1. **(a)** The answer is 86.

   (b) The answer is 1.

   (c)
   $$\left(\frac{-5}{3} \times \frac{3}{-3}\right) - \left(\frac{-4}{-4} \times \frac{5}{1}\right) = \left(\frac{-5}{3} \times \frac{-1}{1}\right) - \left(\frac{4}{4} \times \frac{5}{1}\right)$$
   $$= \left(\frac{5}{3}\right) - \left(\frac{1}{1} \times \frac{5}{1}\right) = \left(\frac{5}{3}\right) - \left(\frac{5}{1}\right)$$
   $$= \frac{5}{3} + \frac{-5}{1} = \frac{5}{3} - \frac{5}{1} \times \frac{3}{3} = \frac{5}{3} - \frac{5 \times 3}{1 \times 3}$$
   $$= \frac{5}{3} - \frac{15}{3} = \frac{5 - 15}{3} = \frac{-10}{3} = -\frac{10}{3}.$$

   (d) $9 \div 3 + 6 = 3 + 6 = 9$ and $9 \div (3 + 6) = 9 \div 9 = 1$.

   (e)
   $$\left(\frac{2}{4} - \frac{3}{5}\right) \times \frac{2}{4} \div \frac{3}{5} = \left(\frac{1}{2} - \frac{3}{5}\right) \times \frac{1}{2} \div \frac{3}{5}$$
   $$= \left(\frac{1}{2} \times \frac{5}{5} - \frac{3}{5} \times \frac{2}{2}\right) \times \frac{1}{2} \div \frac{3}{5}$$
   $$= \left(\frac{5}{10} - \frac{6}{10}\right) \times \frac{1}{2} \div \frac{3}{5} = \frac{-1}{10} \times \frac{1}{2} \div \frac{3}{5} = \frac{-1}{20} \div \frac{3}{5}$$
   $$= -\frac{1}{20} \times \frac{5}{3} = \frac{-5}{60} = -\frac{1}{12}.$$

   (f) **(i)** $36 = 2 \times 18 = 2 \times 2 \times 9 = 2 \times 2 \times 3 \times 3$.
   (ii) $18 = 2 \times 9 = 2 \times 3 \times 3$.
   (iii) The highest common factor of 36 and 18 is 18, so they **are not** relatively prime.
   (iv) $648 = 36 \times 18 = (2 \times 2 \times 3 \times 3) \times (2 \times 3 \times 3) = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$.

2. **(a)** The answer is -2.

   (b) The answer is 4.

   (c)
   $$\left(\frac{-3}{5} \times \frac{1}{2}\right) \times \left(\frac{-2}{5} \div \frac{1}{-3}\right) = \left(\frac{-3}{5} \times \frac{1}{2}\right) \times \left(\frac{-2}{5} \times \frac{-3}{1}\right)$$
   $$= \left(\frac{-3}{10}\right) \times \left(\frac{-2}{5} \times \frac{-3}{1}\right) = \left(\frac{-3}{10}\right) \times \left(\frac{6}{5}\right) = \frac{-3}{10} \times \frac{6}{5} = \frac{-18}{50} = \frac{-9}{25} = -\frac{9}{25}.$$

   (d) $90 \div 9 + 1 = 10 + 1 = 11$ and $90 \div (9 + 1) = 90 \div 10 = 9$.

   (e)
   $$\left(\frac{3}{4} - \frac{4}{7}\right) \times \frac{4}{5} \div \frac{2}{3} = \left(\frac{3}{4} - \frac{4}{7}\right) \times \frac{4}{5} \div \frac{2}{3}$$
   $$= \left(\frac{3}{4} \times \frac{7}{7} - \frac{4}{7} \times \frac{4}{4}\right) \times \frac{4}{5} \div \frac{2}{3}$$
   $$= \left(\frac{21}{28} - \frac{16}{28}\right) \times \frac{4}{5} \div \frac{2}{3} = \frac{5}{28} \times \frac{4}{5} \div \frac{2}{3} = \frac{20}{140} \div \frac{2}{3}$$
   $$= \frac{1}{7} \div \frac{2}{3} = \frac{1}{7} \times \frac{3}{2} = \frac{3}{14}.$$

   (f) **(i)** $32 = 2 \times 16 = 2 \times 2 \times 8 = 2 \times 2 \times 2 \times 4 = 2 \times 2 \times 2 \times 2 \times 2$.
   (ii) $12 = 2 \times 6 = 2 \times 2 \times 3$.
   (iii) The highest common factor of 32 and 12 is 4, so they **are not** relatively prime.

(iv) $384 = 32 \times 12 = (2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 3) = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3.$

3. (a) The answer is -83.

(b) The answer is 1.

(c)
$$\left(\frac{2}{2} \times \frac{1}{2}\right) \times \left(\frac{-1}{3} - \frac{2}{-1}\right) = \left(\frac{1}{1} \times \frac{1}{2}\right) \times \left(\frac{-1}{3} + \frac{2}{1}\right)$$

$$= \left(\frac{1}{2}\right) \times \left(\frac{-1}{3} + \frac{2}{1} \times \frac{3}{3}\right) = \left(\frac{1}{2}\right) \times \left(\frac{-1}{3} + \frac{2 \times 3}{1 \times 3}\right)$$

$$= \left(\frac{1}{2}\right) \times \left(\frac{-1}{3} + \frac{6}{3}\right) = \left(\frac{1}{2}\right) \times \left(\frac{-1+6}{3}\right)$$

$$= \left(\frac{1}{2}\right) \times \left(\frac{5}{3}\right) = \frac{5}{6}.$$

(d) $32 \div 4 + 4 = 8 + 4 = 12$ and $32 \div (4+4) = 32 \div 8 = 4.$

(e)
$$\left(\frac{1}{3} - \frac{4}{7}\right) \times \frac{2}{3} \div \frac{3}{5} = \left(\frac{1}{3} \times \frac{7}{7} - \frac{4}{7} \times \frac{3}{3}\right) \times \frac{2}{3} \div \frac{3}{5}$$

$$= \left(\frac{7}{21} - \frac{12}{21}\right) \times \frac{2}{3} \div \frac{3}{5} = \frac{-5}{21} \times \frac{2}{3} \div \frac{3}{5} = \frac{-10}{63} \div \frac{3}{5}$$

$$= -\frac{10}{63} \times \frac{5}{3} = \frac{-50}{189}.$$

(f) (i) $60 = 2 \times 30 = 2 \times 2 \times 15 = 2 \times 2 \times 3 \times 5.$
(ii) $12 = 2 \times 6 = 2 \times 2 \times 3.$
(iii) The highest common factor of 60 and 12 is 12, so they **are not** relatively prime.
(iv) $720 = 60 \times 12 = (2 \times 2 \times 3 \times 5) \times (2 \times 2 \times 3) = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5.$

4. (a) The answer is -4.

(b) The answer is 1.

(c)
$$\left(\frac{-1}{2} - \frac{5}{-5}\right) - \left(\frac{-5}{-2} + \frac{-5}{4}\right) = \left(\frac{-1}{2} + \frac{5}{5}\right) - \left(\frac{5}{2} + \frac{-5}{4}\right)$$

$$= \left(\frac{-1}{2} + \frac{1}{1}\right) - \left(\frac{5}{2} \times \frac{2}{2} - \frac{5}{4}\right) = \left(\frac{-1}{2} + \frac{1}{1} \times \frac{2}{2}\right) - \left(\frac{10}{4} - \frac{5}{4}\right)$$

$$= \left(\frac{-1}{2} + \frac{1 \times 2}{1 \times 2}\right) - \left(\frac{10 - 5}{4}\right) = \left(\frac{-1}{2} + \frac{2}{2}\right) - \left(\frac{5}{4}\right)$$

$$= \left(\frac{-1+2}{2}\right) - \left(\frac{5}{4}\right) = \left(\frac{1}{2}\right) - \left(\frac{5}{4}\right)$$

$$= \frac{1}{2} + \frac{-5}{4} = \frac{1}{2} \times \frac{2}{2} - \frac{5}{4} = \frac{2}{4} - \frac{5}{4}$$

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

(d) $30 \div 6 + 9 = 5 + 9 = 14$ and $30 \div (6+9) = 30 \div 15 = 2.$

(e)
$$\left(\frac{3}{5} - \frac{3}{6}\right) \times \frac{4}{6} \div \frac{3}{5} = \left(\frac{3}{5} - \frac{1}{2}\right) \times \frac{2}{3} \div \frac{3}{5}$$

$$= \left(\frac{3}{5} \times \frac{2}{2} - \frac{1}{2} \times \frac{5}{5}\right) \times \frac{2}{3} \div \frac{3}{5}$$

$$= \left(\frac{6}{10} - \frac{5}{10}\right) \times \frac{2}{3} \div \frac{3}{5} = \frac{1}{10} \times \frac{2}{3} \div \frac{3}{5} = \frac{2}{30} \div \frac{3}{5}$$

$$= \frac{1}{15} \div \frac{3}{5} = \frac{1}{15} \times \frac{5}{3} = \frac{5}{45} = \frac{1}{9}.$$

2

(f) (i) $48 = 2 \times 24 = 2 \times 2 \times 12 = 2 \times 2 \times 2 \times 6 = 2 \times 2 \times 2 \times 2 \times 3$.

   (ii) $20 = 2 \times 10 = 2 \times 2 \times 5$.

   (iii) The highest common factor of 48 and 20 is 4, so they **are not** relatively prime.

   (iv) $960 = 48 \times 20 = (2 \times 2 \times 2 \times 2 \times 3) \times (2 \times 2 \times 5) = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5$.

5. (a) The answer is -100.

   (b) The answer is 1.

   (c)
$$\left(\frac{1}{-3} \times \frac{1}{5}\right) + \left(\frac{3}{1} + \frac{-5}{-2}\right) = \left(\frac{-1}{3} \times \frac{1}{5}\right) + \left(\frac{3}{1} + \frac{5}{2}\right)$$

$$= \left(\frac{-1}{15}\right) + \left(\frac{3}{1} \times \frac{2}{2} + \frac{5}{2}\right) = \left(\frac{-1}{15}\right) + \left(\frac{6}{2} + \frac{5}{2}\right)$$

$$= \left(\frac{-1}{15}\right) + \left(\frac{6+5}{2}\right) = \left(\frac{-1}{15}\right) + \left(\frac{11}{2}\right) = \frac{-1}{15} \times \frac{2}{2} + \frac{11}{2} \times \frac{15}{15} = \frac{-1 \times 2}{15 \times 2} + \frac{11 \times 15}{2 \times 15}$$

$$= \frac{-2}{30} + \frac{165}{30} = \frac{-2 + 165}{30} = \frac{163}{30}.$$

   (d) $50 \div 5 + 5 = 10 + 5 = 15$ and $50 \div (5 + 5) = 50 \div 10 = 5$.

   (e)
$$\left(\frac{3}{4} - \frac{2}{3}\right) \times \frac{4}{6} \div \frac{2}{3} = \left(\frac{3}{4} - \frac{2}{3}\right) \times \frac{2}{3} \div \frac{2}{3}$$

$$= \left(\frac{3}{4} \times \frac{3}{3} - \frac{2}{3} \times \frac{4}{4}\right) \times \frac{2}{3} \div \frac{2}{3}$$

$$= \left(\frac{9}{12} - \frac{8}{12}\right) \times \frac{2}{3} \div \frac{2}{3} = \frac{1}{12} \times \frac{2}{3} \div \frac{2}{3} = \frac{2}{36} \div \frac{2}{3}$$

$$= \frac{1}{18} \div \frac{2}{3} = \frac{1}{18} \times \frac{3}{2} = \frac{3}{36} = \frac{1}{12}.$$

   (f) (i) $90 = 2 \times 45 = 2 \times 3 \times 15 = 2 \times 3 \times 3 \times 5$.

   (ii) $24 = 2 \times 12 = 2 \times 2 \times 6 = 2 \times 2 \times 2 \times 3$.

   (iii) The highest common factor of 90 and 24 is 6, so they **are not** relatively prime.

   (iv) $2160 = 90 \times 24 = (2 \times 3 \times 3 \times 5) \times (2 \times 2 \times 2 \times 3) = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5$.