NS8-18 Adding and Subtracting Fractions

To add fractions with different denominators:

Step 1: Find the LCM of the denominators.

$\frac{1}{3}+\frac{2}{5}$

Multiples of 3: 0, 3, 6, 9, 12, **15**, 18

Multiples of 5: 0, 5, 10, **15**, 20, 25, 30

LCM (3, 5) = 15

Step 2: Create equivalent fractions with that denominator.

$$\frac{1}{3}+\frac{2}{5}=\frac{5\times 1}{5\times 3}+\frac{2\times 3}{5\times 3}$$
$$=\frac{5}{15}+\frac{6}{15}$$
$$=\frac{11}{15}$$

The LCM of the denominators is called the **lowest common denominator (LCD)** of the fractions.

1. Find the LCD of each pair of fractions. Then show what numbers you would multiply the numerator and denominator of each fraction by in order to add.

a) LCD = 6

$3\times\frac{1}{2}+\frac{2}{3}\times 2$
3×2

b) LCD = 8

$2\times\frac{3}{4}+\frac{1}{8}$
$2\times$

c) LCD = 30

$\frac{1}{30}+\frac{1}{6}\times 5$

d) LCD = 12

$3\times\frac{3}{4}+\frac{2}{3}\times 4$
$3\times$

e) LCD = 21

$3\times\frac{3}{7}+\frac{1}{3}\times 7$
$3\times$

f) LCD = 12

$3\times\frac{3}{4}+\frac{1}{6}\times 2$
$3\times$

g) LCD = 10

$2\times\frac{4}{5}+\frac{1}{10}$
$2\times$

h) LCD = 56

$7\times\frac{1}{8}+\frac{5}{7}\times 8$
$7\times$

2. Add or subtract the fractions by changing them to equivalent fractions with denominator equal to the LCD of the fractions.

a) $\frac{2}{5}+\frac{1}{4}$ $4\times$ $5\times$
$=\frac{8}{20}+\frac{5}{20}$
$=\frac{13}{20}$

b) $\frac{4}{15}+\frac{2}{3}$ $5\times$
$=\frac{4}{15}+\frac{10}{15}$
$=\frac{14}{15}$

c) $\frac{2}{3}-\frac{1}{8}$ $3\times$ $8\times$
$=\frac{16}{24}-\frac{3}{24}$
$=\frac{13}{24}$

d) $\frac{2}{3}-\frac{1}{12}$ $4\times$
$=\frac{8}{12}-\frac{1}{12}$
$=\frac{7}{12}$

e) $\frac{3}{4}+\frac{1}{8}$ $2\times$
$\frac{6}{8}+\frac{1}{8}=\frac{7}{8}$

f) $\frac{1}{6}+\frac{13}{24}$ $4\times$
$\frac{4}{24}+\frac{13}{24}=\frac{17}{24}$

g) $\frac{11}{28}-\frac{2}{7}\times 4$
$\frac{11}{28}-\frac{8}{28}=\frac{3}{28}$

h) $\frac{4}{7}+\frac{1}{8}\times 7$
$\frac{32}{56}+\frac{7}{56}=\frac{39}{56}$

i) $\frac{4}{9}-\frac{1}{6}\times 3$
$\frac{8}{18}-\frac{3}{18}=\frac{5}{18}$

3. Add or subtract.

a) $\frac{5}{6}+\frac{1}{12}=\frac{11}{12}$ $2\times$
$\frac{10}{12}+\frac{1}{12}$

b) $\frac{19}{25}-\frac{3}{5}$ $5\times$
$\frac{19}{25}-\frac{15}{25}=\frac{4}{25}$

c) $\frac{5}{7}-\frac{1}{4}\times 7$ $4\times$
$\frac{20}{28}-\frac{7}{28}=\frac{13}{28}$

d) $\frac{4}{9}+\frac{2}{5}\times 9$ $5\times$
$\frac{20}{45}+\frac{10}{45}=\frac{30}{45}$

e) $\frac{5}{8}-\frac{7}{12}$ $3\times$ $2\times$
$\frac{15}{24}-\frac{14}{24}=\frac{1}{24}$

f) $\frac{2}{3}+\frac{1}{4}+\frac{1}{2}\times 6$ $4\times$ $3\times$
$\frac{8}{12}+\frac{3}{12}+\frac{6}{12}=\frac{17}{12}$

g) $\frac{3}{15}+\frac{2}{3}+\frac{1}{5}\times 3$ $5\times$
$\frac{3}{15}+\frac{10}{15}+\frac{3}{15}=\frac{16}{15}$

h) $\frac{11}{15}+\frac{2}{3}+\frac{1}{5}\times 3$ $5\times$
$\frac{11}{15}+\frac{10}{15}-\frac{3}{15}=\frac{18}{15}$

i) $\frac{3}{5}+\frac{17}{30}-\frac{5}{6}\times 5$ $6\times$
$\frac{18}{30}+\frac{17}{30}-\frac{25}{30}=\frac{10}{30}$

A fraction is reduced to **lowest terms** when the greatest common factor of its numerator and denominator is the number 1.

$\frac{6}{8}$ **is not** in lowest terms because the GCF of 6 and 8 is 2.

Factors of 6: 1, **2**, 3, 6
Factors of 8: 1, **2**, 4, 8

$\frac{3}{4}$ **is** in lowest terms because the GCF of 3 and 4 is 1.

Factors of 3: 1, 3
Factors of 4: 1, 2, 4

4. Find the GCF of the numerator and denominator. Is the fraction in lowest terms? Write yes or no.

a) $\frac{2}{6}$ GCF = 2 — no

b) $\frac{3}{5}$ GCF = 1 — Yes

c) $\frac{4}{5}$ GCF = 1 — Yes

d) $\frac{5}{10}$ GCF = 5 — No

e) $\frac{8}{10}$ GCF = 2 — No

f) $\frac{7}{10}$ GCF=1 Yes

g) $\frac{15}{16}$ GCF=1 Yes

h) $\frac{14}{12}$ GCF=2 No

i) $\frac{9}{5}$ GCF=1 Yes

j) $\frac{5}{9}$ GCF=1 Yes

To reduce a fraction to lowest terms:

Step 1: Find the GCF of the numerator and denominator.

Step 2: Divide both the numerator and denominator by the GCF.

5. Reduce the fractions below by dividing the numerator and the denominator by their GCF.

a) $\frac{2 \div 2}{10 \div 2} = \frac{1}{5}$

b) $\frac{2 \div 2}{6 \div 2} = \frac{1}{3}$

c) $\frac{2 \div 2}{8 \div 2} = \frac{1}{4}$

d) $\frac{2 \div 2}{12 \div 2} = \frac{1}{6}$

e) $\frac{6 \div 3}{9 \div 3} = \frac{2}{3}$

f) $\frac{3 \div 3}{15 \div 3} = \frac{1}{5}$

g) $\frac{4 \div 4}{12 \div 4} = \frac{1}{3}$

h) $\frac{20 \div 5}{25 \div 5} = \frac{4}{5}$

6. Add or subtract, then reduce your answer to lowest terms.

a) $\frac{5\times 1}{5\times 6} + \frac{1\times 3}{10\times 3} = \frac{5}{30} + \frac{3}{30} = \frac{8}{30} = \frac{4}{15}$

b) $\frac{13}{15} - \frac{2\times 3}{5\times 3} = \frac{13}{15} - \frac{6}{15} = \frac{7}{15}$

c) $\frac{5\times 5}{5\times 6} + \frac{7\times 3}{10\times 3} = \frac{25}{30} + \frac{21}{30} = \frac{46}{30} = \frac{23}{15}$

d) $\frac{22}{28} - \frac{2\times 4}{7\times 4} = \frac{22}{28} - \frac{8}{28} = \frac{14}{28} = \frac{1}{2}$

e) $\frac{1}{10} + \frac{1\times 1}{2\times 1} + \frac{1\times 2}{5\times 2} = \frac{4}{10} = \frac{2}{5}$

f) $\frac{5\times 5}{8\times 5} - \frac{1\times 8}{5\times 8} \cdot \frac{1\times 2}{20\times 2} = \frac{35}{40} = \frac{7}{8}$

g) $\frac{1\times 5}{7\times 5} - \frac{4\times 7}{5\times 7} - \frac{8}{35} = \frac{25}{35} = \frac{5}{7}$

h) $\frac{5\times 3}{7\times 3} - \frac{8}{21} + \frac{2\times 7}{3\times 7} = \frac{21}{21} = 1$