4. [Fraction +,–]

Skill 4.1   Adding fractions with the same denominator (1).

- Add the numerators (top numbers of the fractions).
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.

To simplify a fraction

Hint: If the numbers are both even then you can start with dividing by 2.

numerator (even)
$\dfrac{4}{16}$
denominator (even)
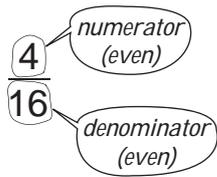
- Divide both the numerator and the denominator by the same number.

$$\dfrac{4}{16}\,{}^{\div 2}_{\div 2} = \dfrac{2}{8}\,{}^{\div 2}_{\div 2} = \dfrac{1}{4}$$

To change an improper fraction to a mixed number

numerator
$\dfrac{7}{3}$ IMPROPER FRACTION
denominator

- Divide the numerator by the denominator.

$$\dfrac{7}{3} = 7 \div 3 = 2 \text{ remainder } 1$$

- Write the result as the whole number and the remainder over the denominator.

$$\dfrac{7}{3} = 7 \div 3 = 2\dfrac{1}{3}$$

To change a mixed number to an improper fraction

MIXED NUMBER

whole number $3\dfrac{2}{5}$ proper fraction
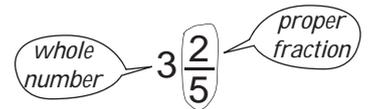
- Multiply the whole number by the denominator and then add the result to the numerator.

$3\dfrac{2}{5}$ $3 \times 5 + 2 = 17$

- Rewrite the total over the denominator.

$$3\dfrac{2}{5} = \dfrac{17}{5}$$

Q. $\dfrac{1}{9} + \dfrac{2}{9} =$

A. $\dfrac{1}{9} + \dfrac{2}{9} =$ (Add the top numbers only)

$$= \dfrac{1 + 2}{9} =$$

$$= \dfrac{3}{9}\,{}^{\div 3}_{\div 3}$$ (Simplify)

$$= \dfrac{1}{3}$$

$\dfrac{1}{9}$ + $\dfrac{2}{9}$ = $\dfrac{3}{9}$

$\dfrac{3}{9}$ = $\dfrac{1}{3}$

---
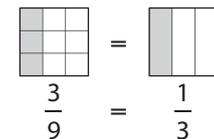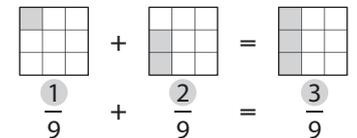
a) $\dfrac{3}{8} + \dfrac{2}{8} =$ (Add the top numbers only)

$$= \dfrac{3 + 2}{8}$$ $= \boxed{\dfrac{5}{8}}$

b) $\dfrac{1}{6} + \dfrac{4}{6} =$

$$=$$ $= \boxed{}$

c) $\dfrac{4}{9} + \dfrac{4}{9} =$

$$=$$ $= \boxed{}$

d) $\dfrac{3}{11} + \dfrac{4}{11} =$

$$=$$ $= \boxed{}$

e) $\dfrac{2}{9} + \dfrac{5}{9} =$

$$=$$ $= \boxed{}$

f) $\dfrac{7}{13} + \dfrac{5}{13} =$

$$=$$ $= \boxed{}$

g) $\dfrac{5}{7} + \dfrac{6}{7} =$

$= \dfrac{11}{7}$ *(Change to mixed number)*

$= 11 \div 7$ $= \boxed{1\dfrac{4}{7}}$

h) $\dfrac{4}{5} + \dfrac{4}{5} =$

$= \dfrac{8}{5}$

$= 8 \div 5$ $= \boxed{}$

i) $\dfrac{5}{9} + \dfrac{8}{9} =$

$=$

$=$ $= \boxed{}$

j) $\dfrac{6}{11} + \dfrac{7}{11} =$

$=$

$=$ $= \boxed{}$

k) $\dfrac{11}{17} + \dfrac{10}{17} =$

$=$

$=$ $= \boxed{}$

l) $\dfrac{13}{15} + \dfrac{6}{15} =$

$=$

$=$ $= \boxed{}$

m) $\dfrac{1}{6} + \dfrac{1}{6} =$ *(Simplify)*

$= \dfrac{2}{6} \begin{smallmatrix} \div 2 \\ \div 2 \end{smallmatrix}$ $= \boxed{\dfrac{1}{3}}$

n) $\dfrac{2}{10} + \dfrac{3}{10} =$

$= \dfrac{5}{10}$ $= \boxed{}$

o) $\dfrac{1}{8} + \dfrac{5}{8} =$

$=$ $= \boxed{}$

p) $\dfrac{5}{12} + \dfrac{4}{12} =$

$=$ $= \boxed{}$

q) $\dfrac{4}{15} + \dfrac{6}{15} =$

$=$ $= \boxed{}$

r) $\dfrac{3}{10} + \dfrac{1}{10} =$

$=$ $= \boxed{}$

s) $\dfrac{3}{4} + \dfrac{3}{4} =$ *(Simplify)*

$= \dfrac{6}{4}$ $= \dfrac{2}{4} \begin{smallmatrix} \div 2 \\ \div 2 \end{smallmatrix}$ $= \boxed{1\dfrac{1}{2}}$

t) $\dfrac{7}{8} + \dfrac{1}{8} =$

$= \dfrac{8}{8} \begin{smallmatrix} \div 8 \\ \div 8 \end{smallmatrix}$ $= \dfrac{1}{1}$ $= \boxed{}$

u) $\dfrac{5}{6} + \dfrac{5}{6} =$

$=$ $=$ $= \boxed{}$

v) $\dfrac{9}{7} + \dfrac{5}{7} =$

$=$ $= \boxed{}$

w) $\dfrac{4}{9} + \dfrac{8}{9} =$

$=$ $= \boxed{}$

x) $\dfrac{11}{18} + \dfrac{13}{18} =$

$=$ $= \boxed{}$

y) $\dfrac{11}{10} + \dfrac{9}{10} =$

$=$ $= \boxed{}$

z) $\dfrac{7}{12} + \dfrac{7}{12} =$

$=$ $= \boxed{}$

zz) $\dfrac{11}{15} + \dfrac{7}{15} =$

$=$ $= \boxed{}$

Skill 4.2 Subtracting fractions with the same denominator.

- Subtract the numerators (top numbers of the fractions).
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
  (see skill 4.1, page 31)

Q. $\dfrac{5}{6} - \dfrac{1}{6} =$

A. $\dfrac{5}{6} - \dfrac{1}{6} =$ *(Subtract the top numbers only)*

$= \dfrac{5-1}{6} =$

$= \dfrac{4 \div 2}{6 \div 2}$ *(Simplify)*

$= \dfrac{2}{3}$

$\dfrac{5}{6} - \dfrac{1}{6} = \dfrac{4}{6}$

$\dfrac{4}{6} = \dfrac{2}{3}$

---

a) $\dfrac{4}{5} - \dfrac{2}{5} =$ *(Subtract the top numbers only)*

$= \dfrac{4-2}{5}$ $= \boxed{\dfrac{2}{5}}$

b) $\dfrac{7}{8} - \dfrac{4}{8} =$

$=$ $= \boxed{}$

c) $\dfrac{8}{9} - \dfrac{4}{9} =$

$=$ $= \boxed{}$

---

d) $\dfrac{17}{9} - \dfrac{4}{9} =$

$= \dfrac{13}{9}$ *(Change to mixed number)*

$= 13 \div 9$ $= \boxed{1\dfrac{4}{9}}$

e) $\dfrac{19}{10} - \dfrac{2}{10} =$

$=$

$=$ $= \boxed{}$

f) $\dfrac{18}{7} - \dfrac{2}{7} =$

$=$

$=$ $= \boxed{}$

---

g) $\dfrac{8}{9} - \dfrac{2}{9} =$ *(Simplify)*

$= \dfrac{6 \div 3}{9 \div 3}$ $= \boxed{}$

h) $\dfrac{7}{12} - \dfrac{5}{12} =$

$=$ $= \boxed{}$

i) $\dfrac{5}{8} - \dfrac{1}{8} =$

$=$ $= \boxed{}$

---

j) $\dfrac{11}{18} - \dfrac{5}{18} =$

$=$ $= \boxed{}$

k) $\dfrac{13}{15} - \dfrac{10}{15} =$

$=$ $= \boxed{}$

l) $\dfrac{11}{16} - \dfrac{7}{16} =$

$=$ $= \boxed{}$

---

m) $\dfrac{17}{5} - \dfrac{2}{5} =$

$= \dfrac{15 \div 5}{5 \div 5} = \dfrac{3}{1}$ $= \boxed{}$

n) $\dfrac{15}{8} - \dfrac{5}{8} =$

$=$ $=$ $= \boxed{}$

o) $\dfrac{19}{12} - \dfrac{5}{12} =$

$=$ $=$ $= \boxed{}$

Skill 4.3   Adding mixed numbers with the same denominator.

- Add the whole numbers first.
- Add the numerators (top numbers of the fractions).
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
 (see skill 4.1, page 31)

Q. $1\frac{4}{5} + 1\frac{4}{5} =$

A. $1 + 1 + \frac{4}{5} + \frac{4}{5} =$ *(Add the top numbers only)*
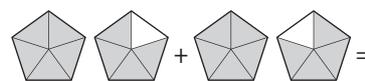
$= 2 + \frac{8}{5}$ *(Change to mixed number)*
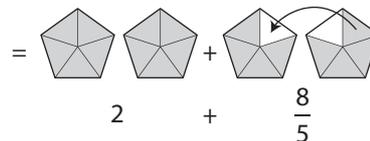
$= 2 + 1\frac{3}{5}$ *(Add the whole numbers)*

$= 3\frac{3}{5}$

$1\frac{4}{5} + 1\frac{4}{5} =$

$= 2 + \frac{8}{5}$
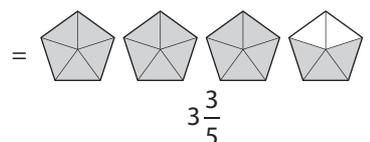
$= 3\frac{3}{5}$

---

a) $2\frac{4}{7} + 3\frac{2}{7} =$ *(Add the whole numbers)*

$= 5 + \frac{6}{7}$ $= \boxed{5\frac{6}{7}}$

b) $2\frac{4}{9} + 1\frac{4}{9} =$

$=$ .... $=$ $\boxed{}$

c) $1\frac{3}{11} + 4\frac{7}{11} =$

$=$ .... $=$ $\boxed{}$

d) $1\frac{1}{6} + 1\frac{5}{6} =$

$= 2 + \frac{6}{6}$

$= 2 + 1$ $=$ $\boxed{}$

e) $2\frac{7}{10} + 3\frac{1}{10} =$

$=$ ....

$=$ .... $=$ $\boxed{}$

f) $2\frac{5}{12} + 1\frac{4}{12} =$

$=$ ....

$=$ .... $=$ $\boxed{}$

g) $2\frac{5}{7} + 1\frac{3}{7} =$

$= 3 + \frac{8}{7}$ *(Change to mixed number)*

$= 3 + 1\frac{1}{7}$ $=$ $\boxed{}$

h) $2\frac{4}{9} + 2\frac{7}{9} =$

$=$ ....

$=$ .... $=$ $\boxed{}$

i) $3\frac{9}{10} + 5\frac{8}{10} =$

$=$ ....

$=$ .... $=$ $\boxed{}$

j) $1\frac{3}{8} + 2\frac{7}{8} =$

$= 3 + \frac{10}{8}$

$= 3 + 1\frac{2 \div 2}{8 \div 2}$ *(Simplify)*

$= 3 + 1\frac{1}{4}$ $=$ $\boxed{}$

k) $2\frac{5}{6} + 3\frac{5}{6} =$

$=$ ....

$=$ ....

$=$ .... $=$ $\boxed{}$

l) $3\frac{5}{12} + 2\frac{10}{12} =$

$=$ ....

$=$ ....

$=$ .... $=$ $\boxed{}$

- Change mixed numbers to improper fractions before subtracting.   (see skill 4.1, page 31)
- Subtract the numerators.
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
  (see skill 4.1, page 31)

Q. $3\frac{3}{8} - 1\frac{5}{8} =$

A. $3\frac{3}{8} - 1\frac{5}{8} =$ *(Change to improper fractions)*

$3\frac{3}{8} = \frac{3 \times 8 + 3}{8} = \frac{27}{8}$

$1\frac{5}{8} = \frac{1 \times 8 + 5}{8} = \frac{13}{8}$

$= \frac{27}{8} - \frac{13}{8}$ *(Subtract the top numbers only)*

   $\frac{27}{8}$ $-$ $\frac{13}{8}$
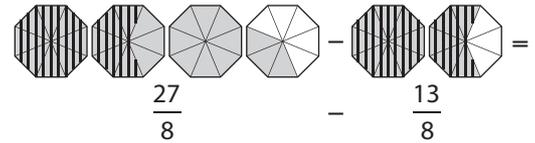
$= \frac{14}{8}$ *(Change to mixed number)*

$=$ $\frac{14}{8} = 1\frac{6}{8}$

$= 1\frac{6}{8}\,{}^{\div 2}_{\div 2}$ *(Simplify)*

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

$= \mathbf{1\frac{3}{4}}$

a) $3\frac{1}{5} - 1\frac{4}{5} =$

$= \frac{16}{5} - \frac{9}{5}$ *(Subtract the top numbers only)*

....

$= \frac{7}{5}$ $= \boxed{1\frac{2}{5}}$

....

b) $5\frac{5}{7} - 2\frac{6}{7} =$

$=$

....

$=$ $= \boxed{}$

....

c) $4\frac{3}{11} - 2\frac{9}{11} =$

$=$

....

$=$ $= \boxed{}$

....

d) $4\frac{7}{8} - 1\frac{5}{8} =$

$= \frac{39}{8} - \frac{13}{8}$

....

$= \frac{26}{8}$ *(Change to mixed number)*

$= 3\frac{2}{8}\,{}^{\div 2}_{\div 2}$ $= \boxed{}$

....

e) $4\frac{9}{12} - 2\frac{5}{12} =$

$=$

....

$=$

....

$=$ $= \boxed{}$

....

f) $5\frac{7}{9} - 3\frac{1}{9} =$

$=$

....

$=$

....

$=$ $= \boxed{}$

....

g) $4\frac{2}{9} - 2\frac{5}{9} =$

$=$

....

$=$

....

$=$ $= \boxed{}$

....

h) $3\frac{3}{8} - 1\frac{7}{8} =$

$=$

....

$=$

....

$=$ $= \boxed{}$

....

i) $4\frac{3}{10} - 2\frac{7}{10} =$

$=$

....

$=$

....

$=$ $= \boxed{}$

....

Skill 4.4   Subtracting mixed numbers with the same denominator (2).

MM5.2 1 1 2 2 3 3 4 4
MM6.1 1 1 2 2 3 3 4 4

- Subtract the whole numbers first.
- Subtract the numerators.
- Do not change the denominators.
- Simplify the resulting fraction if necessary.   (see skill 4.1, page 31)

  Hint: For subtractions you may need to convert 1 to an equivalent fraction.

  Example: 1 whole circle $\rightarrow$ 1 $=$ $\frac{3}{3}$ $=$ $\frac{5}{5}$ $\leftarrow$ numerator = denominator

---

Q. $3\frac{3}{8} - 1\frac{5}{8} =$

A. $3\frac{3}{8} - 1\frac{5}{8} =$

$= 2 + \frac{3}{8} - \frac{5}{8}$

$= 1 + 1 + \frac{3}{8} - \frac{5}{8}$

$= 1 + \frac{8}{8} + \frac{3}{8} - \frac{5}{8}$

$= 1 + \frac{11}{8} - \frac{5}{8}$

$= 1 + \frac{6^{\div 2}}{8_{\div 2}}$

$= 1 + \frac{3}{4}$

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

$3 - 1 = 2$ and $\frac{3}{8} - \frac{5}{8} = ?$

$\frac{5}{8}$ can not be subtracted from $\frac{3}{8}$ and give a positive answer, so borrow a 1 from the 2.

$1 = \frac{8}{8}$ (see hint)

$\frac{8}{8} + \frac{3}{8} = \frac{8 + 3}{8} = \frac{11}{8}$

$\frac{11}{8} - \frac{5}{8} = \frac{11 - 5}{8} = \frac{6}{8}$

Simplify.

---

j) $5\frac{7}{8} - 3\frac{1}{8} =$

$= 2 + \frac{7}{8} - \frac{1}{8}$

$= 2 + \frac{6^{\div 2}}{8_{\div 2}}$

$= 2 + \frac{3}{4}$ $=$ $\boxed{2\frac{3}{4}}$

k) $4\frac{11}{12} - 1\frac{1}{12} =$

$=$

$=$

$=$ $=$ $\boxed{}$

l) $3\frac{11}{15} - 1\frac{2}{15} =$

$=$

$=$

$=$ $=$ $\boxed{}$

m) $5\frac{1}{4} - 3\frac{3}{4} =$

$= 2 + \frac{1}{4} - \frac{3}{4}$

$= 1 + 1 + \frac{1}{4} - \frac{3}{4}$

$= 1 + \frac{4}{4} + \frac{1}{4} - \frac{3}{4}$

$= 1 + \frac{2^{\div 2}}{4_{\div 2}}$

$= 1 + \frac{1}{2}$ $=$ $\boxed{}$

n) $3\frac{1}{3} - 1\frac{2}{3} =$

$=$

$=$

$=$

$=$ $=$ $\boxed{}$

o) $3\frac{1}{15} - 1\frac{6}{15} =$

$=$

$=$

$=$

$=$ $=$ $\boxed{}$

- Change the mixed number to an improper fraction before subtracting.   (see skill 4.1, page 31)
- Write the whole number as an improper fraction with the same denominator as the mixed number.
- Subtract the numerators.
- Do not change the denominators.
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

Q. $3 - 1\frac{2}{9} =$

A. $3 - 1\frac{2}{9} =$ *(Change to improper fractions)* 3 can be written as: $\frac{3}{1}$

$= \frac{3}{1} - \frac{11}{9} =$

$\frac{3}{1} = \frac{27}{9}$ and $1\frac{2}{9} = \frac{1 \times 9 + 2}{9} = \frac{11}{9}$

$= \frac{27}{9} - \frac{11}{9}$ *(Subtract the top numbers only)*

$= \frac{16}{9}$ *(Change to mixed number)*

$= 1\frac{7}{9}$
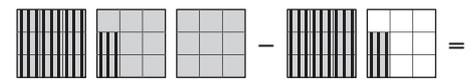
$\frac{27}{9}$ $-$ $\frac{11}{9}$ $=$

$= \frac{16}{9} = 1\frac{7}{9}$

a) $2 - \frac{2}{7} =$

$= \frac{2}{1} - \frac{2}{7}$

$= \frac{14}{7} - \frac{2}{7}$ *(Subtract the top numbers only)*

$= \frac{12}{7}$ $= \boxed{1\frac{5}{7}}$

b) $3 - \frac{4}{9} =$

$=$

$=$

$= \quad = \boxed{}$

c) $2 - \frac{3}{7} =$

$=$

$=$

$= \quad = \boxed{}$

d) $2 - \frac{6}{13} =$

$=$

$=$

$= \quad = \boxed{}$

e) $6 - \frac{5}{8} =$

$=$

$=$

$= \quad = \boxed{}$

f) $4 - \frac{5}{12} =$

$=$

$=$

$= \quad = \boxed{}$

g) $4 - 2\frac{1}{6} =$

$=$

$=$

$= \quad = \boxed{}$

h) $5 - 1\frac{3}{7} =$

$=$

$=$

$= \quad = \boxed{}$

i) $7 - 3\frac{5}{8} =$

$=$

$=$

$= \quad = \boxed{}$

Skill 4.5   Subtracting a mixed number from a whole number (2).

- Subtract the whole numbers first.
- Borrow 1 from the whole number and write it as a fraction with the same denominator.
- Subtract the numerators.
- Do not change the denominators.

Q. $3 - 1\frac{2}{9} =$

A. $2 - \frac{2}{9} =$

$= 1 + 1 - \frac{2}{9}$

$= 1 + \frac{9}{9} - \frac{2}{9}$

$= 1 + \frac{7}{9}$

$= 1\frac{7}{9}$

$3 - 1 = 2$ and $2 = 1 + 1$

$1 = \frac{9}{9}$

$\frac{9}{9} - \frac{2}{9} = \frac{9-2}{9} = \frac{7}{9}$

---

j) $5 - \frac{2}{3} =$

$= 4 + 1 - \frac{2}{3}$

$= 4 + \frac{3}{3} - \frac{2}{3}$

$= 4 + \frac{1}{3}$ $= \boxed{4\frac{1}{3}}$

k) $2 - \frac{3}{4} =$

$=$

$=$

$=$ $=\boxed{}$

l) $6 - \frac{4}{7} =$

$=$

$=$

$=$ $=\boxed{}$

---

m) $4 - \frac{1}{2} =$

$=$

$=$

$=$ $=\boxed{}$

n) $3 - \frac{7}{8} =$

$=$

$=$

$=$ $=\boxed{}$

o) $5 - \frac{7}{10} =$

$=$

$=$

$=$ $=\boxed{}$

---

p) $3 - 1\frac{3}{5} =$

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

$= 1 + 1 - \frac{3}{5}$

$= 1 + \frac{5}{5} - \frac{3}{5}$

$= 1 + \frac{2}{5}$ $=\boxed{}$

q) $5 - 3\frac{3}{8} =$

$=$

$=$

$=$ $=\boxed{}$

r) $4 - 1\frac{5}{6} =$

$=$

$=$

$=$ $=\boxed{}$

---

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Skill 4.6	Adding fractions with different denominators - one denominator divides evenly into the other denominator (1).

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the largest denominator.
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add the fractions with the same denominators. (see skill 4.1, page 31)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Examples:

$$\frac{5}{6} + \frac{1^{\times 3}}{2_{\times 3}} = \frac{5}{6} + \frac{3}{6} = \frac{8^{\div 2}}{6_{\div 2}} = \frac{4}{3} = 1\frac{1}{3}$$ (LCM of 6 and 2 is 6, because 2 divides evenly into 6)

OR

$$\frac{5}{6} + \frac{1}{2} = \frac{10}{12} + \frac{6}{12} = \frac{16^{\div 4}}{12_{\div 4}} = \frac{4}{3} = 1\frac{1}{3}$$ (common denominator of 6 and 2 is 6 × 2 = 12)

To find the Lowest Common Multiple (LCM) of two numbers

- Write in ascending order some multiples of the smaller number first.
- Write in ascending order some multiples of the bigger number and stop when you find a multiple that appears in the first list ⇒ Lowest Common Multiple (LCM).
  Hint: The lowest common multiple is the smallest number that the two numbers divide into.

LCM when one number divides evenly into the other number

```
5        15      ┌ LCM of 5 and 15
5        15  stop
10       30
15       45
20       60
```
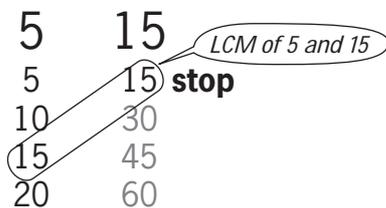
Hint: LCM is the largest number.

LCM when the numbers have NO common factors other than 1

```
2        3
2        3       ┌ LCM of 2 and 3
4        6  stop
6        9
8        12
```
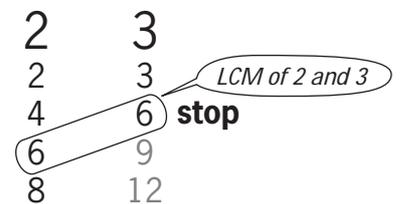
Hint: LCM is the product of the numbers.

To find equivalent fractions

same area shaded

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$$

different numerators and denominators

same value (equivalent fractions)

$$\frac{1^{\times 2}}{2_{\times 2}} = \frac{2}{4} \qquad \frac{1^{\times 3}}{2_{\times 3}} = \frac{3}{6} \qquad \frac{1^{\times 4}}{2_{\times 4}} = \frac{4}{8}$$
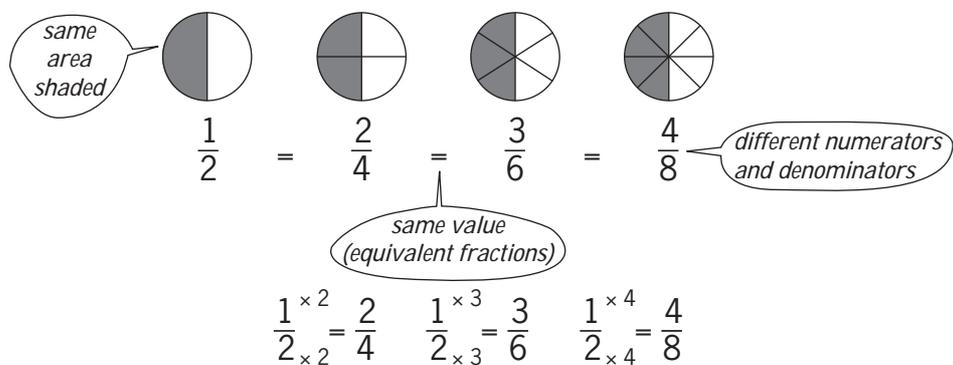
Equivalent fractions have the same value.
Equivalent fractions are formed by multiplying the numerator and denominator by the same number.

Skill 4.6   Adding fractions with different denominators - one
denominator divides evenly into the other denominator (2).

MM5.2 1 1 2 2 3 **3** 4 4
MM6.1 1 1 2 **2** 3 3 4 4

Q. $\dfrac{1}{4} + \dfrac{3}{8} =$ **A.** $\dfrac{1}{4} + \dfrac{3}{8} =$ *(LCM of 4 and 8 is 8)*   *OR*   **A.** $\dfrac{1}{4} + \dfrac{3}{8} =$ *(Use 4 × 8 = 32 as the common denominator)*

(Multiply the numerator and denominator by 2) $\quad = \dfrac{1}{4}{}^{\times 2}_{\times 2} + \dfrac{3}{8}$ $\dfrac{1}{4}{}^{\times 2 \,=\, 2}$ *because 8 ÷ 4 = 2*

$\qquad = \dfrac{1}{4}{}^{\times 8}_{\times 8} + \dfrac{3}{8}{}^{\times 4}_{\times 4}$ $\dfrac{1}{4}{}^{\times 8 \,=\, 8}$ *because 32 ÷ 4 = 8*

$\quad = \dfrac{2 + 3}{8}$ *(Add the top numbers only)*

$\qquad = \dfrac{8 + 12}{32}$ $\dfrac{3}{8}{}^{\times 4 \,=\, 12}$ *because 32 ÷ 8 = 4*

$\quad = \dfrac{5}{8}$

$\qquad = \dfrac{20}{32}{}^{\div 4}_{\div 4}$ *(Simplify)*

$\qquad = \dfrac{5}{8}$

a) $\dfrac{7}{10} + \dfrac{3}{20} =$ *(LCM of 10 and 20 is 20)*

$= \dfrac{7}{10}{}^{\times 2}_{\times 2} + \dfrac{3}{20}$

$= \dfrac{14 + 3}{20}$ $=$ ☐

b) $\dfrac{2}{7} + \dfrac{2}{21} =$

$=$

$=$ ☐

c) $\dfrac{1}{6} + \dfrac{5}{12} =$

$=$

$=$ ☐

d) $\dfrac{1}{5} + \dfrac{3}{10} =$ *(LCM of 5 and 10 is 10)*

$= \dfrac{1}{5}{}^{\times 2}_{\times 2} + \dfrac{3}{10}$

$= \dfrac{2 + 3}{10}$ *(Add the top numbers only)*

$= \dfrac{5}{10}{}^{\div 5}_{\div 5}$ $=$ ☐

e) $\dfrac{2}{3} + \dfrac{5}{6} =$

$=$

$=$

$=$ ☐

f) $\dfrac{5}{8} + \dfrac{1}{2} =$

$=$

$=$

$=$ ☐

g) $\dfrac{3}{4} + \dfrac{5}{8} =$

$=$

$=$

$=$ ☐

h) $\dfrac{4}{5} + \dfrac{7}{10} =$

$=$

$=$

$=$ ☐

i) $\dfrac{1}{5} + \dfrac{1}{20} =$

$=$

$=$

$=$ ☐

j) $\dfrac{3}{4} + \dfrac{11}{12} =$

$=$

$=$

$=$ ☐

k) $\dfrac{3}{10} + \dfrac{3}{50} =$

$=$

$=$

$=$ ☐

l) $\dfrac{2}{3} + \dfrac{1}{12} =$

$=$

$=$

$=$ ☐

Skill 4.7   Adding fractions with different denominators - the HCF of the denominators is 1 (e.g. 2 and 3, 5 and 6).

MM5.2 11 22 33 **4** 44
MM6.1 11 22 **3** 3 44

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the product of the denominators.   (see skill 4.6, page 39)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add the fractions with the same denominators.   (see skill 4.1, page 31)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

Q. $\dfrac{1}{2} + \dfrac{1}{3} =$

A. $\dfrac{1}{2} + \dfrac{1}{3} =$ *(LCM of 2 and 3 is 6)*

$1 \overset{\times 3}{} = 3$ $\dfrac{1}{2}$ because $6 \div 2 = 3$

$1 \overset{\times 2}{} = 2$ $\dfrac{1}{3}$ because $6 \div 3 = 2$

$= \dfrac{1 \times 3}{2 \times 3} + \dfrac{1 \times 2}{3 \times 2}$ *(Multiply the numerator and denominator by 3)*   *(Multiply the numerator and denominator by 2)*

$= \dfrac{3 + 2}{6}$ *(Add the top numbers only)*

$= \dfrac{5}{6}$

a) $\dfrac{2}{5} + \dfrac{1}{8} =$ *(LCM of 5 and 8 is 40)*

$=$ ....

$=$ .... $=$ ☐

b) $\dfrac{1}{3} + \dfrac{3}{10} =$

$=$ ....

$=$ .... $=$ ☐

c) $\dfrac{2}{3} + \dfrac{1}{11} =$

$=$ ....

$=$ .... $=$ ☐

d) $\dfrac{1}{3} + \dfrac{3}{4} =$ *(LCM of 3 and 4 is 12)*

$= \dfrac{1 \times 4}{3 \times 4} + \dfrac{3 \times 3}{4 \times 3}$

$= \dfrac{4 + 9}{12}$ *(Add the top numbers only)*

$= \dfrac{13}{12}$ $=$ ☐

e) $\dfrac{2}{3} + \dfrac{2}{5} =$

$=$ ....

$=$ ....

$=$ .... $=$ ☐

f) $\dfrac{3}{4} + \dfrac{3}{5} =$

$=$ ....

$=$ ....

$=$ .... $=$ ☐

g) $\dfrac{4}{5} + \dfrac{1}{2} =$

$=$ ....

$=$ ....

$=$ .... $=$ ☐

h) $\dfrac{4}{7} + \dfrac{1}{2} =$

$=$ ....

$=$ ....

$=$ .... $=$ ☐

i) $\dfrac{1}{3} + \dfrac{7}{8} =$

$=$ ....

$=$ ....

$=$ .... $=$ ☐

Skill 4.8   Adding fractions with different denominators - the denominators have common factors ≠ 1.

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators.   (see skill 4.6, page 39)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add the fractions with the same denominators.   (see skill 4.1, page 31)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

   Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Q. $\dfrac{1}{4} + \dfrac{1}{6} =$

A. $\dfrac{1}{4} + \dfrac{1}{6} =$ $\overset{\text{LCM of 4 and 6}}{\text{is 12}}$

$= \dfrac{1 \times 3}{4 \times 3} + \dfrac{1 \times 2}{6 \times 2}$ because $\dfrac{1 \times 3 = 3}{4}$ because $12 \div 4 = 3$

$= \dfrac{3+2}{12}$ because $\dfrac{1 \times 2 = 2}{6}$ because $12 \div 6 = 2$

$= \dfrac{5}{12}$

OR **A.** $\dfrac{1}{4} + \dfrac{1}{6} =$ $\overset{\text{Use } 4 \times 6 = 24 \text{ as the}}{\text{common denominator}}$

$= \dfrac{1 \times 6}{4 \times 6} + \dfrac{1 \times 4}{6 \times 4}$ because $\dfrac{1 \times 6 = 6}{4}$ because $24 \div 4 = 6$

$= \dfrac{6+4}{24}$ because $\dfrac{1 \times 4 = 4}{6}$ because $24 \div 6 = 4$

$= \dfrac{10 \div 2}{24 \div 2}$ *Simplify*

$= \dfrac{5}{12}$

a) $\dfrac{5}{6} + \dfrac{1}{8} =$ $\overset{\text{LCM of 6 and 8}}{\text{is 24}}$

$= \dfrac{5 \times 4}{6 \times 4} + \dfrac{1 \times 3}{8 \times 3}$ $\overset{\text{Add the top}}{\text{numbers only}}$

$= \dfrac{20+3}{24}$ $= \boxed{\dfrac{23}{24}}$

b) $\dfrac{1}{4} + \dfrac{3}{10} =$

$=$ ....

$=$ .... $= \boxed{}$

c) $\dfrac{1}{6} + \dfrac{1}{15} =$

$=$ ....

$=$ .... $= \boxed{}$

d) $\dfrac{1}{12} + \dfrac{2}{9} =$

$=$ ....

$=$ .... $= \boxed{}$

e) $\dfrac{1}{10} + \dfrac{2}{25} =$ $\overset{\text{LCM of 10 and 25}}{\text{is 50}}$

$=$ ....

$=$ .... $= \boxed{}$

f) $\dfrac{3}{10} + \dfrac{4}{15} =$

$=$ ....

$=$ .... $= \boxed{}$

g) $\dfrac{3}{10} + \dfrac{5}{6} =$

$=$ ....

$=$ .... $= \boxed{}$

h) $\dfrac{3}{4} + \dfrac{5}{6} =$

$=$ ....

$=$ .... $= \boxed{}$

i) $\dfrac{3}{8} + \dfrac{7}{10} =$

$=$ ....

$=$ .... $= \boxed{}$

Skill 4.9   Subtracting fractions with different denominators - one denominator divides evenly into the other denominator.

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the largest denominator.
  (see skill 4.6, page 39)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Subtract the fractions with the same denominators.   (see skill 4.2, page 33)
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
  (see skill 4.1, page 31)

  Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Q. $\dfrac{2}{3} - \dfrac{4}{9} =$

A. $\dfrac{2}{3} - \dfrac{4}{9} =$ (LCM of 3 and 9 is 9)

$\dfrac{2}{3}$ × 3 = 6 because 9 ÷ 3 = 3

(Multiply the numerator and denominator by 3)

$= \dfrac{2 \times 3}{3 \times 3} - \dfrac{4}{9}$

$= \dfrac{6 - 4}{9}$ (Subtract the top numbers only)

$= \dfrac{\mathbf{2}}{\mathbf{9}}$

OR A. $\dfrac{2}{3} - \dfrac{4}{9} =$ (Use 3 × 9 = 27 as the common denominator)

$\dfrac{2}{3}$ × 9 = 18 because 27 ÷ 3 = 9

$\dfrac{4}{9}$ × 3 = 12 because 27 ÷ 9 = 3

$= \dfrac{2 \times 9}{3 \times 9} - \dfrac{4 \times 3}{9 \times 3}$

$= \dfrac{18 - 12}{27}$

$= \dfrac{6 \ ÷3}{27 \ ÷3}$ (Simplify)

$= \dfrac{\mathbf{2}}{\mathbf{9}}$

---

a) $\dfrac{3}{4} - \dfrac{1}{8} =$ (LCM of 4 and 8 is 8)

$= \dfrac{3 \times 2}{4 \times 2} - \dfrac{1}{8}$ (Subtract the top numbers only)

$= \dfrac{6 - 1}{8}$ $= \boxed{\dfrac{5}{8}}$

b) $\dfrac{3}{4} - \dfrac{3}{16} =$ (LCM of 4 and 16 is 16)

$=$

$=$ $= \boxed{}$

c) $\dfrac{3}{7} - \dfrac{1}{14} =$

$=$

$=$ $= \boxed{}$

d) $\dfrac{1}{5} - \dfrac{1}{15} =$

$=$

$=$ $= \boxed{}$

e) $\dfrac{1}{5} - \dfrac{2}{25} =$

$=$

$=$ $= \boxed{}$

f) $\dfrac{7}{12} - \dfrac{1}{2} =$

$=$

$=$ $= \boxed{}$

g) $\dfrac{3}{4} - \dfrac{3}{20} =$

$=$

$=$

$=$ $= \boxed{}$

h) $\dfrac{1}{6} - \dfrac{1}{24} =$

$=$

$=$

$=$ $= \boxed{}$

i) $\dfrac{4}{18} - \dfrac{1}{9} =$

$=$

$=$

$=$ $= \boxed{}$

Skill 4.10   Subtracting fractions with different denominators - the HCF of the denominators is 1 (e.g. 2 and 3, 5 and 6).

MM5.2 11 22 33 **4** 4
MM6.1 11 22 **3** 3 44

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. In this case the LCM is the product of the denominators.   (see skill 4.6, page 39)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Subtract the fractions with the same denominators.   (see skill 4.2, page 33)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

Q. $\dfrac{1}{3} - \dfrac{1}{5} =$

A. $\dfrac{1}{3} - \dfrac{1}{5} =$ *(LCM of 3 and 5 is 15)*

$\dfrac{1}{3}^{\times 5} = 5$ because $15 \div 3 = 5$ $\dfrac{1}{5}^{\times 3} = 3$ because $15 \div 5 = 3$

$= \dfrac{1^{\times 5}}{3_{\times 5}} - \dfrac{1^{\times 3}}{5_{\times 3}}$ *(Multiply the numerator and denominator by 5)*   *(Multiply the numerator and denominator by 3)*

$= \dfrac{5-3}{15}$ *(Subtract the top numbers only)*

$= \dfrac{2}{15}$

a) $\dfrac{3}{8} - \dfrac{1}{5} =$ *(LCM of 8 and 5 is 40)*

$= \dfrac{3^{\times 5}}{8_{\times 5}} - \dfrac{1^{\times 8}}{5_{\times 8}}$

$= \dfrac{15-8}{40}$ $= \boxed{\dfrac{7}{40}}$

b) $\dfrac{3}{5} - \dfrac{1}{2} =$

$=$

$=$ $=$ ☐

c) $\dfrac{3}{5} - \dfrac{1}{6} =$

$=$

$=$ $=$ ☐

d) $\dfrac{2}{3} - \dfrac{5}{8} =$

$=$

$=$ $=$ ☐

e) $\dfrac{2}{3} - \dfrac{1}{4} =$

$=$

$=$ $=$ ☐

f) $\dfrac{7}{9} - \dfrac{1}{2} =$

$=$

$=$ $=$ ☐

g) $\dfrac{2}{5} - \dfrac{2}{7} =$

$=$

$=$ $=$ ☐

h) $\dfrac{6}{7} - \dfrac{1}{2} =$ *(LCM of 7 and 2 is 14)*

$=$

$=$ $=$ ☐

i) $\dfrac{2}{5} - \dfrac{1}{4} =$

$=$

$=$ $=$ ☐

j) $\dfrac{4}{7} - \dfrac{3}{8} =$

$=$

$=$ $=$ ☐

k) $\dfrac{7}{10} - \dfrac{2}{3} =$

$=$

$=$ $=$ ☐

l) $\dfrac{9}{11} - \dfrac{2}{3} =$

$=$

$=$ $=$ ☐

Skill 4.11   Subtracting fractions with different denominators - the denominators have common factors ≠ 1.

MM5.2 1 1 2 2 3 3 **4** 4
MM6.1 1 1 2 2 **3** 3 4 4

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators.   (see skill 4.6, page 39)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Subtract the fractions with the same denominators.   (see skill 4.2, page 33)
- Simplify the resulting fraction and/or change it to a mixed number if necessary. (see skill 4.1, page 31)

    Hint: If unsure which is the LCM of the denominators, use their product as the common denominator.

Q. $\dfrac{3}{8} - \dfrac{1}{6} =$

A. $\dfrac{3}{8} - \dfrac{1}{6} =$ *(LCM of 8 and 6 is 24)*

$= \dfrac{3^{\times 3}}{8_{\times 3}} - \dfrac{1^{\times 4}}{6_{\times 4}}$ because $24 \div 8 = 3$ $\dfrac{3^{\times 3 = 9}}{8}$

$= \dfrac{9 - 4}{24}$ because $24 \div 6 = 4$ $\dfrac{1^{\times 4 = 4}}{6}$

$= \dfrac{5}{24}$

OR

A. $\dfrac{3}{8} - \dfrac{1}{6} =$ *(Use 8 × 6 = 48 as the common denominator)*

$= \dfrac{3^{\times 6}}{8_{\times 6}} - \dfrac{1^{\times 8}}{6_{\times 8}}$ because $48 \div 8 = 6$ $\dfrac{3^{\times 6 = 18}}{8}$

$= \dfrac{18 - 8}{48}$ because $48 \div 6 = 8$ $\dfrac{1^{\times 8 = 8}}{6}$

$= \dfrac{10^{\div 2}}{48_{\div 2}}$ *(Simplify)*

$= \dfrac{5}{24}$

a) $\dfrac{9}{10} - \dfrac{3}{4} =$ *(LCM of 10 and 4 is 20)*

$= \dfrac{9^{\times 2}}{10_{\times 2}} - \dfrac{3^{\times 5}}{4_{\times 5}}$ *(Subtract the top numbers only)*

$= \dfrac{18 - 15}{20}$ $= \boxed{\dfrac{3}{20}}$

b) $\dfrac{3}{8} - \dfrac{1}{10} =$

$=$ ....

$=$ .... $= \boxed{}$

c) $\dfrac{3}{10} - \dfrac{4}{15} =$

$=$ ....

$=$ .... $= \boxed{}$

d) $\dfrac{4}{9} - \dfrac{5}{12} =$

$=$

....

$=$ .... $= \boxed{}$

e) $\dfrac{3}{8} - \dfrac{1}{12} =$ *(LCM of 8 and 12 is 24)*

$=$

....

$=$ .... $= \boxed{}$

f) $\dfrac{5}{9} - \dfrac{4}{15} =$

$=$

....

$=$ .... $= \boxed{}$

g) $\dfrac{4}{15} - \dfrac{1}{6} =$

$=$

....

$=$

....

$=$ .... $= \boxed{}$

h) $\dfrac{3}{10} - \dfrac{5}{25} =$

$=$

....

$=$

....

$=$ .... $= \boxed{}$

i) $\dfrac{3}{10} - \dfrac{1}{6} =$

$=$

....

$=$

....

$=$ .... $= \boxed{}$

- Find the lowest common denominator of the fractions, which is the Lowest Common Multiple (LCM) of the denominators. (see skills 4.6 to 4.11, pages 39 to 45)
- Change the fractions to equivalent fractions with the lowest common denominator.
- Add and/or subtract the fractions with the same denominators.
  (see skills 4.1, page 31 and 4.2, page 33)
- Simplify the resulting fraction and/or change it to a mixed number if necessary.
  (see skill 4.1, page 31)

Q. $\dfrac{3}{5} - \dfrac{1}{4} + \dfrac{3}{20} =$

A. $\dfrac{3}{5} - \dfrac{1}{4} + \dfrac{3}{20} =$

$= \dfrac{3^{\times 4}}{5_{\times 4}} - \dfrac{1^{\times 5}}{4_{\times 5}} + \dfrac{3}{20}$

$= \dfrac{12 - 5 + 3}{20}$

$= \dfrac{10^{\div 10}}{20_{\div 10}}$

$= \dfrac{1}{2}$

20 is the lowest common denominator.
5 divides into 20 four times. Multiply the numerator and denominator of $\dfrac{3}{5}$ by 4.
4 divides into 20 five times. Multiply the numerator and denominator of $\dfrac{1}{4}$ by 5.
20 divides into 20 once. Leave $\dfrac{3}{20}$ unchanged.

a) $\dfrac{1}{2} + \dfrac{3}{8} - \dfrac{1}{4} =$ *LCM of 2, 8 and 4 is 8*

$= \dfrac{1^{\times 4}}{2_{\times 4}} + \dfrac{3}{8} - \dfrac{1^{\times 2}}{4_{\times 2}} =$ *Add and subtract numerators only*

$= \dfrac{4 + 3 - 2}{8}$ $= \dfrac{5}{8}$

b) $\dfrac{1}{8} + \dfrac{7}{16} - \dfrac{1}{2} =$

$=$

$=$

c) $\dfrac{5}{6} - \dfrac{1}{2} + \dfrac{1}{12} =$

$=$

$=$

d) $\dfrac{1}{2} + \dfrac{1}{3} - \dfrac{3}{5} =$ *LCM of 2, 3 and 5 is 30*

$=$

$=$

e) $\dfrac{2}{3} + \dfrac{1}{2} - \dfrac{6}{7} =$

$=$

$=$

f) $\dfrac{3}{5} - \dfrac{1}{2} + \dfrac{1}{9} =$

$=$

$=$

g) $\dfrac{7}{11} + \dfrac{5}{22} - \dfrac{1}{2} =$

$=$

$=$

$=$

h) $\dfrac{7}{10} - \dfrac{2}{5} + \dfrac{1}{2} =$

$=$

$=$

$=$

i) $\dfrac{6}{7} - \dfrac{1}{2} - \dfrac{1}{14} =$

$=$

$=$

$=$

Skill 4.13   Adding or subtracting mixed numbers with different denominators.

MM5.2 11 22 33 44
MM6.1 11 22 33 4**4**

- Add or subtract the whole numbers first.
- Add or subtract the fractions by finding the common denominator.
  (see skills 4.6 to 4.11, pages 39 to 45)

Q. $1\frac{1}{5} + 1\frac{2}{3} =$

A. $1 + 1 = 2$ Add whole numbers.

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

$$= \frac{1}{5}{}^{\times 3}_{\times 3} + \frac{2}{3}{}^{\times 5}_{\times 5}$$

$$= \frac{3 + 10}{15}$$

$$= \frac{13}{15}$$

$$= 2 + \frac{13}{15} = 2\frac{13}{15}$$

15 is the lowest common denominator.
5 divides into 15 three times.
Multiply the numerator and denominator of $\frac{1}{5}$ by 3.

3 divides into 15 five times.
Multiply the numerator and denominator of $\frac{2}{3}$ by 5.

---

a) $1\frac{1}{6} + 2\frac{2}{9} = 3 + ...$ *Add whole numbers*

$\frac{1}{6} + \frac{2}{9}$ *LCM of 6 and 9 is 18*

$$= \frac{1}{6}{}^{\times 3}_{\times 3} + \frac{2}{9}{}^{\times 2}_{\times 2} = \frac{3 + 4}{18} = \frac{7}{18}$$

$$\Rightarrow 3 + \frac{7}{18} = \boxed{3\frac{7}{18}}$$

b) $2\frac{3}{4} + 2\frac{3}{10} =$

$=$

$=$

$\Rightarrow$ $=$ ☐

c) $1\frac{3}{8} + 1\frac{1}{10} =$

$=$

$=$

$\Rightarrow$ $=$ ☐

---

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

$=$

$=$

$\Rightarrow$ $=$ ☐

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

$=$

$=$

$\Rightarrow$ $=$ ☐

f) $1\frac{4}{7} + 1\frac{1}{3} =$ *LCM of 7 and 3 is 21*

$=$

$=$

$\Rightarrow$ $=$ ☐

---

g) $2\frac{5}{7} - 1\frac{1}{2} =$

$=$

$=$

$\Rightarrow$ $=$ ☐

h) $4\frac{3}{4} - 1\frac{1}{3} =$

$=$

$=$

$\Rightarrow$ $=$ ☐

i) $3\frac{5}{6} - 1\frac{2}{3} =$

$=$

$=$

$\Rightarrow$ $=$ ☐