Equivalent Fractions

- Equivalent fractions can be created by multiplying/dividing the numerator and denominator by the same number.

Examples:

$$\frac{1}{2}$$
$$= \frac{1\times 3}{2\times 3} \leftarrow \text{Multiply by 3}$$
$$= \frac{3}{6} \quad \leftarrow \frac{1}{2} = \frac{3}{6}$$

$$\frac{3}{7}$$
$$= \frac{3\times 5}{7\times 5} \leftarrow \text{Multiply by 5}$$
$$= \frac{15}{35} \leftarrow \frac{3}{7} = \frac{15}{35}$$

Practice: Fill in the blank

a) $\frac{1}{2} = \frac{\quad}{12}$

b) $\frac{2}{3} = \frac{\quad}{24}$

c) $\frac{4}{9} = \frac{16}{\quad}$

d) $\frac{3}{5} = \frac{\quad}{60}$

e) $\frac{1}{4} = \frac{7}{\quad}$

f) $\frac{5}{6} = \frac{\quad}{42}$

g) $\frac{7}{8} = \frac{49}{\quad}$

h) $\frac{2}{9} = \frac{\quad}{108}$

i) $\frac{7}{15} = \frac{\quad}{135}$

j) $\frac{1}{5} = \frac{\quad}{245}$

Answers:

a) $\frac{1\times 6}{2\times 6} = \frac{6}{12}$

b) $\frac{2\times 8}{3\times 8} = \frac{16}{24}$

c) $\frac{4\times 4}{9\times 4} = \frac{16}{36}$

d) $\frac{3\times 12}{5\times 12} = \frac{36}{60}$

e) $\frac{1\times 7}{4\times 7} = \frac{7}{28}$

f) $\frac{5\times 7}{6\times 7} = \frac{35}{42}$

g) $\frac{7\times 7}{8\times 7} = \frac{49}{56}$

h) $\frac{2\times 12}{9\times 12} = \frac{24}{108}$

i) $\frac{7\times 9}{15\times 9} = \frac{63}{135}$

j) $\frac{1\times 49}{5\times 49} = \frac{49}{245}$

numerator → **2**

denominator → **5**

Simplifying Fractions

- To simplify a fraction, divide the numerator and denominator by the same number until the numerator and denominator can be simplified no further.

Examples:

$$\frac{40}{56}$$
$$= \frac{40 \div 8}{56 \div 8}$$ ← Divide by 8 ← Divide by 8
$$= \frac{5}{7}$$

↑ Cannot be simplified further

$$\frac{42}{54}$$
$$= \frac{42 \div 2}{54 \div 2}$$ ← Divide by 2 ← Divide by 2
$$= \frac{21}{27}$$ ← Can be simplified further
$$= \frac{21 \div 3}{27 \div 3}$$ ← Divide by 3 ← Divide by 3
$$= \frac{7}{9}$$ ← Cannot be simplified further

Practice: Simplify each fraction

a) $\frac{15}{20} =$

b) $\frac{18}{27} =$

c) $\frac{40}{48} =$

d) $\frac{7}{13} =$

e) $\frac{60}{150} =$

f) $\frac{39}{52} =$

g) $\frac{135}{215} =$

h) $\frac{121}{154} =$

i) $\frac{72}{108} =$

Answers:

a) $\frac{15 \div 5}{20 \div 5} = \frac{3}{4}$

b) $\frac{18 \div 9}{27 \div 9} = \frac{2}{3}$

c) $\frac{40 \div 8}{48 \div 8} = \frac{5}{6}$

d) $\frac{7}{13}$ (already simplified)

e) $\frac{60 \div 30}{150 \div 30} = \frac{2}{5}$

f) $\frac{39 \div 13}{52 \div 13} = \frac{3}{4}$

g) $\frac{135 \div 5}{215 \div 5} = \frac{27}{43}$

h) $\frac{121 \div 11}{154 \div 11} = \frac{11}{14}$

i) $\frac{72 \div 36}{108 \div 36} = \frac{2}{3}$

Converting Fractions

- Let's look at converting entire fractions to mixed fractions and converting mixed fractions to entire fractions

Entire fractions	Mixed fractions
$\frac{7}{2}$	$3\frac{1}{2}$
$\frac{20}{3}$	$6\frac{2}{3}$
$\frac{40}{17}$	$2\frac{6}{17}$

Converting an entire fraction to a mixed fraction:

1) Determine how many times the denominator divides into the numerator (this becomes the whole number)
2) The remainder becomes the numerator of the new fraction
3) The denominator remains the same

Examples: $\frac{7}{2} = 3\frac{1}{2}$ The denominator (2) divides into the numerator (7) three times, with a remainder of one

$\frac{32}{5} = 6\frac{2}{5}$ The denominator (5) divides into the numerator (32) six times, with a remainder of two

Converting a mixed fraction to an entire fraction:

1) Multiply the whole number by the denominator and add the product to the numerator
2) The result becomes the new numerator and the denominator remains the same

Examples: $5\frac{1}{4} = \frac{21}{4}$ The whole number (**5**) multiplied by the denominator (**4**) equals 21. The denominator (**4**) remains the same

$3\frac{2}{7} = \frac{23}{7}$ The whole number (**3**) multiplied by the denominator (**7**) equals 22. The denominator (**7**) remains the same

Practice questions on the next page

Practice: Convert each entire fraction to a mixed fraction

a) $\frac{9}{4} =$

b) $\frac{19}{5} =$

c) $\frac{35}{2} =$

d) $\frac{40}{7} =$

e) $\frac{68}{11} =$

f) $\frac{59}{6} =$

Answers:

a) $2\frac{1}{4}$

b) $3\frac{4}{5}$

c) $17\frac{1}{2}$

d) $5\frac{5}{7}$

e) $6\frac{2}{11}$

f) $9\frac{5}{6}$

Practice: Convert each mixed fraction to an entire fraction

a) $3\frac{1}{4} =$

b) $8\frac{3}{5} =$

c) $2\frac{4}{9} =$

d) $1\frac{11}{15} =$

e) $3\frac{9}{20} =$

f) $30\frac{1}{3} =$

Answers:

a) $\frac{13}{4}$

b) $\frac{43}{5}$

c) $\frac{22}{9}$

d) $\frac{26}{15}$

e) $\frac{69}{20}$

f) $\frac{91}{3}$

Adding and subtracting fractions

(1) Create equivalent fractions with the same denominator (a.k.a. common denominator)

(2) Add/subtract the numerators, and keep the denominator the same

Examples:

$$\frac{3}{4}+\frac{1}{6}$$
$$=\frac{3\times3}{4\times3}+\frac{1\times2}{6\times2}$$
$$=\frac{9}{12}+\frac{2}{12}$$ ← Create equivalent fractions with the same denominator (12)
$$=\frac{11}{12}$$ ← Add the numerators; keep the denominator the same

$$\frac{8}{9}-\frac{5}{12}$$
$$=\frac{8\times4}{9\times4}-\frac{5\times3}{12\times3}$$
$$=\frac{32}{36}-\frac{15}{36}$$ ← Create equivalent fractions with the same denominator (36)
$$=\frac{17}{36}$$ ← Subtract the numerators; keep the denominator the same

Practice:

a) $\frac{3}{8}+\frac{1}{12}=$

b) $\frac{14}{15}-\frac{7}{10}=$

c) $\frac{7}{16}-\frac{3}{8}=$

d) $\frac{1}{8}+\frac{2}{3}=$

e) $1\frac{1}{2}-\frac{5}{6}=$

f) $\frac{5}{6}+\frac{9}{10}=$

Answers:

a) $\frac{11}{24}$

b) $\frac{7}{30}$

c) $\frac{1}{16}$

d) $\frac{19}{24}$

e) $\frac{2}{3}$

f) $\frac{26}{15}$ or $1\frac{11}{15}$

numerator → **2**

denominator → **5**

Multiplying fractions

- Multiply numerator by numerator, and denominator by denominator.

Examples:

$$\frac{2}{11}\times\frac{5}{7}=\frac{10}{77}$$

$$\frac{5}{6}\times\frac{1}{7}=\frac{5}{42}$$

- Whenever possible, "cross simplify" beforehand.

Cross simplifying

Method 1: $\frac{9}{16}\times\frac{4}{15}=\frac{36}{240}=\frac{36\div12}{240\div12}=\frac{3}{20}$

Cross simplify: $\frac{9}{16}\times\frac{4}{15}=\frac{9\div3}{16\div4}\times\frac{4\div4}{15\div3}=\frac{3}{4}\times\frac{1}{5}=\frac{3}{20}$

Practice: Find each product and write answer in simplest terms

a) $\frac{3}{5}\times\frac{7}{9}=$

b) $\frac{21}{32}\times\frac{16}{35}=$

c) $\frac{7}{24}\times\frac{9}{14}=$

d) $\frac{8}{15}\times\frac{3}{4}=$

e) $\frac{11}{16}\times\frac{4}{33}=$

f) $\frac{72}{125}\times\frac{25}{96}=$

Answers:

a) $\frac{7}{15}$

b) $\frac{3}{10}$

c) $\frac{3}{16}$

d) $\frac{2}{5}$

e) $\frac{1}{12}$

f) $\frac{3}{20}$

Dividing fractions

- Multiply by the reciprocal of the divisor.

Examples:

$$\frac{4}{9} \div \frac{11}{20}$$
$$= \frac{4}{9} \times \frac{20}{11} \quad \rightarrow \text{“flip” } \frac{11}{20} \text{ to become } \frac{20}{11} \text{ and multiply}$$
$$= \frac{80}{99}$$

$$\frac{3}{7} \div \frac{5}{8}$$
$$= \frac{3}{7} \times \frac{8}{5} \quad \rightarrow \text{“flip” } \frac{5}{8} \text{ to become } \frac{8}{5} \text{ and multiply}$$
$$= \frac{24}{35}$$

Practice: Find each quotient and write answer in simplest terms

a) $\frac{2}{7} \div \frac{3}{4} =$

b) $\frac{5}{6} \div \frac{1}{5} =$

c) $\frac{9}{16} \div \frac{15}{16} =$

d) $\frac{21}{40} \div \frac{14}{25} =$

e) $\frac{8}{15} \div \frac{1}{20} =$

f) $\frac{27}{32} \div 1\frac{1}{8} =$

Answers:

a) $\frac{8}{21}$

b) $\frac{25}{6}$ or $4\frac{1}{6}$

c) $\frac{3}{5}$

d) $\frac{15}{16}$

e) $\frac{32}{3}$ or $10\frac{2}{3}$

f) $\frac{3}{4}$