{6}$
 $x = \frac{5}{6} + 2\frac{4}{6}$
 $= 2\frac{9}{6} = 3\frac{3}{6}$
 $= 3\frac{1}{2}$

p. 380

#19. (a) $\frac{14}{21} = \frac{2 \cdot 7}{3 \cdot 7} = \frac{2}{3}$ (b) $\frac{117}{153} = \frac{13 \cdot 9}{17 \cdot 9} = \frac{13}{17}$ (c) $\frac{5^2}{7^2} = \frac{25}{49}$

(d) $\frac{a^2+a}{1+a} = \frac{a(a+1)}{1(a+1)} = \frac{a}{1} = a$ (e) $\frac{a^2+1}{a+1}$ simplified

(f) $\frac{a^2-b^2}{a-b} = \frac{(a+b)(a-b)}{1(a-b)} = \frac{a+b}{1} = a+b$

#20. (a) $\frac{a^2}{b} = \frac{a^2 \cdot b}{b \cdot b} = \frac{a^2 b}{b^2}$

(b) $\frac{377}{400} \neq \frac{378}{401}$

(c) $\frac{0}{10} = 0 = \frac{0}{-10}$

(d) $\frac{a}{b} \neq \frac{a+1}{b+1}$ where $a \neq b$.

#22. (a) $\frac{a}{b} ? \frac{a+c}{b+c}$ with $a < b$.

(b) $\frac{a}{b} ? \frac{a-c}{b-c}$ with $a < b, c < a, c < b$

$\frac{ab+ac}{b(b+c)} ? \frac{ab+bc}{b(b+c)}$

$\frac{ab-ac}{b(b-c)} ? \frac{ab-bc}{b(b-c)}$

$ab+ac ? ab+bc$

$ab-ac ? ab-bc$

$ac ? bc$

$-ac ? -bc$

$a < b$

$-a ? -b$

$\therefore \frac{a}{b} < \frac{a+c}{b+c}$

$b > a$

$\therefore \frac{a}{b} > \frac{a-c}{b-c}$

TIMSS

$1 - (\frac{1}{2} + \frac{1}{4} + \frac{1}{4}) = 1 - 1 = 0$

d. None of the cake is remaining.

Worksheet

$$1. \frac{9}{20} + \frac{7}{20} = \frac{16}{20} = \frac{4 \cdot 4}{5 \cdot 4} = \frac{4}{5}$$

$$2. \frac{11}{12} + \frac{7}{12} = \frac{18}{12} = \frac{3 \cdot 6}{2 \cdot 6} = \frac{3}{2} = 1\frac{1}{2}$$

$$3. \frac{13}{16} - \frac{5}{16} = \frac{8}{16} = \frac{8 \cdot 1}{8 \cdot 2} = \frac{1}{2}$$

$$4. \frac{1}{2} + \frac{9}{16} = \frac{1 \cdot 8}{2 \cdot 8} + \frac{9}{16} = \frac{8}{16} + \frac{9}{16} = \frac{17}{16} = 1\frac{1}{16}$$

$$5. \frac{11}{12} - \frac{1}{2} = \frac{11}{12} - \frac{1 \cdot 6}{2 \cdot 6} \\ = \frac{11}{12} - \frac{6}{12} = \frac{5}{12}$$

$$8. \frac{7}{8} + \frac{1}{3} = \frac{7 \cdot 3}{8 \cdot 3} + \frac{1 \cdot 8}{3 \cdot 8} = \frac{21}{24} + \frac{8}{24} \\ = \frac{29}{24} = 1\frac{5}{24}$$

$$9. \frac{4}{5} - \frac{3}{8} = \frac{4 \cdot 8}{5 \cdot 8} - \frac{3 \cdot 5}{8 \cdot 5} \\ = \frac{32}{40} - \frac{15}{40} = \frac{17}{40}$$

$$10. 3 + \frac{4}{5} = 3\frac{4}{5}$$

$$11. 5\frac{3}{4} + 6 = 11\frac{3}{4}$$

$$12. 17\frac{5}{8} - 8 = 9\frac{5}{8}$$

$$14. 8\frac{1}{8} + 5\frac{7}{8} = 13\frac{8}{8} = 14$$

$$15. 5\frac{3}{4} - 2\frac{1}{4} = 3\frac{2}{4} = 3\frac{1}{2}$$

$$16. \begin{array}{r} 17\frac{3}{16} = 16\frac{19}{16} \\ - 4\frac{11}{16} = -4\frac{11}{16} \\ \hline 12\frac{8}{16} = 12\frac{1}{2} \end{array}$$

$$18. \begin{array}{r} 9\frac{2}{3} = 9\frac{8}{12} \\ 5\frac{5}{6} = 5\frac{10}{12} \\ + 1\frac{1}{4} = +1\frac{3}{12} \\ \hline 15\frac{21}{12} = 16\frac{9}{12} = 16\frac{3}{4} \end{array}$$

$$19. \begin{array}{r} 9\frac{3}{4} = 9\frac{9}{12} \\ - 3\frac{1}{3} = -3\frac{4}{12} \\ \hline 6\frac{5}{12} \end{array}$$

$$22. \frac{1}{4} + \frac{1}{3} = \frac{3}{12} + \frac{4}{12} = \frac{7}{12}$$

$$1 - \frac{7}{12} = \frac{12}{12} - \frac{7}{12} = \frac{5}{12}$$

Pat and Kim ate $\frac{7}{12}$ of the pizza.

Five-twelfths of the pizza is remaining.

$$23. 1 - \left(\frac{2}{5} + \frac{1}{6}\right) = 1 - \left(\frac{12}{30} + \frac{5}{30}\right) = \frac{30}{30} - \frac{17}{30} = \frac{13}{30}$$

There is $\frac{13}{30}$ of the garden left to plant with other crops.

24. (a) Closure Property of Rational Number Addition
(b) Commutative Property of Rational Number Addition
(c) Associative Property of Rational Number Addition
(d) Identity Property of Rational Number Addition
(e) Inverse Property of Rational Number Addition