

1. (1) $|-27 + 6| = |-21| = 21$
 (2) $18 \div 3 + 3 = 6 + 3 = 9$ and $18 \div (3 + 3) = 18 \div 6 = 3$
 (3) 3
 (4) No, since $70 = 2 \times 35$
 (5) i. $16 = 2 \times 8 = 2 \times 2 \times 4 = 2 \times 2 \times 2 \times 2$
 ii. $10 = 2 \times 5$
 iii. No, the highest common factor of 16 and 10 is 2, so **they are not** relatively prime.
 iv. $160 = 16 \times 10 = (2 \times 2 \times 2 \times 2) \times (2 \times 5) = 2 \times 2 \times 2 \times 2 \times 2 \times 5$

(6)

$$\begin{aligned} \frac{\cancel{11}}{14} \times \frac{5}{\cancel{11}} &= \frac{-1}{14} \times \frac{5}{1} \\ &= \frac{-5}{14} \\ &= -\frac{5}{14} \end{aligned}$$

(7)

$$\begin{aligned} \frac{4}{-8} \div \frac{3}{-3} &= \frac{-4}{8} \times \frac{\cancel{3}}{\cancel{3}} \\ &= \frac{-4}{8} \times \frac{-1}{1} \\ &= \frac{\cancel{4} \times 1}{\cancel{4} \times 2} \\ &= \frac{1}{2} \end{aligned}$$

(8)

$$\begin{aligned} \frac{-7}{8} + \frac{3}{4} &= \frac{-7}{8} + \frac{3 \times 2}{4 \times 2} \\ &= \frac{-7 + 6}{8} \\ &= \frac{-1}{8} \\ &= -\frac{1}{8} \end{aligned}$$

(9)

$$\begin{aligned} \frac{-12}{5} - \frac{5}{3} &= \frac{-12 \times 3}{5 \times 3} - \frac{5 \times 5}{3 \times 5} \\ &= \frac{-36 - 25}{15} \\ &= \frac{-61}{15} \\ &= -\frac{61}{15} \\ &= -4\frac{1}{15} \end{aligned}$$

(10)

$$\begin{aligned}\left(\frac{8}{1} - \frac{-4}{-7}\right) \times \frac{-6}{40} \times \frac{8}{6} &= \left(\frac{8 \times 7 - 4}{1 \times 7} - \frac{4}{7}\right) \times \frac{-6}{40} \times \frac{8}{6} \\ &= \frac{56 - 4}{7} \times \frac{-6}{40} \times \frac{8}{6} \\ &= \frac{52}{7} \times \frac{\cancel{6}}{40} \times \frac{8}{\cancel{6}} \\ &= \frac{52}{7} \times \frac{-1}{40} \times \frac{8}{1} \\ &= \frac{52}{7} \times \frac{\cancel{8} \times (-1)}{\cancel{8} \times 5} \\ &= \frac{52}{7} \times \frac{-1}{5} \\ &= \frac{52 \times (-1)}{7 \times 5} \\ &= \frac{-52}{35} \\ &= -1\frac{17}{35}\end{aligned}$$

(11) $(-1)^3 = -1 \times (-1) \times (-1) = -1$

(12) The highest common factor of 6, 58, 28 and 24 is 2. This means that in $\frac{1}{2}$ of a minute (that is, in 30 seconds) the wheels will all come back together to their starting positions.

2. (1) $-|-2 + 30| = -|28| = -28$

(2) $20 \div 2 \div 2 = 10 \div 2 = 5$ and $20 \div (2 \div 2) = 20 \div 1 = 20$

(3) 1

(4) Yes, its only factors are 3 and 1

(5) i. $68 = 2 \times 34 = 2 \times 2 \times 17$

ii. $70 = 2 \times 35 = 2 \times 5 \times 7$

iii. No, the highest common factor of 68 and 70 is 2, so **they are not** relatively prime.

iv. $4760 = 68 \times 70 = (2 \times 2 \times 17) \times (2 \times 5 \times 7) = 2 \times 2 \times 17 \times 2 \times 5 \times 7$

(6)

$$\begin{aligned}\frac{-2}{14} \times \frac{1}{-10} &= \frac{\cancel{2} \times (-1)}{\cancel{2} \times 7} \times \frac{-1}{10} \\ &= \frac{-1}{7} \times \frac{-1}{10} \\ &= \frac{-1 \times (-1)}{7 \times 10} \\ &= \frac{1}{70}\end{aligned}$$

(7)

$$\begin{aligned}\frac{-14}{10} \div \frac{6}{9} &= \frac{-14}{10} \times \frac{9}{6} \\ &= \frac{\cancel{2} \times (-7)}{\cancel{2} \times 5} \times \frac{\cancel{3} \times 3}{\cancel{3} \times 2} \\ &= \frac{-7}{5} \times \frac{3}{2} \\ &= \frac{-7 \times 3}{5 \times 2} \\ &= \frac{-21}{10} \\ &= -2\frac{1}{10}\end{aligned}$$

(8)

$$\begin{aligned}\frac{-13}{2} + \frac{-1}{15} &= \frac{-13 \times 15}{2 \times 15} - \frac{1 \times 2}{15 \times 2} \\ &= \frac{-195 - 2}{30} \\ &= \frac{-197}{30} \\ &= -\frac{197}{30} \\ &= -6\frac{17}{30}\end{aligned}$$

(9)

$$\begin{aligned}\frac{7}{3} - \frac{-7}{10} &= \frac{7 \times 10}{3 \times 10} + \frac{7 \times 3}{10 \times 3} \\ &= \frac{70 + 21}{30} \\ &= \frac{91}{30} \\ &= 3\frac{1}{30}\end{aligned}$$

(10)

$$\begin{aligned} \frac{-2}{-8} \times \frac{8}{-49} \div \left(\frac{47}{-38} + \frac{-28}{-38} \right) &= \frac{-2}{\cancel{-8}} \times \frac{\cancel{8}}{-49} \div \left(\frac{47}{-38} + \frac{-28}{-38} \right) \\ &= \frac{2}{1} \times \frac{-1}{49} \div \left(\frac{47}{-38} + \frac{-28}{-38} \right) \\ &= \frac{-2}{49} \div \left(\frac{47}{-38} + \frac{-28}{-38} \right) \\ &= \frac{-2}{49} \div \frac{-47 + 28}{38} \\ &= \frac{-2}{49} \div \frac{-19}{38} \\ &= \frac{-2}{49} \div \left(-\frac{\cancel{19} \times 1}{\cancel{19} \times 2} \right) \\ &= \frac{-2}{49} \div \frac{-1}{2} \\ &= \frac{-2}{49} \times \frac{-2}{1} \\ &= \frac{-2 \times (-2)}{49 \times 1} \\ &= \frac{4}{49} \end{aligned}$$

(11) $(-5)^2 = -5 \times (-5) = 25$

(12) The highest common factor of 23, 22, 55 and 35 is 1. This means that in 1 minute (that is, in 60 seconds) the wheels will all come back together to their starting positions.

3. (1) $|-44 - 29| = |-73| = 73$

(2) $6 \times 5 + 6 = 30 + 6 = 36$ and $6 \times (5 + 6) = 6 \times 11 = 66$

(3) 2

(4) No, since $100 = 2 \times 50$

(5) i. $30 = 2 \times 15 = 2 \times 3 \times 5$

ii. $21 = 3 \times 7$

iii. No, the highest common factor of 30 and 21 is 3, so **they are not** relatively prime.

iv. $630 = 30 \times 21 = (2 \times 3 \times 5) \times (3 \times 7) = 2 \times 3 \times 5 \times 3 \times 7$

(6)

$$\begin{aligned} \frac{7}{17} \times \frac{0}{-15} &= \frac{7}{17} \times 0 \\ &= 0 \end{aligned}$$

(7)

$$\begin{aligned}\frac{13}{9} \div \frac{14}{7} &= \frac{13}{9} \times \frac{7}{14} \\ &= \frac{13}{9} \times \frac{\cancel{7}}{\cancel{7} \times 2} \\ &= \frac{13}{9} \times \frac{1}{2} \\ &= \frac{13 \times 1}{9 \times 2} \\ &= \frac{13}{18}\end{aligned}$$

(8)

$$\begin{aligned}\frac{-1}{3} + \frac{15}{17} &= \frac{-1 \times 17}{3 \times 17} + \frac{15 \times 3}{17 \times 3} \\ &= \frac{-17 + 45}{51} \\ &= \frac{28}{51}\end{aligned}$$

(9)

$$\begin{aligned}\frac{-7}{5} - \frac{-10}{4} &= \frac{-7 \times 4}{5 \times 4} + \frac{10 \times 5}{4 \times 5} \\ &= \frac{-28 + 50}{20} \\ &= \frac{22}{20} \\ &= \frac{\cancel{2} \times 11}{\cancel{2} \times 10} \\ &= \frac{11}{10} \\ &= 1\frac{1}{10}\end{aligned}$$

(10)

$$\begin{aligned}\frac{0}{7} \times \frac{-6}{44} - \frac{3}{-18} + \frac{21}{-48} &= 0 \times \frac{-6}{44} - \frac{3}{-18} + \frac{21}{-48} \\ &= 0 - \frac{3}{-18} + \frac{21}{-48} \\ &= 0 + \frac{3}{18} + \frac{21}{-48} \\ &= \frac{3}{18} + \frac{21}{-48} \\ &= \frac{\cancel{3} \times 1}{\cancel{3} \times 6} + \frac{21}{-48} \\ &= \frac{1}{6} + \frac{21}{-48} \\ &= \frac{1 \times 8}{6 \times 8} - \frac{21}{48} \\ &= \frac{8 - 21}{48} \\ &= \frac{-13}{48} \\ &= -\frac{13}{48}\end{aligned}$$

(11) $(-3)^3 = -3 \times (-3) \times (-3) = -27$

(12) The highest common factor of 58, 16, 2 and 28 is 2. This means that in $\frac{1}{2}$ of a minute (that is, in 30 seconds) the wheels will all come back together to their starting positions.

4. (1) $|-48.7| = 48.7$

(2) $6 \times 7 - 2 = 42 - 2 = 40$ and $6 \times (7 - 2) = 6 \times 5 = 30$

(3) 2

(4) No, since $50 = 2 \times 25$

(5) i. $52 = 2 \times 26 = 2 \times 2 \times 13$

ii. $100 = 2 \times 50 = 2 \times 2 \times 25 = 2 \times 2 \times 5 \times 5$

iii. No, the highest common factor of 52 and 100 is 4, so **they are not** relatively prime.

iv. $5200 = 52 \times 100 = (2 \times 2 \times 13) \times (2 \times 2 \times 5 \times 5) = 2 \times 2 \times 13 \times 2 \times 2 \times 5 \times 5$

(6)

$$\begin{aligned}\frac{-13}{3} \times \frac{-7}{20} &= \frac{-13 \times (-7)}{3 \times 20} \\ &= \frac{91}{60} \\ &= 1\frac{31}{60}\end{aligned}$$

(7)

$$\begin{aligned}\frac{-5}{14} \div \frac{18}{14} &= \frac{-5}{\cancel{14}} \times \frac{\cancel{14}}{18} \\ &= \frac{-5}{1} \times \frac{1}{18} \\ &= \frac{-5}{18} \\ &= -\frac{5}{18}\end{aligned}$$

(8)

$$\begin{aligned}\frac{-13}{2} + \frac{10}{11} &= \frac{-13 \times 11}{2 \times 11} + \frac{10 \times 2}{11 \times 2} \\ &= \frac{-143 + 20}{22} \\ &= \frac{-123}{22} \\ &= -\frac{123}{22} \\ &= -5\frac{13}{22}\end{aligned}$$

(9)

$$\begin{aligned}\frac{7}{-5} - \frac{-9}{10} &= \frac{-7 \times 2}{5 \times 2} + \frac{9}{10} \\ &= \frac{-14 + 9}{10} \\ &= \frac{-5}{10} \\ &= -\frac{\cancel{5} \times 1}{\cancel{5} \times 2} \\ &= -\frac{1}{2}\end{aligned}$$

(10)

$$\begin{aligned} \frac{-10}{-2} \div \frac{22}{-5} - \frac{55}{-22} + \frac{-44}{-11} &= \frac{10}{2} \times \frac{-5}{22} - \frac{55}{-22} + \frac{-44}{-11} \\ &= \frac{\cancel{2} \times 5}{\cancel{2}} \times \frac{-5}{22} - \frac{55}{-22} + \frac{-44}{-11} \\ &= \frac{5}{1} \times \frac{-5}{22} - \frac{55}{-22} + \frac{-44}{-11} \\ &= \frac{5 \times (-5)}{1 \times 22} - \frac{55}{-22} + \frac{-44}{-11} \\ &= \frac{-25}{22} - \frac{55}{-22} + \frac{-44}{-11} \\ &= \frac{-25 + 55}{22} + \frac{-44}{-11} \\ &= \frac{30}{22} + \frac{-44}{-11} \\ &= \frac{\cancel{2} \times 15}{\cancel{2} \times 11} + \frac{-44}{-11} \\ &= \frac{15}{11} + \frac{-44}{-11} \\ &= \frac{15 + 44}{11} \\ &= \frac{59}{11} \\ &= 5\frac{4}{11} \end{aligned}$$

(11) $(-1)^3 = -1 \times (-1) \times (-1) = -1$

(12) The highest common factor of 54, 27, 33 and 42 is 3. This means that in $\frac{1}{3}$ of a minute (that is, in 20 seconds) the wheels will all come back together to their starting positions.

5. (1) $-|-3| = -3$

(2) $96 \div 4 \times 6 = 24 \times 6 = 144$ and $96 \div (4 \times 6) = 96 \div 24 = 4$

(3) 1

(4) No, since $54 = 2 \times 27$

(5) i. $76 = 2 \times 38 = 2 \times 2 \times 19$

ii. $77 = 7 \times 11$

iii. Yes, the highest common factor of 76 and 77 is 1, so **they are** relatively prime.

iv. $5852 = 76 \times 77 = (2 \times 2 \times 19) \times (7 \times 11) = 2 \times 2 \times 19 \times 7 \times 11$

(6)

$$\begin{aligned} \frac{-12}{1} \times \frac{7}{15} &= \frac{\cancel{3} \times (-4)}{1} \times \frac{7}{\cancel{3} \times 5} \\ &= \frac{-4}{1} \times \frac{7}{5} \\ &= \frac{-4 \times 7}{1 \times 5} \\ &= \frac{-28}{5} \\ &= -5\frac{3}{5} \end{aligned}$$

(7)

$$\begin{aligned}\frac{14}{8} \div \frac{3}{3} &= \frac{14}{8} \times \frac{3}{3} \\ &= \frac{14}{8} \times \frac{1}{1} \\ &= \frac{\cancel{2} \times 7}{\cancel{2} \times 4} \\ &= \frac{7}{4} \\ &= 1\frac{3}{4}\end{aligned}$$

(8)

$$\begin{aligned}\frac{-10}{8} + \frac{13}{2} &= \frac{-10}{8} + \frac{13 \times 4}{2 \times 4} \\ &= \frac{-10 + 52}{8} \\ &= \frac{42}{8} \\ &= \frac{\cancel{2} \times 21}{\cancel{2} \times 4} \\ &= \frac{21}{4} \\ &= 5\frac{1}{4}\end{aligned}$$

(9)

$$\begin{aligned}\frac{7}{20} - \frac{-4}{3} &= \frac{7 \times 3}{20 \times 3} + \frac{4 \times 20}{3 \times 20} \\ &= \frac{21 + 80}{60} \\ &= \frac{101}{60} \\ &= 1\frac{41}{60}\end{aligned}$$

(10)

$$\begin{aligned}\frac{-2}{10} \times \frac{52}{-36} \times \frac{-54}{20} - \frac{-60}{50} &= \frac{\cancel{2} \times (-1)}{\cancel{2} \times 5} \times \frac{\cancel{4} \times (-13)}{\cancel{4} \times 9} \times \frac{-54}{20} - \frac{-60}{50} \\ &= \frac{-1}{5} \times \frac{-13}{9} \times \frac{-54}{20} - \frac{-60}{50} \\ &= \frac{-1 \times (-13)}{5 \times 9} \times \frac{-54}{20} - \frac{-60}{50} \\ &= \frac{13}{45} \times \frac{-54}{20} - \frac{-60}{50} \\ &= \frac{13}{\cancel{9} \times 5} \times \frac{\cancel{2} \times \cancel{9} \times (-3)}{\cancel{2} \times 10} - \frac{-60}{50} \\ &= \frac{13}{5} \times \frac{-3}{10} - \frac{-60}{50} \\ &= \frac{13 \times (-3)}{5 \times 10} - \frac{-60}{50} \\ &= \frac{-39}{50} - \frac{-60}{50} \\ &= \frac{-39 + 60}{50} \\ &= \frac{21}{50}\end{aligned}$$

(11) $(-4)^1 = -4$

(12) The highest common factor of 2 and 54 is 2. This means that in $\frac{1}{2}$ of a minute (that is, in 30 seconds) the wheels will all come back together to their starting positions.