

**§1-2****FRACTIONS****Properties**

If  $\frac{p}{q}$  is a fraction and if  $r \neq 0$  then  $\frac{p}{q} = \frac{p \div r}{q \div r}$  and  $\frac{p}{q} = \frac{p \cdot r}{q \cdot r}$ .

**Example 1**

Reduce the fractions below.

$$\text{a. } \frac{13}{39} = \frac{13 \div 13}{39 \div 13} = \frac{1}{3} \quad \text{b. } \frac{6}{50} = \frac{6 \div 2}{50 \div 2} = \frac{3}{25} \quad \text{c. } -\frac{14}{49} = -\frac{14 \div 7}{49 \div 7} = -\frac{2}{7}$$

**Procedure****Multiplying Fractions**

The product of the fractions  $\frac{p}{q}$  and  $\frac{r}{s}$  is  $\frac{p}{q} \cdot \frac{r}{s} = \frac{pr}{qs}$ .

**Example 2**

Multiply the fractions below. Reduce your answers.

$$\text{a. } -\frac{1}{5} \cdot \frac{2}{3} = -\frac{1 \cdot 2}{5 \cdot 3} = -\frac{2}{15} \quad \text{b. } \frac{1}{4} \cdot \frac{2}{3} = \frac{1 \cdot 2}{4 \cdot 3} = \frac{2}{12} = \frac{2 \div 2}{12 \div 2} = \frac{1}{6}$$

**Procedure****Dividing Fractions**

The quotient of the fractions  $\frac{p}{q}$  and  $\frac{r}{s}$  is  $\frac{p}{q} \div \frac{r}{s} = \frac{p}{q} \cdot \frac{s}{r} = \frac{ps}{qr}$ .

**Example 3**

Divide the fractions below. Reduce your answers.

$$\text{a. } -\frac{1}{5} \div \frac{2}{3} = -\frac{1}{5} \cdot \frac{3}{2} = -\frac{1 \cdot 3}{5 \cdot 2} = -\frac{3}{10} \quad \text{b. } \frac{1}{4} \div \frac{3}{8} = \frac{1}{4} \cdot \frac{8}{3} = \frac{1 \cdot 8}{4 \cdot 3} = \frac{8}{12} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}$$

**Procedure****Adding Fractions**

The sum of the fractions  $\frac{p}{q}$  and  $\frac{r}{s}$  is  $\frac{p}{q} + \frac{r}{q} = \frac{p+r}{q}$ .

**Example 4**

Add the fractions below. Reduce your answers.

$$\frac{3}{20} + \frac{1}{4} = \frac{3}{20} + \frac{1 \cdot 5}{4 \cdot 5} = \frac{3}{20} + \frac{5}{20} = \frac{3+5}{20} = \frac{8}{20} = \frac{8 \div 4}{20 \div 4} = \frac{2}{5}$$

**Procedure****Subtracting Fractions**

The difference of the fractions  $\frac{p}{q}$  and  $\frac{r}{q}$  is  $\frac{p}{q} - \frac{r}{q} = \frac{p-r}{q}$ .

**Example 5**

Subtract the fractions below. Reduce your answers.

$$\frac{8}{35} + \frac{1}{5} = \frac{8}{35} + \frac{1 \cdot 7}{5 \cdot 7} = \frac{8}{35} + \frac{7}{35} = \frac{8+7}{35} = \frac{15}{35} = \frac{15 \div 5}{35 \div 5} = \frac{3}{7}$$

Reduce each fraction.

1.  $\frac{3}{12}$       2.  $\frac{7}{-35}$       3.  $\frac{13}{52}$       4.  $-\frac{11}{121}$       5.  $\frac{25}{45}$   
 6.  $\frac{8}{12}$       7.  $\frac{-42}{72}$       8.  $\frac{300}{6}$       9.  $\frac{-85}{-68}$       10.  $\frac{156}{130}$

Multiply. Reduce when possible.

11.  $\frac{1}{2} \cdot \frac{3}{4}$       12.  $\left(-\frac{2}{3}\right) \cdot \frac{3}{7}$       13.  $\frac{5}{7} \cdot \frac{14}{15}$       14.  $\frac{23}{50} \cdot \left(-\frac{5}{7}\right)$   
 15.  $\frac{7}{27} \cdot \frac{9}{14}$       16.  $2\frac{1}{3} \cdot 3\frac{1}{4}$       17.  $\frac{4}{15} \cdot \frac{6}{16}$       18.  $\left(-\frac{12}{25}\right)\left(-\frac{13}{44}\right)$

Divide. Reduce when possible.

19.  $\frac{1}{4} \div \frac{1}{2}$       20.  $\frac{5}{42} \div \frac{2}{7}$       21.  $\frac{2}{3} \div \left(-\frac{1}{6}\right)$       22.  $\left(-\frac{1}{3}\right) \div \left(-\frac{1}{6}\right)$   
 23.  $\left(-\frac{3}{10}\right) \div \frac{3}{5}$       24.  $\frac{5}{24} \div \frac{7}{18}$       25.  $\frac{12}{11} \div \frac{60}{17}$       26.  $3\frac{1}{2} \div 1\frac{1}{4}$

Add or subtract. Reduce when possible.

27.  $\frac{1}{2} + \frac{1}{4}$       28.  $\left(-\frac{1}{3}\right) + \frac{3}{7}$       29.  $\frac{2}{5} + \frac{4}{15}$       30.  $\left(-\frac{1}{2}\right) + \left(-\frac{1}{3}\right)$   
 31.  $\frac{6}{35} + \frac{3}{7}$       32.  $\frac{1}{10} + \frac{2}{5}$       33.  $\frac{2}{5} + \left(-\frac{1}{3}\right)$       34.  $2\frac{1}{6} + 5\frac{1}{3}$   
 35.  $\frac{1}{2} - \frac{1}{4}$       36.  $\frac{1}{2} - \frac{1}{3}$       37.  $\frac{5}{7} - \frac{1}{2}$       38.  $\left(-\frac{4}{15}\right) - \left(-\frac{1}{5}\right)$   
 39.  $\frac{2}{7} - \frac{7}{30}$       40.  $\frac{1}{3} - \left(-\frac{1}{6}\right)$       41.  $3\frac{1}{3} - 7\frac{1}{5}$       42.  $\left(-\frac{5}{6}\right) - \frac{2}{3}$

Perform the indicated operations. Reduce when possible.

43.  $\frac{1}{3}\left(\frac{3}{5} + \frac{3}{4}\right) + \frac{1}{2}$       44.  $\frac{11}{32} - \frac{3}{4} \cdot \frac{1}{4} + \frac{1}{2}$       45.  $\frac{1}{2} + \frac{1}{5} \div \frac{2}{3} + \left(-\frac{1}{3}\right)$   
 46.  $\left(-\frac{2}{3} - \frac{1}{5}\right) \div \frac{4}{5}$       47.  $\left(-\frac{7}{8}\right) \div \frac{3}{4} + \frac{1}{2}$       48.  $\left(-\frac{2}{3}\right) \cdot \frac{1}{4} \cdot \frac{5}{6} \div \frac{8}{9}$   
 49.  $\frac{2}{5} \div \frac{1}{3} \cdot \frac{5}{8} \div \frac{5}{6}$       50.  $\frac{2}{3}\left(\frac{1}{4} - \left(\frac{2}{5} - \frac{1}{10}\right)\right)$       51.  $\frac{1}{12} \div \left(-\frac{2}{3}\right) + \left(-\frac{1}{2}\right)$

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|-----|-------------------|-----|-----------------|-----|------------------|-----|------------------|-----|-----------------|
| 1.  | $\frac{1}{4}$     | 2.  | $-\frac{1}{5}$  | 3.  | $\frac{1}{4}$    | 4.  | $-\frac{1}{11}$  | 5.  | $\frac{5}{9}$   |
| 6.  | $\frac{2}{3}$     | 7.  | $-\frac{7}{12}$ | 8.  | 50               | 9.  | $1\frac{1}{4}$   | 10. | $1\frac{1}{5}$  |
| 11. | $\frac{3}{8}$     | 12. | $-\frac{2}{7}$  | 13. | $\frac{2}{3}$    | 14. | $-\frac{23}{70}$ | 15. | $\frac{1}{6}$   |
| 16. | $7\frac{7}{12}$   | 17. | $\frac{1}{10}$  | 18. | $\frac{39}{275}$ | 19. | $\frac{1}{2}$    | 20. | $\frac{5}{12}$  |
| 21. | -4                | 22. | 2               | 23. | $-\frac{1}{2}$   | 24. | $\frac{15}{28}$  | 25. | $\frac{17}{55}$ |
| 26. | $2\frac{4}{5}$    | 27. | $\frac{3}{4}$   | 28. | $\frac{2}{21}$   | 29. | $\frac{2}{3}$    | 30. | $-\frac{5}{6}$  |
| 31. | $\frac{3}{5}$     | 32. | $\frac{1}{2}$   | 33. | $\frac{1}{15}$   | 34. | $7\frac{1}{2}$   | 35. | $\frac{1}{4}$   |
| 36. | $\frac{1}{6}$     | 37. | $\frac{3}{14}$  | 38. | $-\frac{1}{15}$  | 39. | $\frac{11}{210}$ | 40. | $\frac{1}{2}$   |
| 41. | $-3\frac{13}{15}$ | 42. | $-1\frac{1}{2}$ | 43. | $\frac{19}{20}$  | 44. | $\frac{21}{32}$  | 45. | $\frac{7}{15}$  |
| 46. | $-1\frac{1}{12}$  | 47. | $-\frac{2}{3}$  | 48. | $-\frac{5}{32}$  | 49. | $\frac{9}{10}$   | 50. | $-\frac{1}{30}$ |
| 51. | $-\frac{5}{8}$    |     |                 |     |                  |     |                  |     |                 |