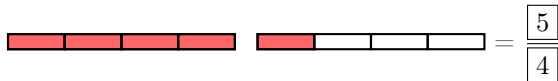# FRACTIONS

A DEFINITIONS

A.1 FINDING FRACTIONS

Ex 1: A bar represents 1. Find the fraction that represents the shaded part:

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

Answer:

- A bar (1) is divided into 4 equal parts:

- 5 parts are shaded.

- So, $\dfrac{5}{4} =$

Ex 2: A bar represents 1. Find the fraction that represents the shaded part:

$$= \boxed{\dfrac{\boxed{5}}{\boxed{3}}}$$

Answer:

- A bar (1) is divided into 3 equal parts:

- 5 parts are shaded.

- So, $\dfrac{5}{3} =$

Ex 3: A bar represents 1. Find the fraction that represents the shaded part:

$$= \boxed{\dfrac{\boxed{8}}{\boxed{3}}}$$
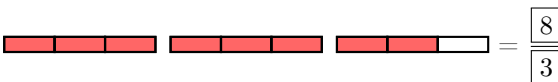
Answer:

- A bar (1) is divided into 3 equal parts:

- 8 parts are shaded.

- So, $\dfrac{8}{3} =$

Ex 4: A circle represents 1. Find the fraction that represents the shaded part:

$$= \boxed{\dfrac{\boxed{7}}{\boxed{4}}}$$
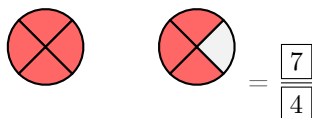
Answer:

- A circle (1) is divided into 4 equal parts.

- 7 parts are shaded.

- So, $\dfrac{7}{4} =$

Ex 5: A circle represents 1. Find the fraction that represents the shaded part:

$$= \boxed{\dfrac{\boxed{7}}{\boxed{3}}}$$
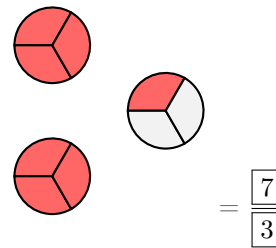
Answer:

- A circle (1) is divided into 3 equal parts.

- 7 parts are shaded.

- So, $\dfrac{7}{3} =$

A.2 WRITING FRACTIONS FROM WORDS

Ex 6: Write as fraction:

$$\text{one over four} = \boxed{\dfrac{\boxed{1}}{\boxed{4}}}$$

Answer:

- one over four $= \dfrac{1}{4} =$

Ex 7: Write as fraction:

$$\text{three over five} = \boxed{\dfrac{\boxed{3}}{\boxed{5}}}$$

Answer:

- three over five $= \dfrac{3}{5} =$

Ex 8: Write as fraction:

$$\text{three quarters} = \boxed{\dfrac{\boxed{3}}{\boxed{4}}}$$

Answer:

- three quarters $= \dfrac{3}{4} =$

Ex 9: Write as fraction:

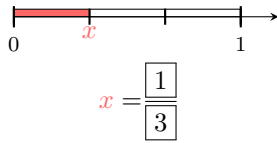$$\text{six over hundred} = \boxed{\dfrac{\boxed{6}}{\boxed{100}}}$$

Answer:

- six over hundred (six thousandths) $= \dfrac{6}{100}$

B ON THE NUMBER LINE

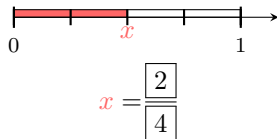## B.1 FINDING FRACTIONS WITH BAR FRACTION MODEL

Ex 10: Find the value of x

$$x = \frac{\boxed{1}}{\boxed{3}}$$

Answer:

- 1 is divided in 3 equals parts.
- x is located at 1 part.
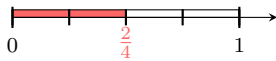- So, $x = \dfrac{1}{3}$.

Ex 11: Find the value of x

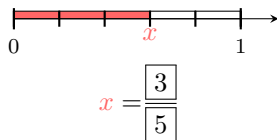$$x = \frac{\boxed{2}}{\boxed{4}}$$

Answer:

- 1 is divided in 4 equals parts.
- x is located at 2 parts.
- So, $x = \dfrac{2}{4}$.

Ex 12: Find the value of x

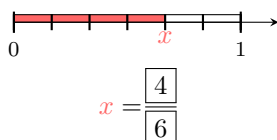$$x = \frac{\boxed{3}}{\boxed{5}}$$

Answer:

- 1 is divided in 5 equals parts.
- x is located at 3 parts.
- So, $x = \dfrac{3}{5}$.
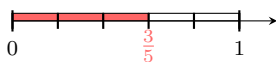
Ex 13: Find the value of x

$$x = \frac{\boxed{4}}{\boxed{6}}$$
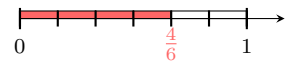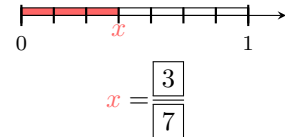
Answer:

- 1 is divided in 6 equals parts.
- x is located at 4 parts.
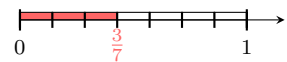- So, $x = \dfrac{4}{6}$.

Ex 14: Find the value of x

$$x = \frac{\boxed{3}}{\boxed{7}}$$
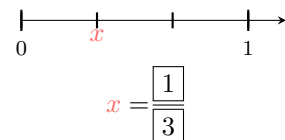
Answer:

- 1 is divided in 7 equals parts.
- x is located at 3 parts.
- So, $x = \dfrac{3}{7}$.

B.2 FINDING FRACTIONS

Ex 15: Find the value of x

$$x = \frac{\boxed{1}}{\boxed{3}}$$

Answer:

- 1 is divided in 3 equals parts.
- x is located at 1 part from 0.
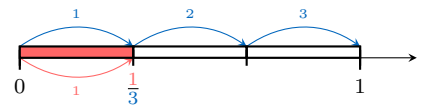
- So, $x = \dfrac{1}{3}$.

Ex 16: Find the value of x

$$x = \frac{\boxed{3}}{\boxed{4}}$$

Answer:

- 1 is divided in 4 equals parts.
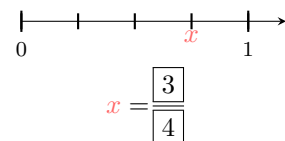- x is located at 3 parts from 0.
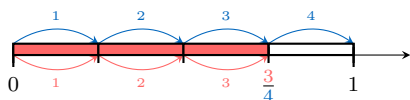
- So, $x = \dfrac{3}{4}$.

Ex 17: Find the value of x

$$x = \dfrac{\boxed{2}}{\boxed{6}}$$

Answer:

- 1 is divided in 6 equals parts.

- x is located at 2 parts from 0.
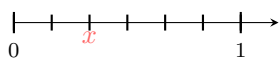

- So, $x = \dfrac{2}{6}$.

Ex 18: Find the value of x

$$x = \dfrac{\boxed{3}}{\boxed{5}}$$

Answer:

- 1 is divided in 5 equals parts.

- x is located at 3 parts from 0.

- So, $x = \dfrac{3}{5}$.

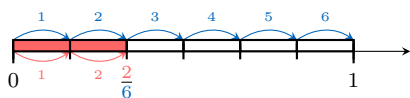## B.3 FINDING FRACTIONS GREATER THAN 1

Ex 19: Find the value of x

$$x = \dfrac{\boxed{4}}{\boxed{3}}$$

Answer:

- 1 is divided in 3 equals parts.

- x is located at 4 parts from 0.

- So, $x = \dfrac{4}{3}$.

Ex 20: Find the value of x
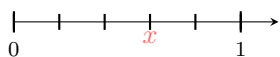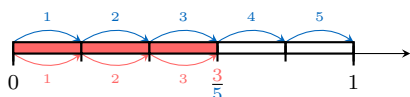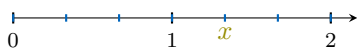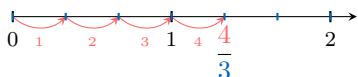

$$x = \dfrac{\boxed{7}}{\boxed{3}}$$
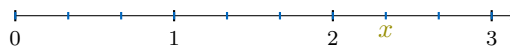
Answer:

- 1 is divided in 3 equal parts.

- x is located at 7 parts from 0.
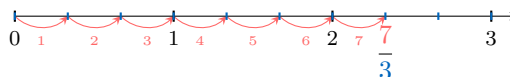
- So, $x = \dfrac{7}{3}$.

Ex 21: Find the value of x

$$x = \dfrac{\boxed{7}}{\boxed{4}}$$

Answer:

- 1 is divided in 4 equal parts.

- x is located at 7 parts from 0.
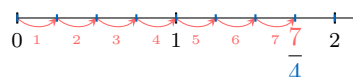
- So, $x = \dfrac{7}{4}$.

Ex 22: Find the value of x

$$x = \dfrac{\boxed{7}}{\boxed{6}}$$

Answer:

- 1 is divided into 6 equal parts.

- x is located at 7 parts from 0.

- So, $x = \dfrac{7}{6}$.

Ex 23: Find the value of x

$$x = \dfrac{\boxed{8}}{\boxed{5}}$$

Answer:

- 1 is divided into 5 equal parts.

- x is located at 8 parts from 0.

- So, $x = \dfrac{8}{5}$.
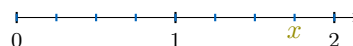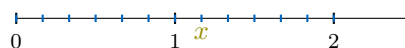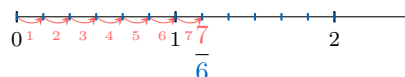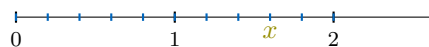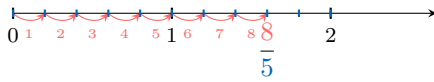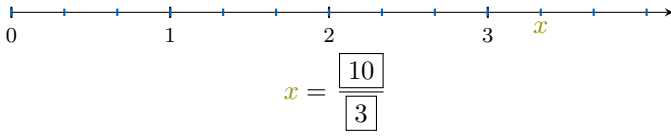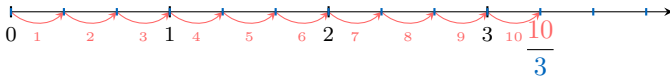
Ex 24: Find the value of x

$$x = \dfrac{\boxed{10}}{\boxed{3}}$$

Answer:

- 1 is divided into 3 equal parts.

- x is located at 10 parts from 0.
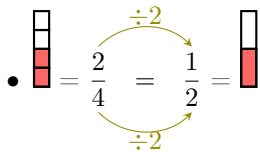

- So, $x = \dfrac{10}{3}$.

C EQUIVALENT FRACTIONS

C.1 FINDING THE MISSING NUMERATOR

Ex 25:

$$\dfrac{2}{4} = \dfrac{\boxed{1}}{2}$$

Answer:

- $\dfrac{2}{4} = \dfrac{1 \times \cancel{2}}{2 \times \cancel{2}}$
  $= \dfrac{1}{2}$

- The second denominator 2 is the first denominator 4 divided by 2 : $4 \times 2 = 2$.

- To keep the fractions equivalent, the numerator must also be divided by 2.

- This means: $2 \div 2 = 1$, so the missing numerator is 1.

Ex 26:

$$\dfrac{9}{6} = \dfrac{\boxed{3}}{2}$$

Answer:

- $\dfrac{9}{6} = \dfrac{3 \times \cancel{3}}{2 \times \cancel{3}}$
  $= \dfrac{3}{2}$

- The second denominator 2 is the first denominator 6 divided by 3 : $6 \div 3 = 2$.

- To keep the fractions equivalent, the numerator must also be divided by 3.

- This means: $9 \div 3 = 3$, so the missing numerator is 3.

Ex 27:

$$\dfrac{5}{10} = \dfrac{\boxed{1}}{2}$$

Answer:

- $\dfrac{5}{10} = \dfrac{1 \times \cancel{5}}{2 \times \cancel{5}}$
  $= \dfrac{1}{2}$

- The second denominator 2 is the first denominator 10 divided by 5 : $10 \div 5 = 2$.

- To keep the fractions equivalent, the numerator must also be divided by 5.

- This means: $5 \div 5 = 1$, so the missing numerator is 1.

Ex 28:

$$\dfrac{16}{12} = \dfrac{\boxed{4}}{3}$$

Answer:

- $\dfrac{16}{12} = \dfrac{4 \times \cancel{4}}{3 \times \cancel{4}}$
  $= \dfrac{4}{3}$

- The second denominator 3 is the first denominator 12 divided by 4 : $12 \div 4 = 3$.

- To keep the fractions equivalent, the numerator must also be divided by 4.

- This means: $16 \div 4 = 4$, so the missing numerator is 4.

Ex 29:

$$\frac{4}{10} = \frac{\boxed{2}}{5}$$

Answer:

- $\dfrac{4}{10} = \dfrac{2\times\cancel{2}}{5\times\cancel{2}}$
  $= \dfrac{2}{5}$

- $\blacksquare = \dfrac{4}{10} \overset{\div 2}{\underset{\div 2}{=}} \dfrac{2}{5} = \blacksquare$
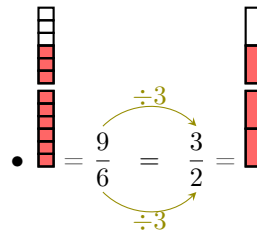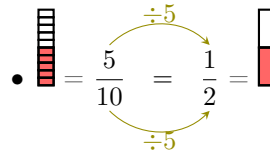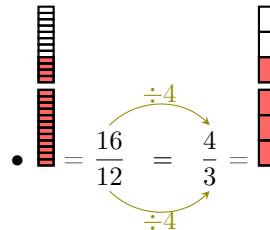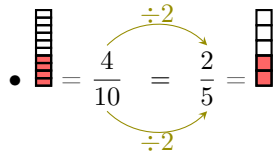
- The second denominator 5 is the first denominator 10 divided by 2 : $10 \div 2 = 5$.

- To keep the fractions equivalent, the numerator must also be divided by 2.

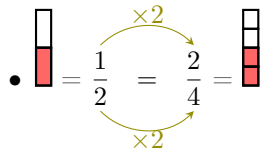- This means: $4 \div 2 = 2$, so the missing numerator is 2.

C.2 FINDING THE MISSING NUMERATOR

Ex 30:

$$\frac{1}{2} = \frac{\boxed{2}}{4}$$

Answer:

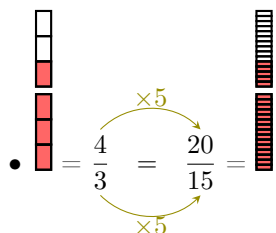- $\dfrac{1}{2} = \dfrac{1\times 2}{2\times 2}$
  $= \dfrac{2}{4}$

- $\blacksquare = \dfrac{1}{2} \overset{\times 2}{\underset{\times 2}{=}} \dfrac{2}{4} = \blacksquare$

Ex 31:

$$\frac{4}{3} = \frac{\boxed{20}}{15}$$

Answer:

- $\dfrac{4}{3} = \dfrac{4\times 5}{3\times 5}$
  $= \dfrac{20}{15}$

- $\blacksquare = \dfrac{4}{3} \overset{\times 5}{\underset{\times 5}{=}} \dfrac{20}{15} = \blacksquare$

Ex 32:

$$\frac{3}{4} = \frac{\boxed{9}}{12}$$

Answer:

- $\dfrac{3}{4} = \dfrac{3\times 3}{4\times 3}$
  $= \dfrac{9}{12}$

- $\blacksquare = \dfrac{3}{4} \overset{\times 3}{\underset{\times 3}{=}} \dfrac{9}{12} = \blacksquare$
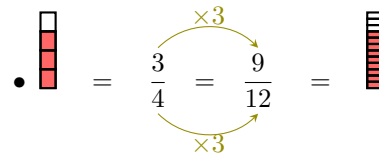
Ex 33:

$$\frac{5}{6} = \frac{\boxed{10}}{12}$$

Answer:

- $\dfrac{5}{6} = \dfrac{5\times 2}{6\times 2}$
  $= \dfrac{10}{12}$

- $\blacksquare = \dfrac{5}{6} \overset{\times 2}{\underset{\times 2}{=}} \dfrac{10}{12} = \blacksquare$
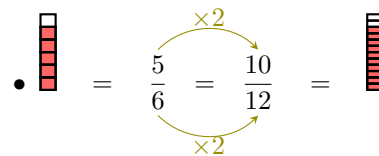
Ex 34:

$$\frac{7}{8} = \frac{\boxed{28}}{32}$$

Answer:

- $\dfrac{7}{8} = \dfrac{7\times 4}{8\times 4}$
  $= \dfrac{28}{32}$

- $\blacksquare = \dfrac{7}{8} \overset{\times 4}{\underset{\times 4}{=}} \dfrac{28}{32} = \blacksquare$
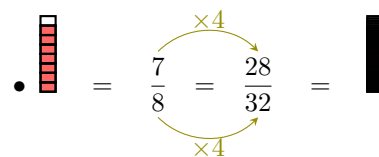
C.3 FINDING THE MISSING DENOMINATOR

Ex 35:

$$\frac{4}{10} = \frac{2}{\boxed{5}}$$

Answer:

- $\dfrac{4}{10} = \dfrac{2\times\cancel{2}}{5\times\cancel{2}}$
  $= \dfrac{2}{5}$

- $\blacksquare = \dfrac{4}{10} \overset{\div 2}{\underset{\div 2}{=}} \dfrac{2}{5} = \blacksquare$

- The second numerator 2 is the first numerator 4 divided by 2 : $4 \div 2 = 2$.

- To keep the fractions equivalent, the denominator must also be divided by 2.

- This means: $10 \div 2 = 5$, so the missing denominator is 5.

Ex 36:

$$\frac{6}{12} = \frac{1}{\boxed{2}}$$

Answer:

- $\frac{6}{12} = \frac{1 \times 6}{2 \times 6}$

  $= \frac{1}{2}$

-
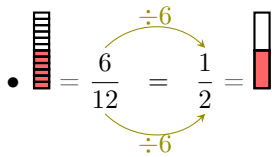
- The second numerator 1 is the first numerator 6 divided by 6 : $6 \div 6 = 1$.

- To keep the fractions equivalent, the denominator must also be divided by 6.

- This means: $12 \div 6 = 2$, so the missing denominator is 2.

Ex 37:

$$\frac{9}{6} = \frac{3}{\boxed{2}}$$

Answer:

- $\frac{9}{6} = \frac{3 \times 3}{2 \times 3}$

  $= \frac{3}{2}$

-
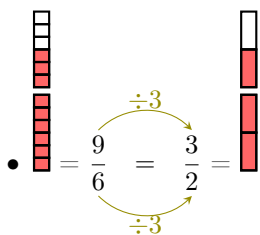
- The second numerator 3 is the first numerator 9 divided by 3 : $9 \div 3 = 3$.

- To keep the fractions equivalent, the denominator must also be divided by 3.

- This means: $6 \div 3 = 2$, so the missing denominator is 2.

Ex 38:

$$\frac{12}{10} = \frac{6}{\boxed{5}}$$

Answer:

- $\frac{12}{10} = \frac{6 \times 2}{5 \times 2}$

  $= \frac{6}{5}$

-

- The second numerator 6 is the first numerator 12 divided by 2 : $12 \div 2 = 6$.

- To keep the fractions equivalent, the denominator must also be divided by 2.

- This means: $10 \div 2 = 5$, so the missing denominator is 5.

C.4 FINDING THE MISSING DENOMINATOR

Ex 39:

$$\frac{2}{5} = \frac{6}{\boxed{15}}$$

Answer:
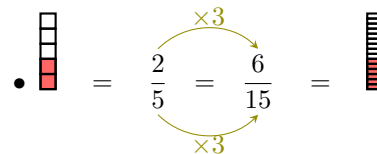
- $\frac{2}{5} = \frac{2 \times 3}{5 \times 3}$

  $= \frac{6}{15}$

-

Ex 40:

$$\frac{2}{3} = \frac{8}{\boxed{12}}$$

Answer:

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

  $= \frac{8}{12}$

-

Ex 41:

$$\frac{3}{5} = \frac{9}{\boxed{15}}$$

Answer:

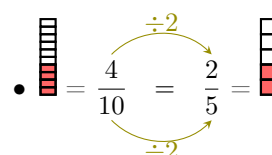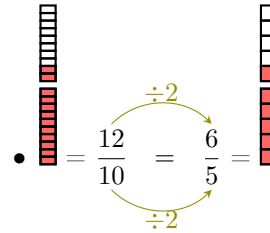- $\frac{3}{5} = \frac{3 \times 3}{5 \times 3}$

  $= \frac{9}{15}$

$$\bullet \quad \text{▯} \quad = \quad \frac{3}{5} \xrightarrow{\times 3} = \xrightarrow{\times 3} \frac{9}{15} = \quad \text{▯}$$
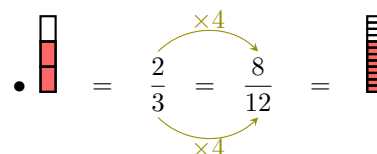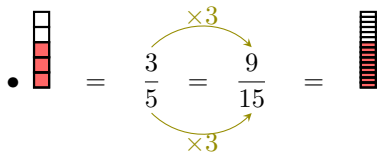
Ex 42:

$$\frac{4}{7} = \frac{12}{\boxed{21}}$$

Answer:

$$\bullet \quad \frac{4}{7} = \frac{4 \times 3}{7 \times 3}$$
$$= \frac{12}{21}$$

$$\bullet \quad \text{▯} \quad = \quad \frac{4}{7} \xrightarrow{\times 3} = \xrightarrow{\times 3} \frac{12}{21} = \quad \text{▯}$$
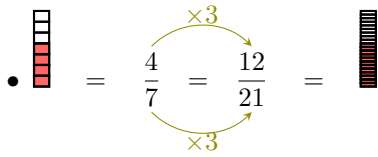
Ex 43:

$$\frac{5}{9} = \frac{20}{\boxed{36}}$$

Answer:

$$\bullet \quad \frac{5}{9} = \frac{5 \times 4}{9 \times 4}$$
$$= \frac{20}{36}$$

$$\bullet \quad \text{▯} \quad = \quad \frac{5}{9} \xrightarrow{\times 4} = \xrightarrow{\times 4} \frac{20}{36} = \quad \text{▮}$$
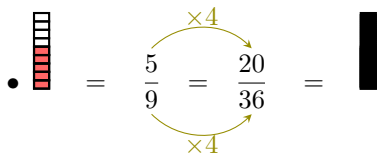
D SIMPLIFICATION

D.1 SIMPLIFYING FRACTIONS

Ex 44: Simplify:

$$\frac{4}{6} = \frac{2}{\boxed{3}}$$

Answer:

$$\text{▯} = \quad \frac{4}{6} \xrightarrow{\div 2} = \xrightarrow{\div 2} \frac{2}{3} = \quad \text{▯}$$
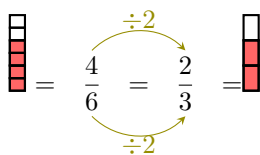
Ex 45: Simplify:

$$\frac{2}{4} = \frac{1}{\boxed{2}}$$

Answer:

$$\bullet \quad \text{▯} \quad = \quad \frac{2}{4} \xrightarrow{\div 2} = \xrightarrow{\div 2} \frac{1}{2} = \quad \text{▯}$$
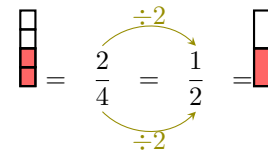
Ex 46: Simplify:

$$\frac{10}{8} = \frac{5}{\boxed{4}}$$

Answer:

$$\text{▯} = \quad \frac{10}{8} \xrightarrow{\div 2} = \xrightarrow{\div 2} \frac{5}{4} = \quad \text{▯}$$
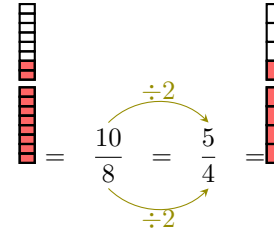
Ex 47: Simplify:

$$\frac{6}{9} = \frac{2}{\boxed{3}}$$

Answer:

$$\text{▯} = \quad \frac{6}{9} \xrightarrow{\div 3} = \xrightarrow{\div 3} \frac{2}{3} = \quad \text{▯}$$
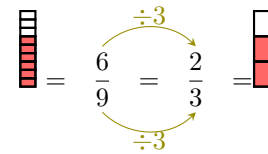
D.2 SIMPLIFYING FRACTIONS

Ex 48: Simplify:

$$\frac{4}{6} = \frac{2}{\boxed{3}}$$

Answer:

$$\bullet$$

$$\frac{2}{4} = \frac{1 \times \cancel{2}}{2 \times \cancel{2}}$$
$$= \frac{1}{2}$$

$$\bullet \quad \frac{4}{6} \xrightarrow{\div 2} = \xrightarrow{\div 2} \frac{2}{3}$$
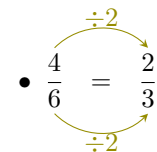
Ex 49: Simplify:

$$\frac{24}{16} = \frac{3}{\boxed{2}}$$

Answer:

$$\bullet$$

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

$$\bullet \quad \frac{24}{16} \; \overset{\div 8}{\underset{\div 8}{=}} \; \frac{3}{2}$$

Ex 50: Simplify:

$$\frac{12}{20} = \frac{\boxed{3}}{\boxed{5}}$$

Answer:

-
$$\frac{12}{20} = \frac{3 \times 4}{5 \times 4}$$
$$= \frac{3}{5}$$

$$\bullet \quad \frac{12}{20} \; \overset{\div 4}{\underset{\div 4}{=}} \; \frac{3}{5}$$

Ex 51: Simplify:

$$\frac{30}{100} = \frac{\boxed{3}}{\boxed{10}}$$

Answer:

-
$$\frac{30}{100} = \frac{3 \times 10}{10 \times 10}$$
$$= \frac{3}{10}$$

$$\bullet \quad \frac{30}{100} \; \overset{\div 10}{\underset{\div 10}{=}} \; \frac{3}{10}$$

Ex 52: Simplify:

$$\frac{25}{100} = \frac{\boxed{1}}{\boxed{4}}$$

Answer:

-
$$\frac{25}{100} = \frac{1 \times 25}{4 \times 25}$$
$$= \frac{1}{4}$$

$$\bullet \quad \frac{25}{100} \; \overset{\div 25}{\underset{\div 25}{=}} \; \frac{1}{4}$$

E CROSS MULTIPLICATION

E.1 SOLVING PROPORTIONS USING CROSS-MULTIPLICATION

Ex 53: Solve x for $\frac{12}{4} = \frac{x}{6}$:

$$x = \boxed{18}$$

Answer:

$$\frac{12}{4} \; \diagdown \; \frac{x}{6}$$
$$4 \times x = \quad 12 \times 6 \qquad \text{(cross multiplication)}$$
$$x \quad = 12 \times 6 \div 4 \quad \text{(dividing both sides by 4)}$$
$$x \quad = \quad 18$$

Ex 54: Solve x for $\frac{11}{10} = \frac{x}{5}$:

$$x = \boxed{5.5}$$

Answer:

$$\frac{11}{10} \; \diagdown \; \frac{x}{5}$$
$$10 \times x = \quad 11 \times 5 \qquad \text{(cross multiplication)}$$
$$x \quad = 11 \times 5 \div 10 \quad \text{(dividing both sides by 10)}$$
$$x \quad = \quad 5.5$$

Ex 55: Solve x for $\frac{12}{10} = \frac{18}{x}$:

$$x = \boxed{15}$$

Answer:

$$\frac{12}{10} \; \diagdown \; \frac{18}{x}$$
$$12 \times x = \quad 18 \times 10 \qquad \text{(cross multiplication)}$$
$$x \quad = 18 \times 10 \div 12 \quad \text{(dividing both sides by 12)}$$
$$x \quad = \quad 15$$

Ex 56: Solve x for $\frac{27}{x} = \frac{30}{10}$:

$$x = \boxed{9}$$
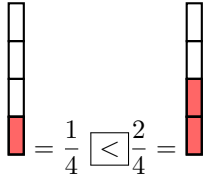
Answer:

$$\frac{27}{x} \; \diagdown \; \frac{30}{10}$$
$$30 \times x = \quad 27 \times 10 \qquad \text{(cross multiplication)}$$
$$x \quad = 27 \times 10 \div 30 \quad \text{(dividing both sides by 30)}$$
$$x \quad = \quad 9$$

F ORDERING FRACTIONS

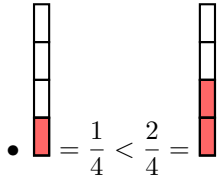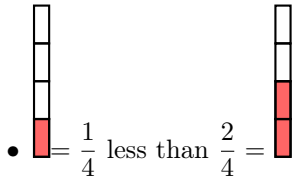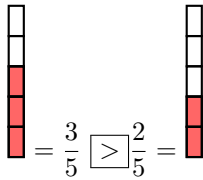## F.1 COMPARING WITH SAME DENOMINATOR WITH BAR MODELS

Ex 57: Compare using $>, <, =$:

$$= \frac{1}{4} \boxed{<} \frac{2}{4} =$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $= \frac{1}{4}$ less than $\frac{2}{4} =$

- $= \frac{1}{4} < \frac{2}{4} =$

Ex 58: Compare using $>, <, =$:
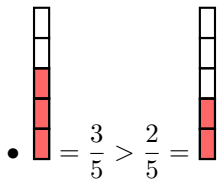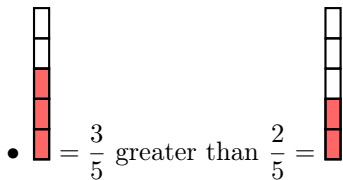
$$= \frac{3}{5} \boxed{>} \frac{2}{5} =$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

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

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

Ex 59: Compare using $>, <, =$:

$$= \frac{4}{7} \boxed{>} \frac{3}{7} =$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $= \frac{4}{7}$ greater than $\frac{3}{7} =$

- $= \frac{4}{7} > \frac{3}{7} =$

Ex 60: Compare using $>, <, =$:

$$= \frac{7}{4} \boxed{>} \frac{5}{4} =$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $= \frac{7}{4}$ greater than $\frac{5}{4} =$

- $= \frac{7}{4} > \frac{5}{4} =$
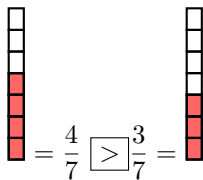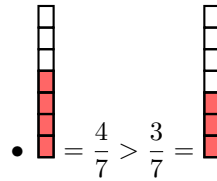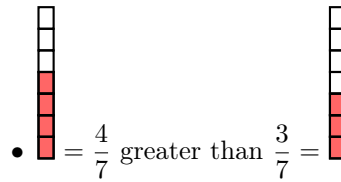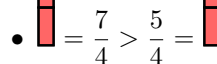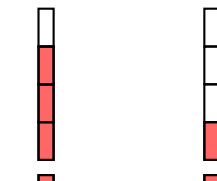
Ex 61: Compare using $>, <, =$:

$$\frac{5}{3} \boxed{<} \frac{6}{3} =$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $\blacksquare = \frac{5}{3}$ less than $\frac{6}{3} =$

- $\blacksquare = \frac{5}{3} < \frac{6}{3} =$
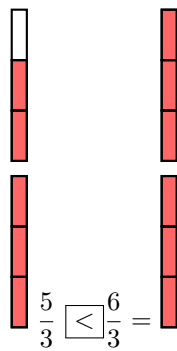
F.2 COMPARING WITH SAME DENOMINATOR

Ex 62: Compare using $>, <, =$:

$$\frac{7}{3} \boxed{>} \frac{6}{3}$$
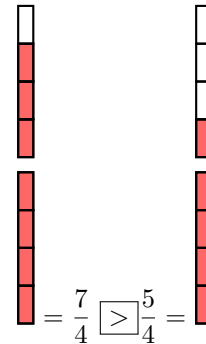
Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $\blacksquare = \frac{7}{3}$ less than $\frac{6}{3} =$

- So $\frac{7}{3} > \frac{6}{3}$
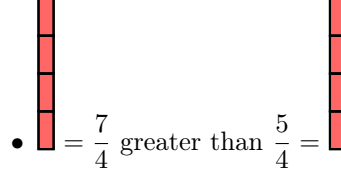
Ex 63: Compare using $>, <, =$:

$$\frac{5}{4} \boxed{>} \frac{3}{4}$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*
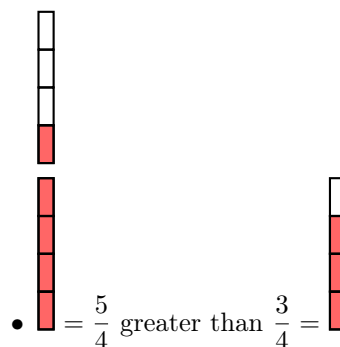
- $\blacksquare = \frac{5}{4}$ greater than $\frac{3}{4} =$

- So $\frac{5}{4} > \frac{3}{4}$

Ex 64: Compare using $>, <, =$:

$$\frac{2}{6} \boxed{<} \frac{4}{6}$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
  $=$ means *equal to.*

- $\blacksquare = \frac{2}{6}$ less than $\frac{4}{6} =$

- So $\frac{2}{6} < \frac{4}{6}$

Ex 65: Compare using $>, <, =$:

$$\frac{7}{5} \boxed{>} \frac{3}{5}$$

Answer:

- $>$ means *greater than.*
  $<$ means *less than.*
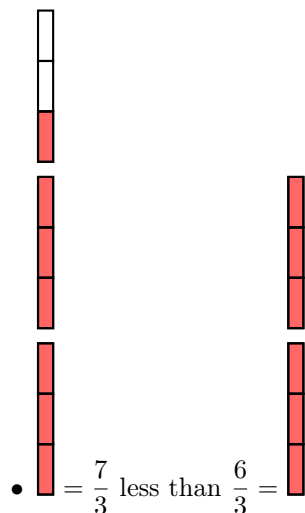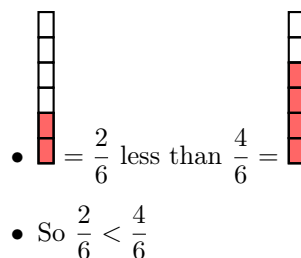 $=$ means *equal to.*

- $\blacksquare = \frac{7}{5}$ greater than $\frac{3}{5} =$

- So $\dfrac{7}{5} > \dfrac{3}{5}$

Ex 66: Compare using $>, <, =$:

$$\dfrac{3}{8} \;\boxed{<}\; \dfrac{6}{8}$$

Answer:

- $>$ means *greater than.*
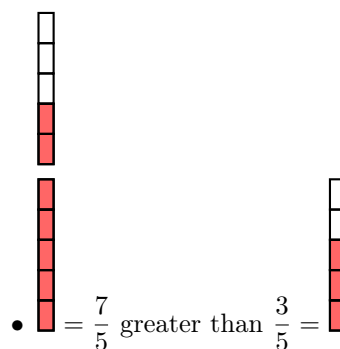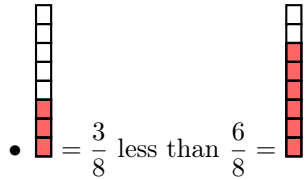 $<$ means *less than.*
  $=$ means *equal to.*

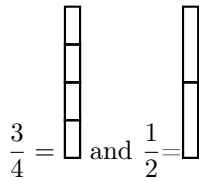- $\blacksquare = \dfrac{3}{8}$ less than $\dfrac{6}{8} = \blacksquare$

- So $\dfrac{3}{8} < \dfrac{6}{8}$

F.3 COMPARING FRACTIONS WITH DIFFERENT DENOMINATORS
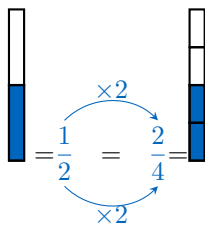
Ex 67: Compare using $>, <, =$:

$$\dfrac{3}{4} \;\boxed{>}\; \dfrac{1}{2}$$

Hint: color the bars below to help you compare the fractions.

$$\dfrac{3}{4} = \square \text{ and } \dfrac{1}{2} = \square$$

Answer:

- Find equivalent fractions with the same denominator:

$$= \dfrac{1}{2} \;\xrightarrow{\times 2}\; = \;\xrightarrow{\times 2}\; \dfrac{2}{4} =$$

- Compare with same denominator:

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

- So

$$= \dfrac{3}{4} > \dfrac{1}{2} =$$

Ex 68: Compare using $>, <, =$:

$$\dfrac{5}{6} \;\boxed{>}\; \dfrac{2}{3}$$

Hint: color the bars below to help you compare the fractions.

$$\dfrac{5}{6} = \square \text{ and } \dfrac{2}{3} = \square$$

Answer:

- Find equivalent fractions with the same denominator:

$$= \dfrac{2}{3} \;\xrightarrow{\times 2}\; = \;\xrightarrow{\times 2}\; \dfrac{4}{6} =$$

- Compare with same denominator:

$$= \dfrac{5}{6} > \dfrac{4}{6} =$$

- So

$$= \dfrac{5}{6} > \dfrac{2}{3} =$$
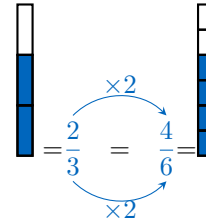
Ex 69: Compare using $>, <, =$:

$$\dfrac{5}{6} \;\boxed{>}\; \dfrac{1}{2}$$

Hint: color the bars below to help you compare the fractions.

$$\dfrac{5}{6} = \square \text{ and } \dfrac{1}{2} = \square$$

Answer:

- Find equivalent fractions with the same denominator:

$$= \dfrac{1}{2} \;\xrightarrow{\times 3}\; = \;\xrightarrow{\times 3}\; \dfrac{3}{6} =$$

- Compare with same denominator:

$$= \frac{5}{6} > \frac{3}{6} =$$

- So

$$= \frac{5}{6} > \frac{1}{2} =$$
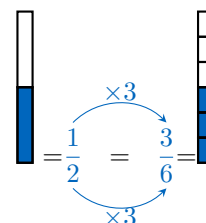
Ex 70: Compare using $>, <, =$:

$$\frac{7}{6} \boxed{<} \frac{4}{3}$$

Hint: color the bars below to help you compare the fractions.

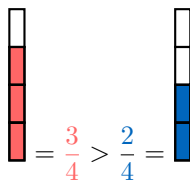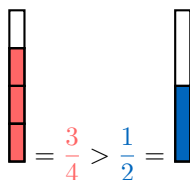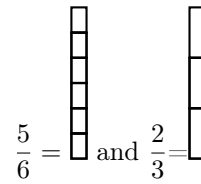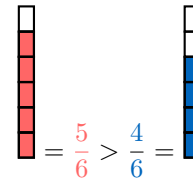$$\frac{7}{6} = \quad \text{and} \quad \frac{4}{3} =$$

Answer:

- Find equivalent fractions with the same denominator:

$$= \frac{4}{3} \xrightarrow{\times 2} = \frac{8}{6} = $$

- Compare with same denominator:

$$= \frac{7}{6} < \frac{8}{6} =$$

- So

$$= \frac{7}{6} < \frac{4}{3} =$$
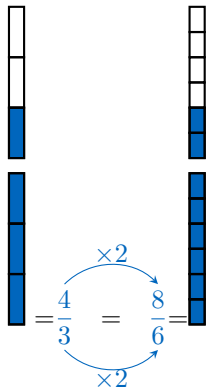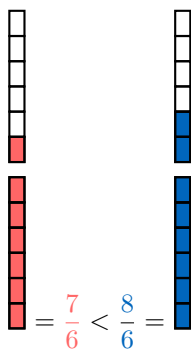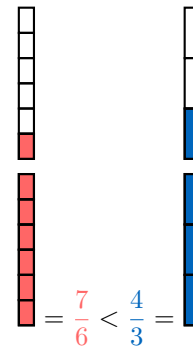
Ex 71: Compare using $>, <, =$:

$$\frac{3}{4} \boxed{<} \frac{7}{8}$$

Hint: color the bars below to help you compare the fractions.

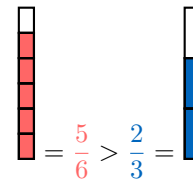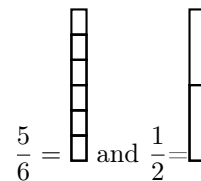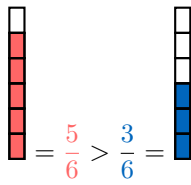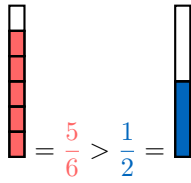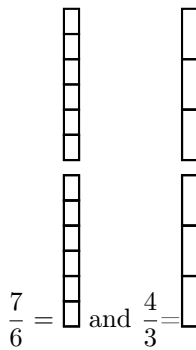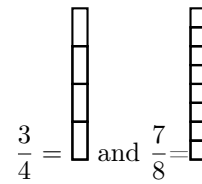$$\frac{3}{4} = \quad \text{and} \quad \frac{7}{8} =$$

Answer:

- Find equivalent fractions with the same denominator:

$$= \frac{3}{4} \xrightarrow{\times 2} = \frac{6}{8} =$$

- Compare with same denominator:

$$= \frac{6}{8} < \frac{7}{8} =$$

- So

$$= \frac{3}{4} < \frac{7}{8} =$$
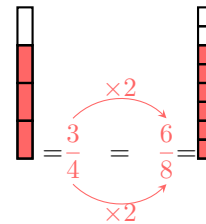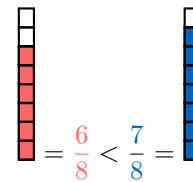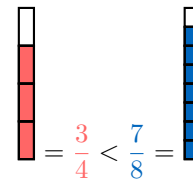
F.4 COMPARING FRACTIONS TO REAL-WORLD PROBLEMS

MCQ 72: Hugo spends $\frac{3}{8}$ of his money on Pokemon cards and $\frac{1}{4}$ of his money to buy a tennis racket. On which does he spend more money?

- ☒ Pokemon cards

- ☐ Tennis racquet

Answer:

- Convert to a common denominator: $\dfrac{1}{4} \overset{\times 2}{=} \dfrac{2}{8}$ (×2)

- Since $\dfrac{2}{8} < \dfrac{3}{8}$, $\dfrac{1}{4} < \dfrac{3}{8}$

- So, Hugo spends more money on Pokemon cards than on a tennis racquet.

MCQ 73: Sophie spends $\frac{1}{2}$ of her money on clothes and $\frac{3}{8}$ of her money on books. On which does she spend more money?

$\boxtimes$ Clothes

$\square$ Books

Answer:

- Convert to a common denominator: $\dfrac{1}{2} \overset{\times 4}{=} \dfrac{4}{8}$ (×4)

- Since $\dfrac{4}{8} > \dfrac{3}{8}$, $\dfrac{1}{2} > \dfrac{3}{8}$

- So, Sophie spends more money on clothes than on books.

MCQ 74: For her cake recipe, Sarah uses $\frac{2}{5}$ of a cup of butter and $\frac{3}{10}$ of a cup of sugar. Which ingredient does she use more of?

$\boxtimes$ Butter

$\square$ Sugar

Answer:

- Convert to a common denominator: $\dfrac{2}{5} \overset{\times 2}{=} \dfrac{4}{10}$ (×2)

- Since $\dfrac{4}{10} > \dfrac{3}{10}$, Sarah uses more butter than sugar.

MCQ 75: In Class A, $\frac{6}{10}$ of the students are girls, and in Class B, $\frac{13}{20}$ of the students are girls. In which class is the proportion of girls higher?

$\square$ Class A

$\boxtimes$ Class B

Answer:

- Convert to a common denominator: $\dfrac{6}{10} \overset{\times 2}{=} \dfrac{12}{20}$ (×2)

- Since $\dfrac{12}{20} < \dfrac{13}{20}$, the proportion of girls is higher in Class B.

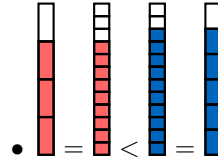**Ex 76:**

$$\frac{3}{4} \boxed{<} \frac{5}{6}$$

Answer:

- Find a common denominator :
  - The multiples of 4 are: 4, 8, **12**, 16, ...
  - The multiples of 6 are: 6, **12**, 18, ...
  - So, the common denominator is **12**.

- Write them with a denominator equal to 12:
  - $\dfrac{3}{4} = \dfrac{3 \times 3}{4 \times 3} = \dfrac{9}{12}$
  - $\dfrac{5}{6} = \dfrac{5 \times 2}{6 \times 2} = \dfrac{10}{12}$

- Compare: $\dfrac{3}{4} = \dfrac{9}{12} < \dfrac{10}{12} = \dfrac{5}{6}$

- $\blacksquare = \blacksquare < \blacksquare = \blacksquare$

Ex 77:

$$\frac{7}{8} \boxed{<} \frac{9}{10}$$

Answer:

- Find a common denominator :
  - The multiples of 8 are: 8, 16, 24, 32, **40**, ...
  - The multiples of 10 are: 10, 20, 30, **40**, ...
  - So, the common denominator is **40**.

- Write them with a denominator equal to 40:
  - $\dfrac{7}{8} = \dfrac{7 \times 5}{8 \times 5} = \dfrac{35}{40}$
  - $\dfrac{9}{10} = \dfrac{9 \times 4}{10 \times 4} = \dfrac{36}{40}$

- Compare: $\dfrac{7}{8} = \dfrac{35}{40} < \dfrac{36}{40} = \dfrac{9}{10}$

- $\blacksquare = \blacksquare < \blacksquare = \blacksquare$
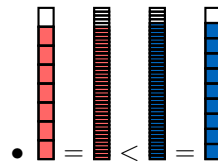
Ex 78:

$$\frac{4}{5} \boxed{>} \frac{2}{3}$$
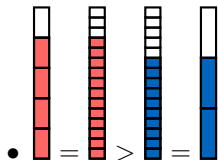
Answer:

- Find a common denominator :

- The multiples of 5 are: 5, 10, **15**, …
- The multiples of 3 are: 3, 6, 9, 12, **15**, 18, …
- So, the common denominator is **15**.

- Write them with a denominator equal to 15:
  $$-\frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15}$$
  $$-\frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

- Compare: $\frac{4}{5} = \frac{12}{15} > \frac{10}{15} = \frac{2}{3}$

Ex 79:

$$\frac{2}{3} \boxed{<} \frac{3}{4}$$
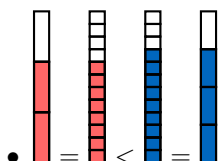
Answer:

- Find a common denominator :
  - The multiples of 3 are: 3, 6, 9, **12**, 15, 18, ….
  - The multiples of 4 are: 4, 8, **12**, 16, 20, ….
  - So, the common denominator is **12**.

- Write them with a denominator equal to 12:
  $$-\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$
  $$-\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$$

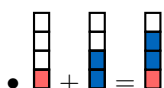- Compare: $\frac{2}{3} = \frac{8}{12} < \frac{9}{12} = \frac{3}{4}$

G ADDITION AND SUBTRACTION WITH COMMON DENOMINATORS

G.1 ADDING FRACTIONS WITH COMMON DENOMINATORS

Ex 80:

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

Answer:

$$\bullet \quad \frac{1}{4} + \frac{2}{4} = \frac{1+2}{4}$$
$$= \frac{3}{4}$$

Ex 81:

$$\frac{3}{5} + \frac{1}{5} = \boxed{\frac{4}{5}}$$

Answer:

$$\bullet \quad \frac{3}{5} + \frac{1}{5} = \frac{3+1}{5}$$
$$= \frac{4}{5}$$

Ex 82:

$$\frac{2}{6} + \frac{3}{6} = \boxed{\frac{5}{6}}$$

Answer:

$$\bullet \quad \frac{2}{6} + \frac{3}{6} = \frac{2+3}{6}$$
$$= \frac{5}{6}$$

Ex 83:

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

Answer:

$$\bullet \quad \frac{2}{3} + \frac{2}{3} = \frac{2+2}{3}$$
$$= \frac{4}{3}$$

Ex 84:

$$\frac{4}{5} + \frac{2}{5} = \boxed{\frac{6}{5}}$$

Answer:

$$\bullet \quad \frac{4}{5} + \frac{2}{5} = \frac{4+2}{5}$$
$$= \frac{6}{5}$$

G.2 SUBTRACTING FRACTIONS WITH COMMON DENOMINATORS

Ex 85:

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

Answer:

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

$\qquad = \dfrac{1}{4}$

Ex 86:

$$\frac{4}{5} - \frac{3}{5} = \boxed{\frac{1}{5}}$$

Answer:
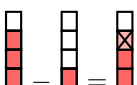
- $\dfrac{4}{5} - \dfrac{3}{5} = \dfrac{4-3}{5}$

$\qquad = \dfrac{1}{5}$

Ex 87:

$$\frac{3}{4} - \frac{1}{4} = \boxed{\frac{3}{4}}$$
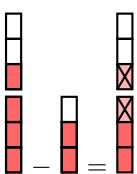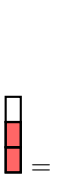
Answer:

- $\dfrac{3}{4} - \dfrac{1}{4} = \dfrac{3-1}{4}$

$\qquad = \dfrac{2}{4}$

Ex 88:

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

Answer:
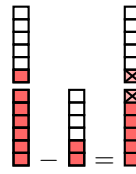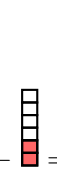
- $\dfrac{4}{3} - \dfrac{2}{3} = \dfrac{4-2}{3}$

$\qquad = \dfrac{2}{3}$

Ex 89:

$$\frac{7}{6} - \frac{2}{6} = \boxed{\frac{5}{6}}$$

Answer:

- $\dfrac{7}{6} - \dfrac{2}{6} = \dfrac{7-2}{6}$

$\qquad = \dfrac{5}{6}$

H ADDITION AND SUBTRACTION WITH DIFFERENT DENOMINATORS

H.1 ADDING FRACTIONS

Ex 90:

$$\frac{2}{5} + \frac{3}{10} = \boxed{\frac{7}{10}}$$

Answer:

- Since $\dfrac{2}{5}$ and $\dfrac{3}{10}$ have different denominators, rewrite $\dfrac{2}{5}$ with the denominator 10:

This ensures the fractions have the same denominator.

-
$$\frac{2}{5} + \frac{3}{10} = \frac{4}{10} + \frac{3}{10}$$
$$= \frac{7}{10}$$

Ex 91:

$$\frac{1}{4} + \frac{3}{8} = \boxed{\frac{5}{8}}$$

Answer:

- Since $\dfrac{1}{4}$ and $\dfrac{3}{8}$ have different denominators, rewrite $\dfrac{1}{4}$ with the denominator 8:

$$\frac{1}{4} = \frac{2}{8}$$
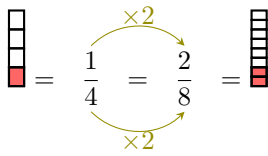
This ensures the fractions have the same denominator.

-
$$\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8}$$
$$= \frac{5}{8}$$

Ex 92:

$$\frac{2}{3} + \frac{1}{6} = \boxed{\frac{5}{6}}$$

Answer:

- Since $\frac{2}{3}$ and $\frac{1}{6}$ have different denominators, rewrite $\frac{2}{3}$ with the denominator 6:

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

This ensures the fractions have the same denominator.

-
$$\frac{2}{3} + \frac{1}{6} = \frac{4}{6} + \frac{1}{6}$$
$$= \frac{5}{6}$$

Ex 93:

$$\frac{3}{5} + \frac{2}{15} = \boxed{\frac{11}{15}}$$

Answer:

- Since $\frac{3}{5}$ and $\frac{2}{15}$ have different denominators, rewrite $\frac{3}{5}$ with the denominator 15:

$$\frac{3}{5} = \frac{9}{15}$$

This ensures the fractions have the same denominator.

-
$$\frac{3}{5} + \frac{2}{15} = \frac{9}{15} + \frac{2}{15}$$
$$= \frac{11}{15}$$

Ex 94:

$$\frac{3}{10} + \frac{2}{5} = \boxed{\frac{7}{10}}$$

Answer:

- Since $\frac{3}{10}$ and $\frac{2}{5}$ have different denominators, rewrite $\frac{2}{5}$ with the denominator 10:

$$\frac{2}{5} = \frac{4}{10}$$

This ensures the fractions have the same denominator.

-
$$\frac{3}{10} + \frac{2}{5} = \frac{3}{10} + \frac{4}{10}$$
$$= \frac{7}{10}$$

Ex 95:

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

Answer:

- Since $\frac{3}{8}$ and $\frac{1}{2}$ have different denominators, rewrite $\frac{1}{2}$ with the denominator 8:

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

This ensures the fractions have the same denominator.

-
$$\frac{3}{8} + \frac{1}{2} = \frac{3}{8} + \frac{4}{8}$$
$$= \frac{7}{8}$$

H.2 SUBTRACTING FRACTIONS

Ex 96:

$$\frac{2}{5} - \frac{3}{10} = \frac{\boxed{4}}{\boxed{10}} - \frac{\boxed{3}}{\boxed{10}}$$
$$= \frac{\boxed{1}}{\boxed{10}}$$

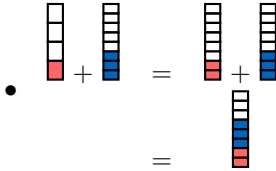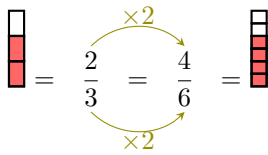*Answer:*

- Since $\frac{2}{5}$ and $\frac{3}{10}$ have different denominators, rewrite $\frac{2}{5}$ with the denominator 10:

$$= \quad \frac{2}{5} \quad \overset{\times 2}{=} \quad \frac{4}{10} \quad =$$

This ensures the fractions have the same denominator.

-

$$\frac{2}{5} - \frac{3}{10} = \frac{4}{10} - \frac{3}{10}$$
$$= \frac{4-3}{10}$$
$$= \frac{1}{10}$$

Ex 97:

$$\frac{7}{6} - \frac{1}{3} = \frac{\boxed{7}}{\boxed{6}} - \frac{\boxed{2}}{\boxed{6}}$$
$$= \frac{\boxed{5}}{\boxed{6}}$$
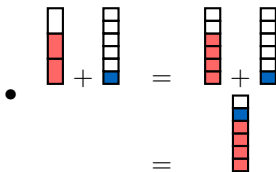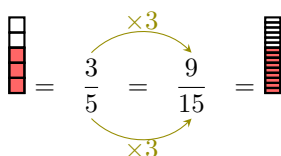
Answer:

- Since $\frac{7}{6}$ and $\frac{1}{3}$ have different denominators, rewrite $\frac{1}{3}$ with the denominator 6:

$$= \quad \frac{1}{3} \quad \overset{\times 2}{=} \quad \frac{2}{6} \quad =$$

This ensures the fractions have the same denominator.

-

$$\frac{7}{6} - \frac{1}{3} = \frac{7}{6} - \frac{2}{6}$$
$$= \frac{7-2}{6}$$
$$= \frac{5}{6}$$

-

Ex 98:

$$\frac{7}{8} - \frac{3}{4} = \frac{\boxed{7}}{\boxed{8}} - \frac{\boxed{6}}{\boxed{8}}$$
$$= \frac{\boxed{1}}{\boxed{8}}$$
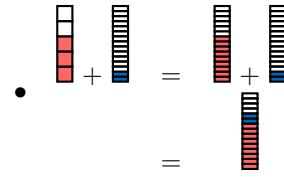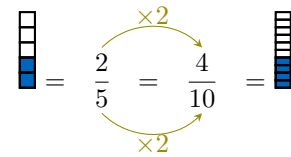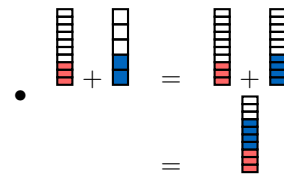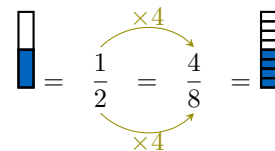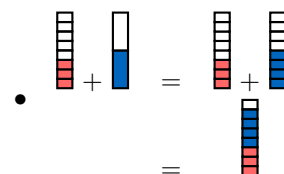
Answer:

- Since $\frac{7}{8}$ and $\frac{3}{4}$ have different denominators, rewrite $\frac{3}{4}$ with the denominator 8:

$$= \quad \frac{3}{4} \quad \overset{\times 2}{=} \quad \frac{6}{8} \quad =$$

This ensures the fractions have the same denominator.

-

$$\frac{7}{8} - \frac{3}{4} = \frac{7}{8} - \frac{6}{8}$$
$$= \frac{7-6}{8}$$
$$= \frac{1}{8}$$

-

Ex 99:

$$\frac{5}{3} - \frac{5}{9} = \frac{\boxed{5}}{\boxed{3}} - \frac{\boxed{5}}{\boxed{9}}$$
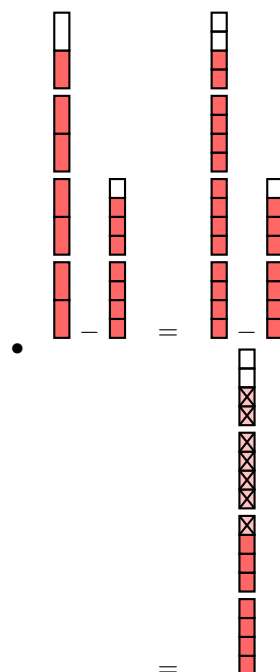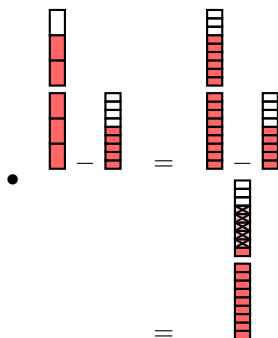$$= \frac{\boxed{10}}{\boxed{9}}$$

Answer:

- Since $\frac{5}{3}$ and $\frac{5}{9}$ have different denominators, rewrite $\frac{5}{3}$ with the denominator 9:

$$= \quad \frac{5}{3} \quad \overset{\times 3}{=} \quad \frac{15}{9} \quad =$$

This ensures the fractions have the same denominator.

- $$\frac{5}{3} - \frac{5}{9} = \frac{15}{9} - \frac{5}{9}$$
$$= \frac{15 - 5}{9}$$
$$= \frac{10}{9}$$

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

Ex 100:

$$\frac{7}{2} - \frac{7}{4} = \frac{\boxed{7}}{\boxed{2}} - \frac{\boxed{7}}{\boxed{4}}$$
$$= \frac{\boxed{7}}{\boxed{4}}$$

Answer:

- Since $\frac{7}{2}$ and $\frac{7}{4}$ have different denominators, rewrite $\frac{7}{2}$ with the denominator 4:
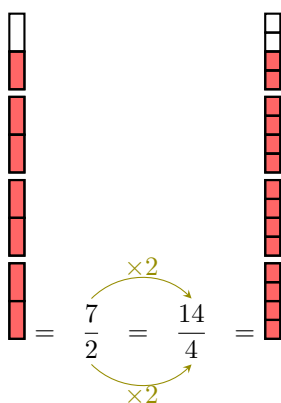
$$= \frac{7}{2} \overset{\times 2}{\underset{\times 2}{=}} \frac{14}{4} =$$

This ensures the fractions have the same denominator.

- $$\frac{7}{2} - \frac{7}{4} = \frac{14}{4} - \frac{7}{4}$$
$$= \frac{14 - 7}{4}$$
$$= \frac{7}{4}$$

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

H.3 SOLVING REAL-WORLD PROBLEMS

Ex 101: Louis has a whole cake. He cuts it into 8 equal slices and eats 3 slices. What fraction of the whole cake remains?

$$\boxed{\frac{5}{8}} \text{ of the cake}$$

Answer:

- **Represent the cake as a fraction**
  The whole cake is divided into 8 slices, so the whole cake is $\frac{8}{8}$.

- **Subtract the slices eaten by Louis**
  Louis eats 3 slices, which is $\frac{3}{8}$ of the cake. Remaining cake after Louis eats:
  $$\frac{8}{8} - \frac{3}{8} = \frac{5}{8}.$$

- **Final Answer:**
  The fraction of the cake that remains is $\frac{5}{8}$.

Ex 102: Today, Louis eats $\frac{1}{2}$ of a croissant. Then, Louis eats $\frac{1}{4}$ of another croissant. How much croissant did Louis eat in total?

$$\boxed{\frac{3}{4}} \text{ of a croissant}$$

Answer:

- **Represent the croissants as fractions**
  Louis eats $\frac{1}{2}$ of the first croissant and $\frac{1}{4}$ of the second croissant. To find the total, add the two fractions:
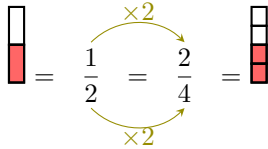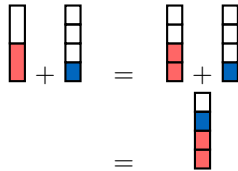
  $$\frac{1}{2} + \frac{1}{4}.$$

- **Find a common denominator**
  The denominators are 2 and 4. The least common denominator is 4. Convert $\frac{1}{2}$ to a fraction with denominator 4:

- **Add the fractions**

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

- **Final Answer:**
  Louis ate a total of $\frac{3}{4}$ of a croissant.

Ex 103: At the beginning, there are $\frac{5}{6}$ of a cake. After eating, there are $\frac{2}{3}$ of the cake. What quantity of cake did Louis eat?

$$\frac{\boxed{1}}{\boxed{6}} \text{ of the cake}$$
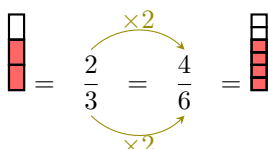
Answer:

- **Represent the cake as fractions**
  At the beginning, there is $\frac{5}{6}$ of the cake. After eating, $\frac{2}{3}$ of the cake remains. To find the quantity Louis ate, subtract the remaining cake from the initial amount:
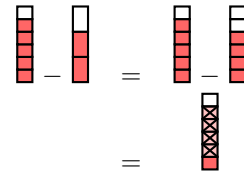
  $$\frac{5}{6} - \frac{2}{3}.$$

- **Find a common denominator**
  The denominators are 6 and 3. The least common denominator is 6. Convert $\frac{2}{3}$ to a fraction with denominator 6:

- **Subtract the fractions**

  $$\frac{5}{6} - \frac{2}{3} = \frac{5}{6} - \frac{4}{6}$$
  $$= \frac{1}{6}$$

- **Final Answer:**
  Louis ate $\frac{1}{6}$ of the cake.

Ex 104: At the beginning, there are $\frac{7}{8}$ of a pizza. After eating, there are $\frac{3}{4}$ of the pizza. What quantity of pizza did Louis eat?

$$\frac{\boxed{1}}{\boxed{8}} \text{ of the pizza}$$

Answer:

- **Represent the pizza as fractions**
  At the beginning, there is $\frac{7}{8}$ of the pizza. After eating, $\frac{3}{4}$ of the pizza remains. To find the quantity Louis ate, subtract the remaining pizza from the initial amount:

  $$\frac{7}{8} - \frac{3}{4}.$$

- **Find a common denominator**
  The denominators are 8 and 4. The least common denominator is 8. Convert $\frac{3}{4}$ to a fraction with denominator 8:
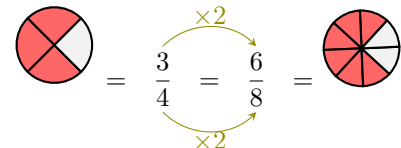
- **Subtract the fractions**

  $$\frac{7}{8} - \frac{3}{4} = \frac{7}{8} - \frac{6}{8}$$
  $$= \frac{1}{8}$$

- **Final Answer:**
  Louis ate $\frac{1}{8}$ of the pizza.

Ex 105: Louis read $\frac{2}{5}$ of his book on Saturday and $\frac{3}{10}$ of his book on Sunday. How much of his book did Louis read in total?

$$\frac{\boxed{7}}{\boxed{10}} \text{ of the book}$$

Answer:

- **Represent the book as fractions**
  Louis read $\frac{2}{5}$ of the book on Saturday and $\frac{3}{10}$ of the book on Sunday. To find the total, add the two fractions:
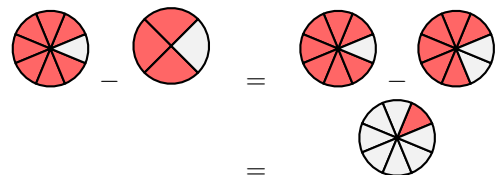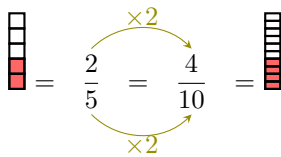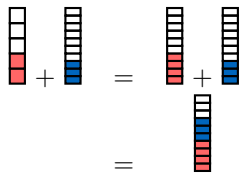
  $$\frac{2}{5} + \frac{3}{10}.$$

- **Find a common denominator**
  The denominators are 5 and 10. The least common denominator is 10. Convert $\frac{2}{5}$ to a fraction with denominator 10:

  $$= \frac{2}{5} \xrightarrow{\times 2} = \frac{4}{10} =$$

- **Add the fractions**

  $$\frac{2}{5} + \frac{3}{10} = \frac{4}{10} + \frac{3}{10}$$
  $$= \frac{7}{10}$$

- **Final Answer:**
  Louis read a total of $\frac{7}{10}$ of his book.

H.4 ADDING FRACTIONS WITH UNLIKE DENOMINATORS

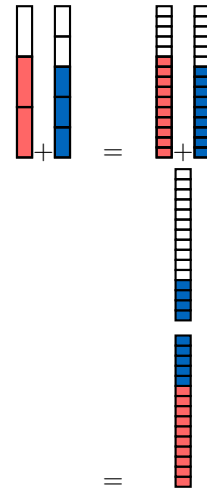**Ex 106:** Calculate and simplify:

$$\frac{2}{3} + \frac{3}{5} = \frac{\boxed{19}}{\boxed{15}}$$

Answer:

- **Find a common denominator:** To add fractions, they must have the same denominator.

  - Multiples of 3: 3, 6, 9, 12, **15**, . . .
  - Multiples of 5: 5, 10, **15**, 20, . . .
  - The smallest common denominator is **15**.

-
  $$\frac{2}{3} + \frac{3}{5} = \frac{2 \times 5}{3 \times 5} + \frac{3 \times 3}{5 \times 3}$$
  $$= \frac{10}{15} + \frac{9}{15} \quad \text{(common denominator = 15)}$$
  $$= \frac{10 + 9}{15}$$
  $$= \frac{19}{15}$$

- **Visual representation:**

Ex 107: Calculate and simplify:

$$\frac{1}{2} + \frac{2}{3} = \frac{\boxed{7}}{\boxed{6}}$$

Answer:

- **Find a common denominator:** To add fractions, they must have the same denominator.

  - Multiples of 2: 2, 4, **6**, 8, 10, . . .
  - Multiples of 3: 3, **6**, 9, 12, . . .
  - The smallest common denominator is **6**.

- $\frac{1}{2} + \frac{2}{3} = \frac{1 \times 3}{2 \times 3} + \frac{2 \times 2}{3 \times 2}$
  $$= \frac{3}{6} + \frac{4}{6} \qquad \text{(common denominator = 6)}$$
  $$= \frac{3 + 4}{6} \qquad \text{(adding numerators)}$$
  $$= \frac{7}{6}$$

- **Visual representation:**

Ex 108: Calculate and simplify:

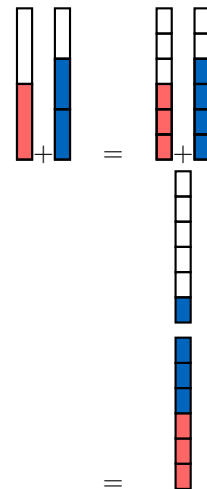$$\frac{3}{2} + \frac{4}{5} = \frac{\boxed{23}}{\boxed{10}}$$
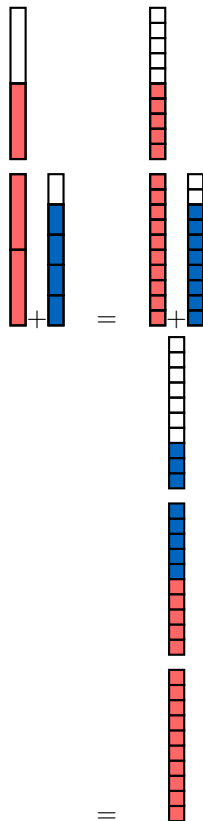
Answer:

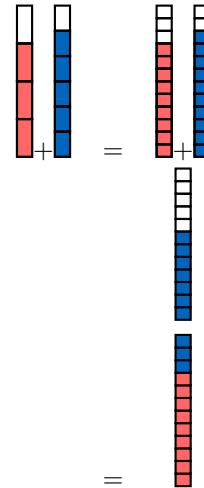- **Find a common denominator**: To add fractions, they must have the same denominator.
  - Multiples of 2: 2, 4, 6, 8, **10**, ...
  - Multiples of 5: 5, **10**, 15, ...
  - The smallest common denominator is **10**.

-
$$\frac{3}{2} + \frac{4}{5} = \frac{3 \times 5}{2 \times 5} + \frac{4 \times 2}{5 \times 2}$$
$$= \frac{15}{10} + \frac{8}{10} \quad \text{(common denominator = 10)}$$
$$= \frac{15 + 8}{10}$$
$$= \frac{23}{10}.$$

- **Visual representation**:

Ex 109: Calculate and simplify:
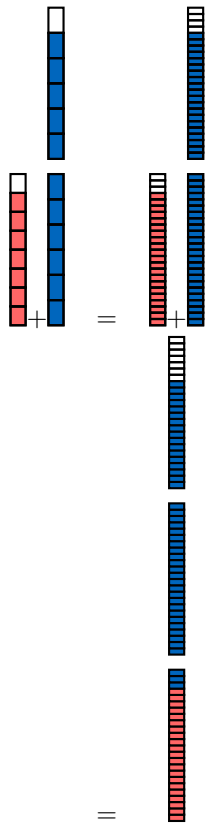$$\frac{3}{4} + \frac{5}{6} = \boxed{\frac{\boxed{19}}{\boxed{12}}}$$

Answer:

- **Find a common denominator**: To add fractions, they must have the same denominator.
  - Multiples of 4: 4, 8, **12**, 16, 20, ...
  - Multiples of 6: 6, **12**, 18, 24, ...
  - The smallest common denominator is **12**.

-
$$\frac{3}{4} + \frac{5}{6} = \frac{3 \times 3}{4 \times 3} + \frac{5 \times 2}{6 \times 2}$$
$$= \frac{9}{12} + \frac{10}{12} \quad \text{(common denominator = 12)}$$
$$= \frac{9 + 10}{12} \quad \text{(adding numerators)}$$
$$= \frac{19}{12}$$

- **Visual representation**:

Ex 110: Calculate and simplify:
$$\frac{7}{8} + \frac{11}{6} = \boxed{\frac{\boxed{65}}{\boxed{24}}}$$

Answer:

- **Find a common denominator**: To add fractions, they must have the same denominator.

  - Multiples of 8: 8, 16, **24**, 32, ...

  - Multiples of 6: 6, 12, 18, **24**, 30, ...

  - The smallest common denominator is **24**.

-
$$\frac{7}{8} + \frac{11}{6} = \frac{7 \times 3}{8 \times 3} + \frac{11 \times 4}{6 \times 4}$$
$$= \frac{21}{24} + \frac{44}{24} \quad \text{(common denominator = 24)}$$
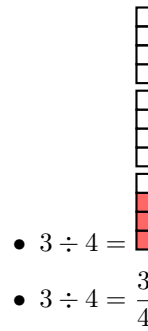$$= \frac{21 + 44}{24}$$
$$= \frac{65}{24}$$

- **Visual representation**:

$$+ = +$$

$$=$$

I FRACTION AS QUOTIENT

I.1 CONVERTING DIVISION TO FRACTIONS

Ex 111: Write as a fraction:

$$3 \div 2 = \frac{\boxed{3}}{\boxed{2}}$$

Answer:

- $3 \div 2 =$
- $3 \div 2 = \dfrac{3}{2}$

Ex 112: Write as a fraction:

$$2 \div 5 = \frac{\boxed{2}}{\boxed{5}}$$

Answer:

- $2 \div 5 =$
- $2 \div 5 = \dfrac{2}{5}$

Ex 113: Write as a fraction:

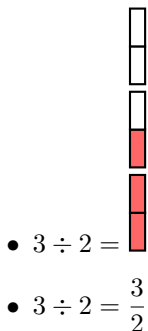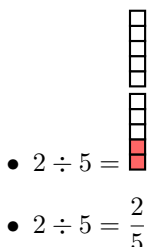$$3 \div 4 = \frac{\boxed{3}}{\boxed{4}}$$

Answer:

- $3 \div 4 =$
- $3 \div 4 = \dfrac{3}{4}$

Ex 114: Write as a fraction:

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

Answer:

- $5 \div 3 =$
- $5 \div 3 = \dfrac{5}{3}$

I.2 CONVERTING FRACTIONS TO DIVISION EXPRESSIONS

Ex 115: Convert the fraction into a division expression:

$$\frac{2}{5} = \boxed{2} \div \boxed{5}$$

Answer: The fraction $\dfrac{2}{5}$ can be written as the division $2 \div 5$.

Ex 116: Convert the fraction into a division expression:

$$\frac{4}{7} = \boxed{4} \div \boxed{7}$$

Answer: The fraction $\dfrac{4}{7}$ can be written as the division $4 \div 7$.

Ex 117: Convert the fraction into a division expression:

$$\frac{3}{8} = \boxed{3} \div \boxed{8}$$

Answer: The fraction $\dfrac{3}{8}$ can be written as the division $3 \div 8$.

Ex 118: Convert the fraction into a division expression:

$$\frac{6}{9} = \boxed{6} \div \boxed{9}$$

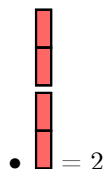*Answer:* The fraction $\dfrac{6}{9}$ can be written as the division $6 \div 9$.

I.3 CONVERTING FRACTIONS TO WHOLE NUMBERS

Ex 119: Convert the fraction into a whole number:

$$\frac{4}{2} = \boxed{2}$$
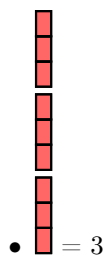
Answer:

- $\frac{4}{2} = 4 \div 2$

  $= 2$

- $\boxed{} = 2$

Ex 120: Convert the fraction into a whole number:

$$\frac{9}{3} = \boxed{3}$$

Answer:

- $\frac{9}{3} = 9 \div 3$

  $= 3$

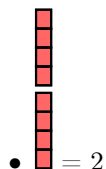- $\boxed{} = 3$

Ex 121: Convert the fraction into a whole number:

$$\frac{8}{4} = \boxed{2}$$

Answer:

- $\frac{8}{4} = 8 \div 4$

  $= 2$

- $\boxed{} = 2$

Ex 122: Convert the fraction into a whole number:

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

Answer:

- $\frac{5}{5} = 5 \div 5$

  $= 1$

- $\boxed{} = 1$

I.4 FINDING FRACTIONS IN WORD PROBLEMS

Ex 123: Four friends share 3 cakes equally. What fraction does each friend get?

$$\frac{\boxed{3}}{\boxed{4}} \text{ of a cake}$$

Answer:

- When you share equally, you divide the 3 cakes by 4 friends:

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

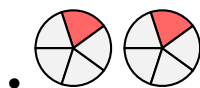- So, each friend gets $\frac{3}{4}$ of a cake.

Ex 124: Five friends share 2 pizzas equally. What fraction does each friend get?

$$\frac{\boxed{2}}{\boxed{5}} \text{ of a pizza}$$

Answer:

- When you share equally, you divide the 2 pizzas by 5 friends:

$$2 \div 5 = \frac{2}{5}$$

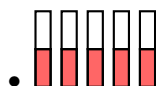- So, each friend gets $\frac{2}{5}$ of a pizza.

Ex 125: A couple shares 5 chocolate bars equally. What fraction of a chocolate bar does each person get?

$$\frac{\boxed{5}}{\boxed{2}} \text{ of a chocolate bar}$$

Answer:

- When you share equally, you divide the 5 chocolate bars by 2 people:

$$5 \div 2 = \frac{5}{2}$$

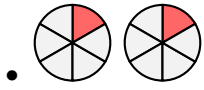- So, each person gets $\frac{5}{2}$ chocolate bars, which is 2 whole bars and half of another one.

Ex 126: Six family members share 2 apple pies equally. What fraction of a pie does each family member get?

$$\frac{\boxed{2}}{\boxed{6}} \text{ of a pie}$$

Answer:

- When you share equally, you divide the 2 apple pies by 6 family members:

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

-

- So, each family member gets $\frac{2}{6}$ of an apple pie.

J FRACTION AS RATIO

J.1 IDENTIFYING FRACTIONS IN REAL-LIFE CONTEXTS

Ex 127:
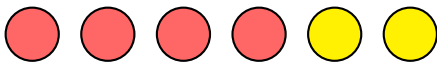
What fraction of the circles are red?

$\boxed{\dfrac{4}{6}}$ of the circles are red.

Answer:

- There are 6 circles.

- 4 of the circles are red.

- $\frac{4}{6}$ of the circles are red.

Ex 128:

What fraction of the squares are blue?

$\boxed{\dfrac{3}{5}}$ of the squares are blue.

Answer:

- There are 5 squares.

- 3 of the squares are blue.

- $\frac{3}{5}$ of the squares are blue.

Ex 129:

What fraction of the children are girls?
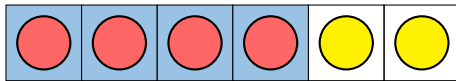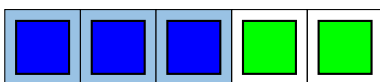
$\boxed{\dfrac{2}{4}}$ of the children are girls.

Answer:

- There are 4 children.

- 2 of the children are girls.

- $\frac{2}{4}$ of the children are girls.

Ex 130:

What fraction of the children raised their hand?

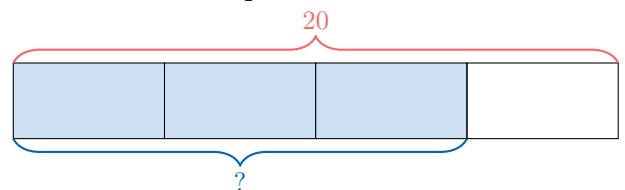$\boxed{\dfrac{1}{4}}$ of the children raised their hand.

Answer:

- There are 4 children.

- 1 of the children raised their hand.

- $\frac{1}{4}$ of the children raised their hand.

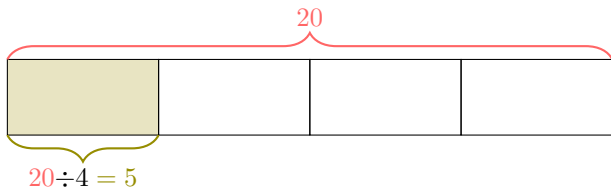## J.2 CALCULATING FRACTIONS OF A WHOLE

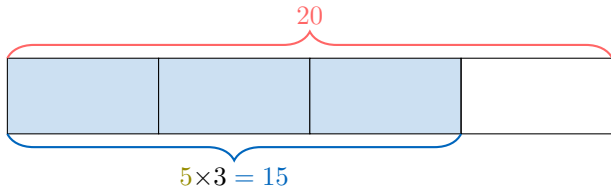**Ex 131:**

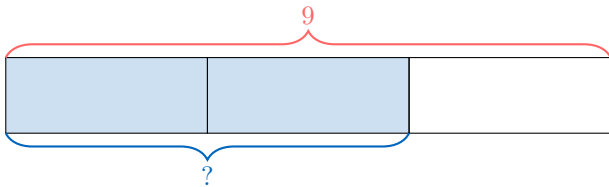$$\frac{3}{4} \text{ of } 20 = \boxed{15}$$

Answer:

- Find the quantity of 1 part:

$$20 \div 4 = 5$$

- Find the quantity of 3 parts:

$$5 \times 3 = 15$$

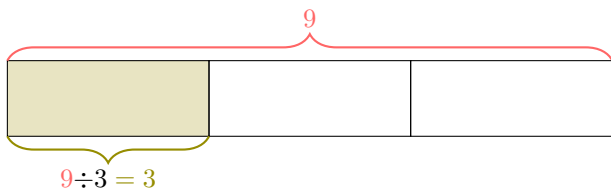- $\dfrac{3}{4}$ of $20 = 15$

Ex 132:

$$\frac{2}{3} \text{ of } 9 = \boxed{6}$$

$?$

Answer:

- Find the quantity of 1 part:

$$9 \div 3 = 3$$

- Find the quantity of 2 parts:

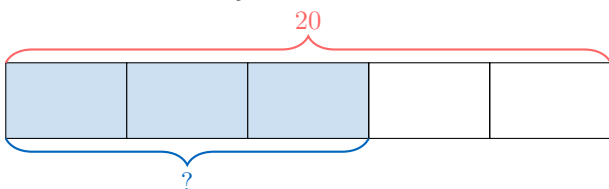$$3 \times 2 = 6$$

- $\dfrac{2}{3}$ of $9 = 6$

Ex 133:

$$\frac{3}{5} \text{ of } 20 = \boxed{12}$$

$?$

Answer:

- Find the quantity of 1 part:

$$20 \div 5 = 4$$

- Find the quantity of 3 parts:

$$4 \times 3 = 12$$
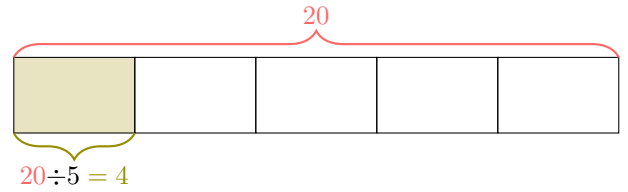
- $\dfrac{3}{5}$ of $20 = 12$

Ex 134:

$$\frac{2}{5} \text{ of } 10 = \boxed{4}$$

$?$

Answer:

- Find the quantity of 1 part:

$$10 \div 5 = 2$$

- Find the quantity of 2 parts:

$$2 \times 2 = 4$$
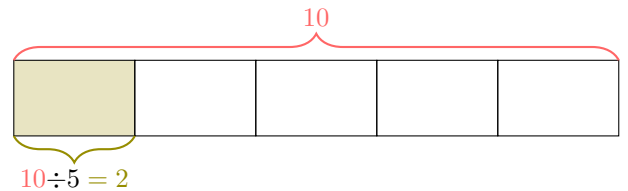
- $\dfrac{2}{5}$ of $10 = 4$

Ex 135:

$$\frac{2}{4} \text{ of } 12 = \boxed{6}$$

$?$

Answer:

- Find the quantity of 1 part:

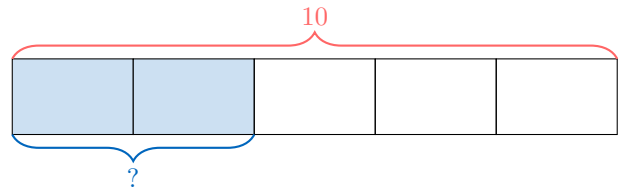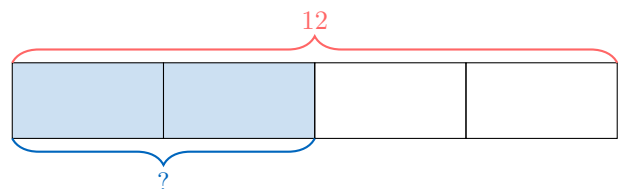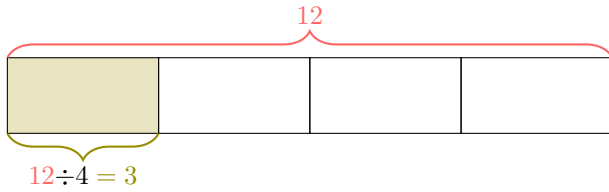$12 \div 4 = 3$

- Find the quantity of 2 parts:

$3 \times 2 = 6$

- $\dfrac{2}{4}$ of $12 = 6$
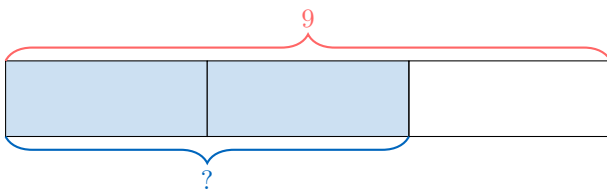
J.3 APPLYING FRACTIONS TO REAL-WORLD PROBLEMS

Ex 136: In a class of 9 students, $\frac{2}{3}$ of the students are girls. How many of the students are girls?

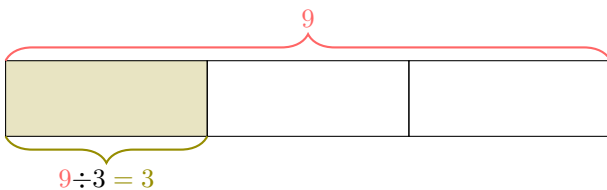$\boxed{6}$ girls

Answer:

- **Method 1** (unitary method):

  – Number of girls $= \dfrac{2}{3}$ of 9

?

  – Find the quantity of 1 part:

$9 \div 3 = 3$

  – Find the quantity of 2 parts:

$3 \times 2 = 6$

  – $\dfrac{2}{3}$ of $9 = 6$

- **Method 2** (calculation using a formula):

$$\text{Number of girls} = \frac{2}{3} \text{ of } 30$$
$$= \frac{2}{3} \times 30$$
$$= (2 \div 3) \times 30$$
$$= 20$$

Ex 137: In a group of 16 fruits, $\dfrac{3}{4}$ of them are apples. How many of the fruits are apples?

$\boxed{12}$ apples

Answer:

- **Method 1** (unitary method):

  – Number of apples $= \dfrac{3}{4}$ of 16

?

  – Find the quantity of 1 part:

$16 \div 4 = 4$

  – Find the quantity of 3 parts:

$4 \times 3 = 12$
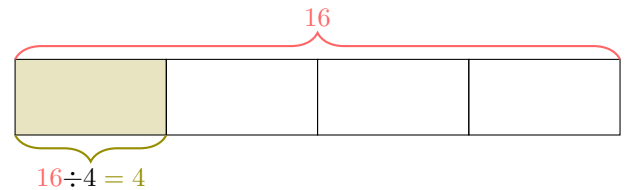
  – $\dfrac{3}{4}$ of $16 = 12$

- **Method 2** (calculation using a formula):

$$\text{Number of apples} = \frac{3}{4} \text{ of } 16$$
$$= \frac{3}{4} \times 16$$
$$= (3 \div 4) \times 16$$
$$= 12$$

Ex 138: In a collection of 15 books, $\dfrac{2}{5}$ of them are novels. How many of the books are novels?

$\boxed{6}$ novels

Answer:
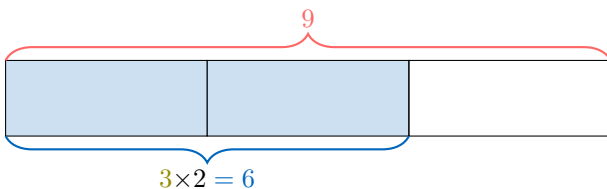
- **Method 1** (unitary method):

– Number of novels $= \dfrac{2}{5}$ of 15

– Find the quantity of 1 part:

– Find the quantity of 2 parts:

– $\dfrac{2}{5}$ of $15 = 6$

• **Method 2** (calculation using a formula):

$$\begin{aligned} \text{Number of novels} &= \dfrac{2}{5} \text{ of } 15 \\ &= \dfrac{2}{5} \times 15 \\ &= (2 \div 5) \times 15 \\ &= 6 \end{aligned}$$
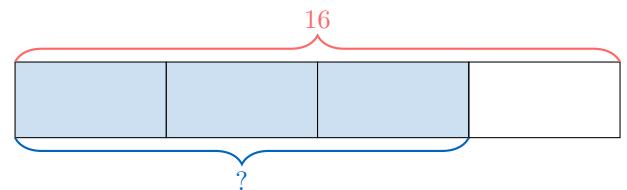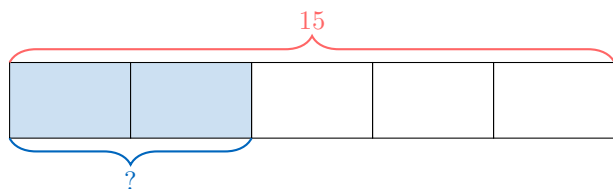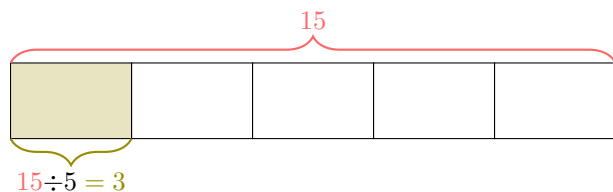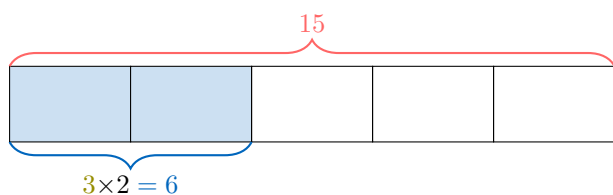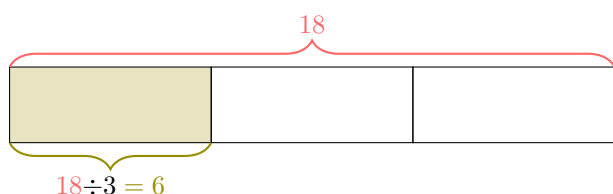
Ex 139: For a refreshing drink recipe, the mixture consists of $\dfrac{1}{3}$ lemon and $\dfrac{2}{3}$ water for a total of 18 cl. How much lemon and water are used in the drink?

$\boxed{6}$ cl of lemon
$\boxed{12}$ cl of water

Answer:

• **Method 1** (unitary method):

– Total volume $= 18$ cl
– Find the quantity of 1 part (which represents the lemon part):

– Find the quantity of 2 parts (which represents the water part):
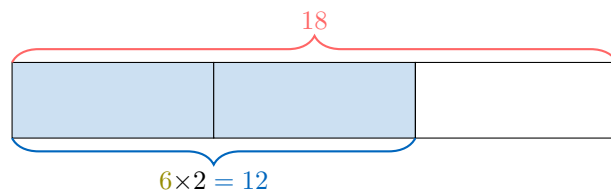
– $\dfrac{1}{3}$ of 18 cl $= 6$ cl of lemon
– $\dfrac{2}{3}$ of 18 cl $= 12$ cl of water

• **Method 2** (calculation using a formula):

$$\begin{aligned} \text{Quantity of lemon} &= \dfrac{1}{3} \text{ of } 18 \\ &= \dfrac{1}{3} \times 18 \\ &= (1 \div 3) \times 18 \\ &= 6 \text{ cl of lemon} \end{aligned}$$

$$\begin{aligned} \text{Quantity of water} &= \dfrac{2}{3} \text{ of } 18 \\ &= \dfrac{2}{3} \times 18 \\ &= (2 \div 3) \times 18 \\ &= 12 \text{ cl of water} \end{aligned}$$

K   FRACTION AS DECIMAL NUMBER

K.1 CONVERTING FRACTIONS TO DECIMALS

Ex 140: Convert to a decimal number:
$$\dfrac{3}{4} = \boxed{0.75}$$

Answer:

• **Division Method**:

$$\begin{aligned} \dfrac{3}{4} &= 3 \div 4 \\ &= 0.75 \end{aligned}$$

$$\begin{array}{r} 0.75 \\ 4\,\overline{)3.00} \\ 2.8 \\ \hline 20 \\ 20 \\ \hline 0 \end{array}$$

• **Power of 10 Denominator Method**:

$$\begin{aligned} \dfrac{3}{4} &= \dfrac{3\times25}{4\times25} \\ &= \dfrac{75}{100} \\ &= 75 \div 100 \\ &= 0.75 \end{aligned}$$

Ex 141: Convert to a decimal number:
$$\dfrac{2}{5} = \boxed{0.4}$$

Answer:

- **Division Method**:

$$\frac{2}{5} = 2 \div 5$$
$$= 0.4$$

$$\begin{array}{r} 0.4 \\ 5\,)\overline{2.0} \\ \underline{2.0} \\ 0 \end{array}$$

- **Power of 10 Denominator Method**:

$$\frac{2}{5} = \frac{2\times 2}{5\times 2}$$
$$= \frac{4}{10}$$
$$= 4 \div 10$$
$$= 0.4$$

Ex 142: Convert to a decimal number:

$$\frac{3}{20} = \boxed{0.15}$$

Answer:

- **Division Method**:

$$\frac{3}{20} = 3 \div 20$$
$$= 0.15$$

$$\begin{array}{r} 0.15 \\ 20\,)\overline{3.00} \\ \underline{2.0} \\ 1.00 \\ \underline{1.00} \\ 0 \end{array}$$

- **Power of 10 Denominator Method**:

$$\frac{3}{20} = \frac{3\times 5}{20\times 5}$$
$$= \frac{15}{100}$$
$$= 15 \div 100$$
$$= 0.15$$

Ex 143: Convert to a decimal number:

$$\frac{40}{50} = \boxed{0.8}$$

Answer:

- **Division Method**:

$$\frac{40}{50} = 40 \div 50$$
$$= 0.8$$

$$\begin{array}{r} 0.8 \\ 50\,)\overline{40.0} \\ \underline{40.0} \\ 0 \end{array}$$

- **Power of 10 Denominator Method**:

$$\frac{40}{50} = \frac{40\times 2}{50\times 2}$$
$$= \frac{80}{100}$$
$$= 80 \div 100$$
$$= 0.8$$

K.2 CONVERTING DECIMALS TO FRACTIONS

Ex 144: Convert to a fraction:

$$1.3 = \frac{\boxed{13}}{\boxed{10}}$$

Answer:

$$1.3 = \frac{1.3 \times 10}{10}$$
$$= \frac{13}{10}$$

Ex 145: Convert 0.3 to a fraction:

$$0.3 = \frac{\boxed{3}}{\boxed{10}}$$

Answer:

$$0.3 = \frac{0.3 \times 10}{10}$$
$$= \frac{3}{10}$$

Ex 146: Convert 10.7 to a fraction:

$$10.7 = \frac{\boxed{107}}{\boxed{10}}$$

Answer:

$$10.7 = \frac{10.7 \times 10}{10}$$
$$= \frac{107}{10}$$

Ex 147: Convert 0.99 to a fraction:

$$0.99 = \frac{\boxed{99}}{\boxed{100}}$$

Answer:

$$0.99 = \frac{0.99 \times 100}{100}$$
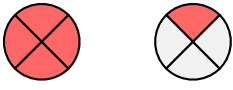$$= \frac{99}{100}$$

L PROPER AND IMPROPER FRACTIONS

L.1 SOLVING REAL-WORLD PROBLEMS

Ex 148: I eat $\dfrac{5}{2}$ of a pain au chocolat:▮.

So I eat $\boxed{2}$ whole pains au chocolat and $\boxed{\dfrac{1}{2}}$ of another pain au chocolat.

Answer: $\dfrac{5}{2} = \dfrac{2 \times 2 + 1}{2}$ (division by 2: $5 = 2 \times 2 + 1$)

$\qquad = \dfrac{2 \times \cancel{2}}{\cancel{2}} + \dfrac{1}{2}$

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

Ex 149: I eat $\dfrac{5}{4}$ of a pizza: ⊗ ⊗.

So I eat $\boxed{1}$ whole pizza and $\boxed{\dfrac{1}{4}}$ of another pizza.

Answer: $\dfrac{5}{4} = \dfrac{1 \times 4 + 1}{4}$ (division by 4: $5 = 1 \times 4 + 1$)

$\qquad = \dfrac{1 \times \cancel{4}}{\cancel{4}} + \dfrac{1}{4}$

$\qquad = 1 + \dfrac{1}{4}$

Ex 150: I have $\dfrac{8}{6}$ of a ribbon:▮.

So I have $\boxed{1}$ whole ribbon and $\boxed{\dfrac{2}{6}}$ of another ribbon.

Answer: $\dfrac{8}{6} = \dfrac{1 \times 6 + 2}{6}$ (division by 6: $8 = 1 \times 6 + 2$)

$\qquad = \dfrac{1 \times \cancel{6}}{\cancel{6}} + \dfrac{2}{6}$
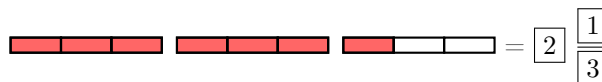
$\qquad = 1 + \dfrac{2}{6}$

$\qquad = 1\dfrac{2}{6}$

Ex 151: I have $\dfrac{10}{3}$ of a wood plank:▮.

So I have $\boxed{3}$ whole wood planks and $\boxed{\dfrac{1}{3}}$ of another wood plank.

Answer: $\dfrac{10}{3} = \dfrac{3 \times 3 + 1}{3}$ (division by 3: $10 = 3 \times 3 + 1$)

$\qquad = \dfrac{3 \times \cancel{3}}{\cancel{3}} + \dfrac{1}{3}$

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

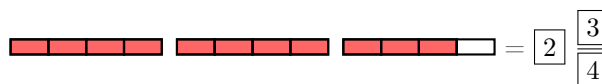$\qquad = 3\dfrac{1}{3}$

L.2 FINDING MIXED NUMBERS FROM BAR MODELS

Ex 152: Write the mixed number shown in the diagram:

$= \boxed{2}\,\boxed{\dfrac{1}{3}}$

Answer:

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

Ex 153: Write the mixed number shown in the diagram:

$= \boxed{2}\,\boxed{\dfrac{3}{4}}$

Answer:

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

Ex 154: Write the mixed number shown in the diagram:

$= \boxed{4}\,\boxed{\dfrac{1}{2}}$
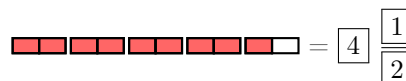
Answer:

- $= 4 + \dfrac{1}{2} = 4\dfrac{1}{2}$

Ex 155: Write the mixed number shown in the diagram:

$= \boxed{3}\,\boxed{\dfrac{3}{4}}$
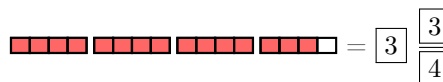
Answer:

- $= 3 + \dfrac{3}{4} = 3\dfrac{3}{4}$

Ex 156: Write the mixed number shown in the diagram:

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

Answer:

- $= 4 + \dfrac{2}{5} = 4\dfrac{2}{5}$
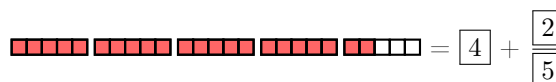
L.3 FINDING FRACTIONS FROM MIXED NUMBERS

Ex 157: Convert into improper fraction:

$$2\frac{1}{3} = \frac{\boxed{7}}{\boxed{3}}$$

Answer:

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

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

  $= \frac{6}{3} + \frac{1}{3}$

  $= \frac{7}{3}$

-

Ex 158: Convert into an improper fraction:

$$3\frac{2}{5} = \frac{\boxed{17}}{\boxed{5}}$$

Answer:

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

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

  $= \frac{15}{5} + \frac{2}{5}$

  $= \frac{17}{5}$

-

Ex 159: Convert into an improper fraction:

$$2\frac{3}{4} = \frac{\boxed{11}}{\boxed{4}}$$

Answer:

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

  $= \frac{2{\times}4}{1{\times}4} + \frac{3}{4} \quad \left(2 = \frac{2}{1}\right)$

  $= \frac{8}{4} + \frac{3}{4}$

  $= \frac{11}{4}$

-

Ex 160: Convert into an improper fraction:

$$4\frac{1}{2} = \frac{\boxed{9}}{\boxed{2}}$$

Answer:

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

  $= \frac{4{\times}2}{1{\times}2} + \frac{1}{2} \quad \left(4 = \frac{4}{1}\right)$

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

  $= \frac{9}{2}$

-

L.4 FINDING MIXED NUMBERS FROM FRACTIONS

Ex 161: Convert into mixed number:

$$\frac{3}{2} = \boxed{1}\,\frac{\boxed{1}}{\boxed{2}}$$

Answer:

- $\frac{3}{2} = \frac{1 \times 2 + 1}{2}$ (division of 3 by 2: $3 = 1 \times 2 + 1$)

  $= \frac{1 \times \cancel{2}}{\cancel{2}} + \frac{1}{2}$

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

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

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

Ex 162: Convert into a mixed number:

$$\frac{7}{3} = \boxed{2}\,\frac{\boxed{1}}{\boxed{3}}$$

Answer:

- $\frac{7}{3} = \frac{2 \times 3 + 1}{3}$ (division of 7 by 3: $7 = 2 \times 3 + 1$)

  $= \frac{2 \times \cancel{3}}{\cancel{3}} + \frac{1}{3}$

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

  $= 2\frac{1}{3}$

- $\frac{7}{3} =$ $= 2 + \frac{1}{3} = 2\frac{1}{3}$

Ex 163: Convert into a mixed number:

$$\frac{9}{2} = \boxed{4}\,\frac{\boxed{1}}{\boxed{2}}$$

Answer:

- $\frac{9}{2} = \frac{4 \times 2 + 1}{2}$ (division of 9 by 2: $9 = 4 \times 2 + 1$)

  $= \frac{4 \times \cancel{2}}{\cancel{2}} + \frac{1}{2}$

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

  $= 4\frac{1}{2}$

- $\frac{9}{2} =$ $= 4 + \frac{1}{2} = 4\frac{1}{2}$

Ex 164: Convert into a mixed number:

$$\frac{13}{5} = \boxed{2}\,\frac{\boxed{3}}{\boxed{5}}$$

Answer:

- $\dfrac{13}{5} = \dfrac{2 \times 5 + 3}{5}$ (division of 13 by 5: $13 = 2 \times 5 + 3$)

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

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

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

- $\dfrac{13}{5} =$ $= 2 + \dfrac{3}{5} = 2\dfrac{3}{5}$