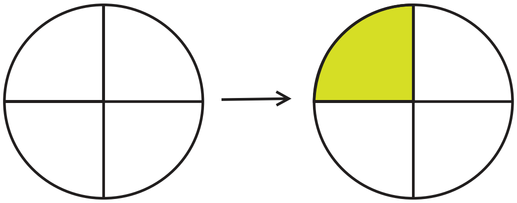
CHAPTER 5: FRACTIONS

5.1 Understanding fractions

Look at the circle.

It is divided into 4 equal parts.
1 part out of the 4 is coloured.



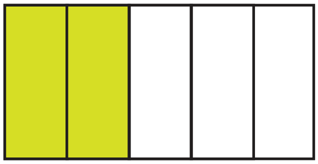
$= \frac{1}{4}$

We say that $\frac{1}{4}$ of the circle is coloured.

$\frac{1}{4}$ is an example of a fraction.

A fraction represents a part of a whole that is divided into equal parts.

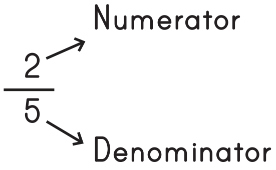
Look at the rectangle.



2 parts out of 5 are coloured.

$\frac{2}{5}$ of the rectangle is coloured.

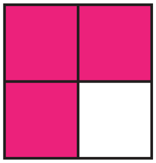
A fraction has two parts.



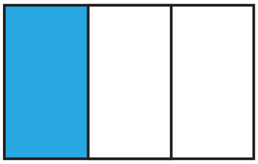
Numerator shows the number of equal parts of a whole that are taken.

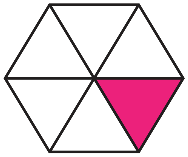
Denominator shows the number of equal parts the whole is divided into.

Look at the total number of parts and the coloured parts of the following shapes and write the correct fraction under each shape.



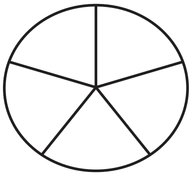
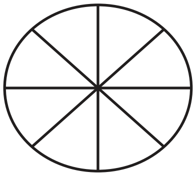
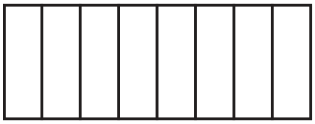
$\frac{3}{4}$



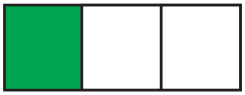
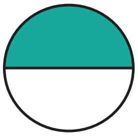
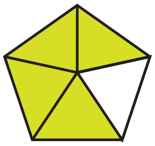
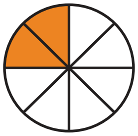
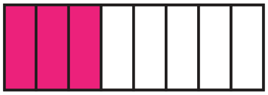


Exercise 5.1

1. Colour the shapes according to the given fractions.

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

2. Match the fraction with the related shape.

$\frac{3}{8}$	
$\frac{1}{3}$	
$\frac{2}{8}$	
$\frac{4}{5}$	
$\frac{1}{2}$	

REMEMBER

Fraction: represents a part of a whole that is divided into equal parts.

Numerator: the top number in a fraction that shows the number of equal parts of a whole that are taken.

Denominator: the bottom number in a fraction that shows the number of equal parts the whole is divided into.

5.2 Like and unlike fractions

Ahmad's mother bought two similar cakes.

She cut first cake in 8 equal pieces and took 1 piece out.

She took $\frac{1}{8}$ of the first cake.

She cut second cake in 8 equal pieces and took 3 pieces

She took $\frac{3}{8}$ of the second cake.

Since, both cakes were cut into equal sized pieces, denominator is same for both fractions. We call such fractions like fractions.

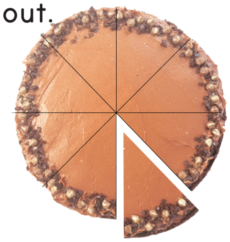
$\frac{1}{8}$ and $\frac{3}{8}$ are like fractions.

> Like fractions result in equal sized pieces of the whole. Like fractions are the fractions which have same denominators.

Anam's mother bought two similar cakes.

She cut first cake in 6 equal pieces and took 1 piece out.

She took $\frac{1}{6}$ of the first cake.



She cut second cake in 8 equal pieces and took 1 piece out.

She took $\frac{1}{8}$ of the second cake.

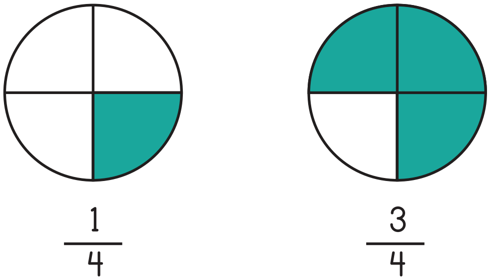
Since, both cakes were cut into different sized pieces, denominator is different for both fractions.

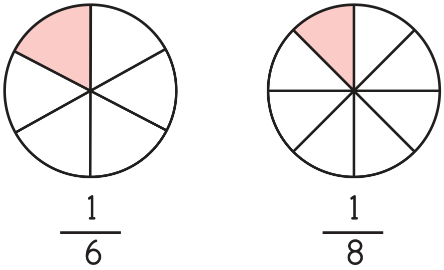
We call such fractions unlike fractions. $\frac{1}{6}$ and $\frac{1}{8}$ are unlike fractions.

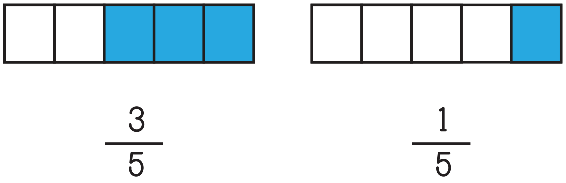
> Unlike fractions result in unequal sized pieces of the whole. Unlike fractions are the fractions which have different denominators.

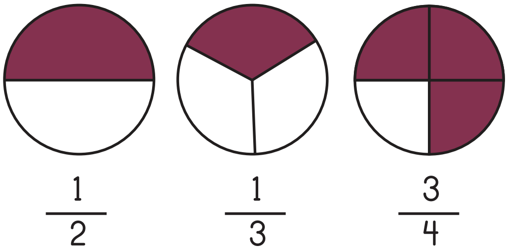
Exercise 5.2

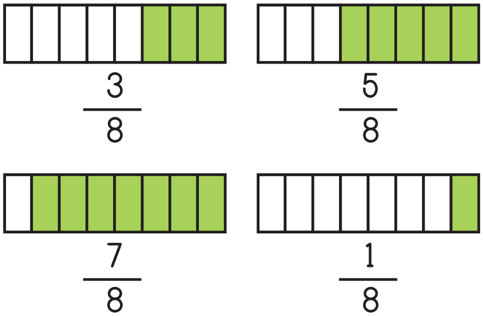
1. Which of the following sets show like fractions?

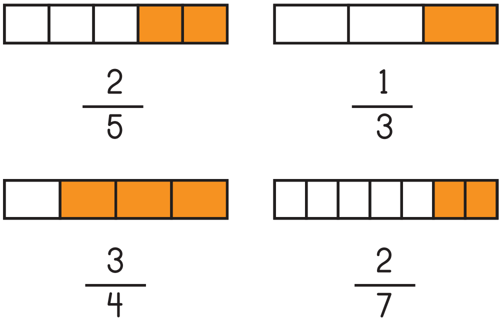

$\frac{1}{4}$ $\frac{3}{4}$


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


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


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


$\frac{3}{8}$ $\frac{5}{8}$ $\frac{7}{8}$ $\frac{1}{8}$


$\frac{2}{5}$ $\frac{1}{3}$ $\frac{3}{4}$ $\frac{2}{7}$

2. Circle like fractions in each of the following sets.

a) [✓ $\frac{1}{4}$] [✓ $\frac{3}{4}$] $\frac{5}{7}$ $\frac{8}{9}$

b) $\frac{1}{3}$ $\frac{2}{3}$ $\frac{3}{7}$ $\frac{1}{9}$

c) $\frac{7}{8}$ $\frac{2}{3}$ $\frac{5}{8}$ $\frac{1}{4}$

d) $\frac{1}{9}$ $\frac{5}{6}$ $\frac{4}{9}$ $\frac{2}{9}$

e) $\frac{5}{7}$ $\frac{1}{7}$ $\frac{2}{9}$ $\frac{3}{7}$

f) $\frac{1}{6}$ $\frac{3}{5}$ $\frac{4}{7}$ $\frac{5}{6}$

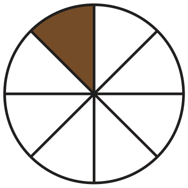
5.3 Comparing and ordering like fractions

Comparing like fractions

Look at the circle.

Sara colours 1 part out of 8.

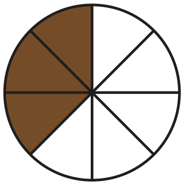
She colours $\frac{1}{8}$ of the circle.



$\frac{1}{8}$

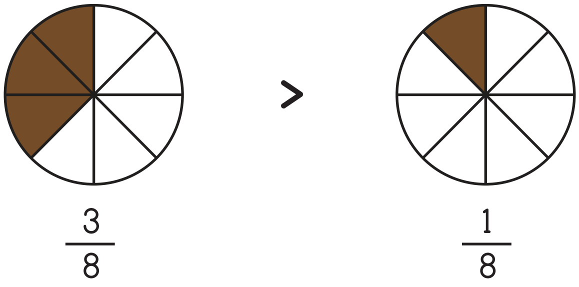
Ahmed colours 3 parts out of 8.

He colours $\frac{3}{8}$ of the circle.



$\frac{3}{8}$

Each part is of the same size. So, 3 parts out of 8 is greater than 1 part out of 8.



$\frac{3}{8}$ is greater than $\frac{1}{8}$.

When comparing fractions with the same denominators, fraction with the greater numerator is the greater fraction.

Compare the fractions using symbols of “<” or “>”.

$\frac{1}{5} \square \frac{4}{5}$

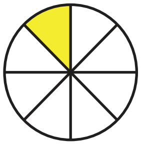
$\frac{5}{7} \square \frac{1}{7}$

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

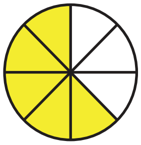
Ordering like fractions

Ali, Ahmad and Sara bought a cake. Ali ate $\frac{1}{8}$ of the cake, Ahmad ate $\frac{5}{8}$ of it and Sara ate $\frac{2}{8}$ of it. Who ate the most cake?

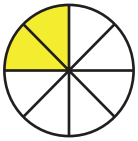
$\frac{1}{8}$



$\frac{5}{8}$



$\frac{2}{8}$



Denominators are same for all fractions. So, we will compare the numerators.

5 is greater than 1 and 2. So, $\frac{5}{8}$ is the greatest fraction.

Ahmed ate the most cake.

Let's arrange these fractions in ascending order.

Write the smallest fraction first and the greatest fraction at the end.

$$\underrightarrow{\boxed{\frac{1}{8}} \qquad \boxed{\frac{2}{8}} \qquad \boxed{\frac{5}{8}}}$$

Recall if you write the smallest number first and the greatest number at the end, it is called ascending order.

Arrange $\frac{1}{7}$, $\frac{3}{7}$ and $\frac{2}{7}$ in descending order.

$\frac{3}{7}$ is the greatest fraction. We will write it first. $\frac{1}{7}$ is the smallest fraction. We will write it at the end.

$$\underleftarrow{\boxed{\frac{3}{7}} \qquad \boxed{\frac{2}{7}} \qquad \boxed{\frac{1}{7}}}$$

Recall if you write the greatest number first and the smallest number at the end, it is called descending order.

Arrange the following fractions in ascending order:

$\frac{1}{5}$ $\frac{4}{5}$ $\frac{3}{5}$ ______________________

Arrange the following fractions in descending order:

$\frac{1}{9}$ $\frac{7}{9}$ $\frac{4}{9}$ ______________________

Exercise 5.3

1. Compare the fractions using symbols of "<" or ">".

a) $\frac{1}{8} \; \square \; \frac{5}{8}$ b) $\frac{5}{9} \; \square \; \frac{2}{9}$ c) $\frac{2}{7} \; \square \; \frac{3}{7}$

d) $\frac{7}{8} \; \square \; \frac{3}{8}$ e) $\frac{1}{5} \; \square \; \frac{2}{5}$ f) $\frac{6}{7} \; \square \; \frac{4}{7}$

2. Arrange the following fractions in ascending order:

a) $\frac{3}{5} \quad \frac{1}{5} \quad \frac{2}{5}$ ____________________

b) $\frac{2}{7} \quad \frac{4}{7} \quad \frac{3}{7}$ ____________________

c) $\frac{5}{9} \quad \frac{2}{9} \quad \frac{1}{9}$ ____________________

3. Arrange the following fractions in descending order:

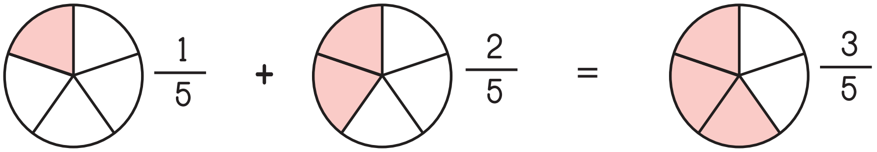
a) $\frac{1}{8} \quad \frac{5}{8} \quad \frac{3}{8}$ ____________________

b) $\frac{2}{5} \quad \frac{4}{5} \quad \frac{1}{5}$ ____________________

c) $\frac{7}{13} \quad \frac{5}{13} \quad \frac{3}{13}$ ____________________

5.4 Addition and subtraction of like fractions

Ahmed ate $\frac{1}{5}$ of a cake. Sara ate $\frac{2}{5}$ of a cake. How much did they eat altogether?



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

Both fractions show that the cakes are divided into same number of equal sized pieces. So, we can simply add 2 and 1.

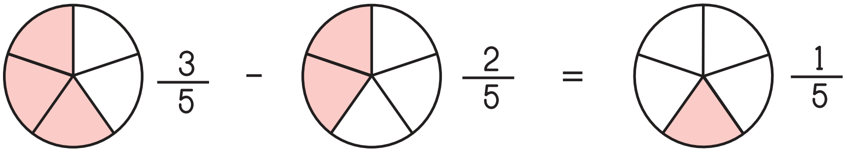
> To add the fractions with same denominators, we simply add the numerators and put it over the same denominator.

So, $\frac{1}{5} + \frac{2}{5} = \frac{1+2}{5} = \frac{3}{5}$

Ahmed and Sara ate $\frac{3}{5}$ of the cake.

Ali colours $\frac{3}{5}$ of a circle. He then erases $\frac{2}{5}$ of it.
How much fraction of the circle is left coloured?

Let's subtract $\frac{2}{5}$ from $\frac{3}{5}$



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

Both fractions show that the circles are divided into same number of equal sized parts. So, we can simply subtract 2 from 3.

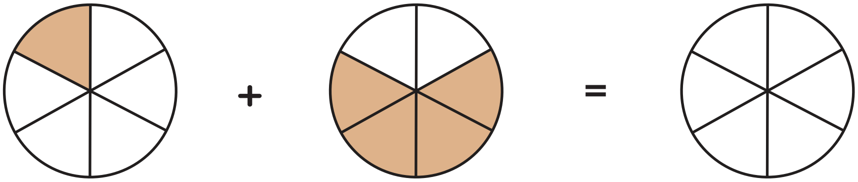
> To subtract the fractions with same denominators, we simply subtract the numerators and put it over the same denominator.

So, $\frac{3}{5} - \frac{2}{5} = \frac{3-2}{5} = \frac{1}{5}$

$\frac{1}{5}$ of the circle is left coloured.

Exercise 5.4

1. Add the fractions and colour the figure.



$\frac{1}{6}$ $\frac{4}{6}$ $\frac{}{6}$

2. Find sum of the following fractions:

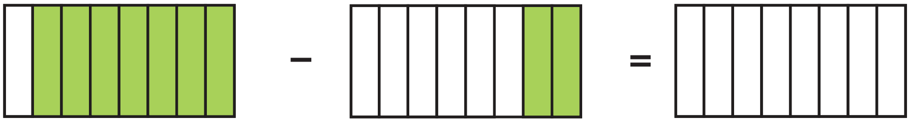
a) $\frac{3}{5} + \frac{1}{5} = \boxed{}$

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

c) $\frac{2}{9} + \frac{5}{9} = \boxed{}$

d) $\frac{3}{8} + \frac{4}{8} = \boxed{}$

3. Subtract the fractions and colour the figure:



$\frac{7}{8}$ $\frac{2}{8}$ $\frac{}{8}$

4. Find the difference between the following fractions.

a) $\frac{2}{3} - \frac{1}{3} = \boxed{}$

b) $\frac{2}{6} - \frac{1}{6} = \boxed{}$

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

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

5.5 Multiplying whole number with fraction

Recall that if we multiply any number by 1, we get the same number.

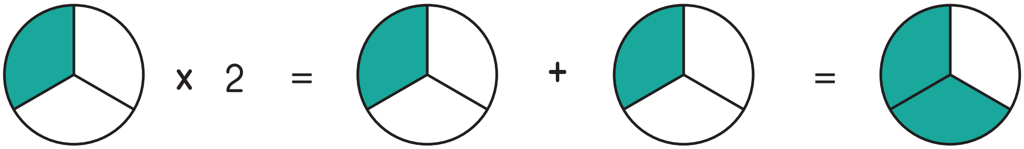
$1 \times 3 = 3$, $5 \times 1 = 5$ etc.

Similarly, if we multiply any fraction by 1, we get the same fraction.

$\frac{1}{2} \times 1 = \frac{1}{2}$, $\frac{3}{5} \times 1 = \frac{3}{5}$ and $\frac{5}{7} \times 1 = \frac{5}{7}$

Let's multiply $\frac{1}{3}$ by 2.

We know that multiplication is repeated addition. So, we will add $\frac{1}{3}$ two times.



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

So, $\frac{1}{3} \times 2 = \frac{2}{3}$

Let's find $\frac{2}{7} \times 3$.

We will add $\frac{2}{7}$ three times.

$$\frac{2}{7} + \frac{2}{7} + \frac{2}{7} = \frac{2+2+2}{7} = \frac{6}{7}$$

Complete the following:

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

$$\frac{2}{11} \times 5 = \boxed{} + \boxed{} + \boxed{} + \boxed{} + \boxed{} = \boxed{}$$

We have learnt to calculate the product using repeated addition.

$$\frac{2}{7} \times 3 = \frac{2}{7} + \frac{2}{7} + \frac{2}{7} = \frac{2+2+2}{7} = \frac{6}{7}$$

Let's also calculate this product expressing whole number as a fraction.

Any whole number can be written as a fraction by putting 1 as a denominator. $3 = \frac{3}{1}$. If we divide 3 by 1, we get 3.

3 is same as $\frac{3}{1}$.

Let's find $\frac{2}{7} \times \frac{3}{1}$

To multiply fractions, we multiply numerator of one fraction with the numerator of other fraction and denominator of one fraction with the denominator of other fraction.

$$\frac{2}{7} \times \frac{3}{1} = \frac{2 \times 3}{7 \times 1} = \frac{6}{7}$$

Find $3 \times \frac{3}{7}$.

$$\frac{3}{1} \times \frac{3}{7} = \frac{3 \times 3}{1 \times 7} = \frac{9}{7}$$

Find the product of the following:

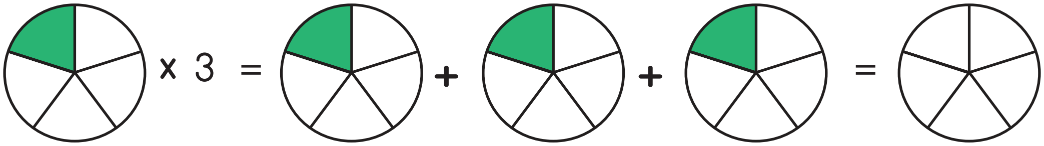
$5 \times \frac{1}{3} =$

$2 \times \frac{4}{9} =$

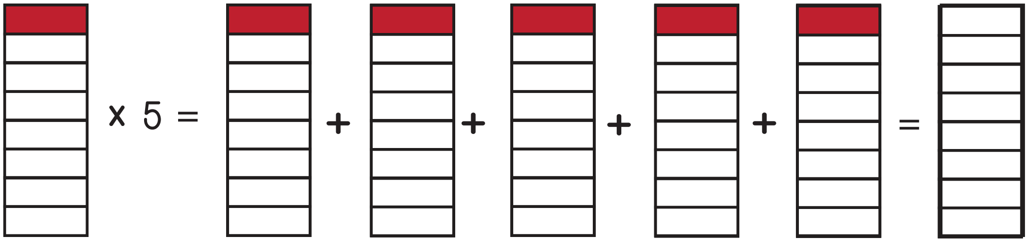
Exercise 5.5

1. Multiply the fractions by the given whole number and colour the figures.

a)



b)



2. Multiply the following using repeated addition.

a) $2 \times \frac{1}{7} = \frac{1}{7} + \frac{1}{7} = \frac{2}{7}$

b) $5 \times \frac{2}{11} =$ $=$

c) $3 \times \frac{3}{10} =$ $=$

d) $6 \times \frac{1}{2} =$ $=$

e) $2 \times \frac{4}{9} =$ $=$

f) $7 \times \frac{1}{8} =$ $=$

3. Convert the whole numbers into fractions and find the required products.

a) $2 \times \frac{1}{3} = \boxed{\frac{2}{1} \times \frac{1}{3} = \frac{2 \times 1}{1 \times 3} = \frac{2}{3}}$

b) $5 \times \frac{1}{7} =$

c) $7 \times \frac{2}{15} =$

d) $5 \times \frac{1}{7} =$

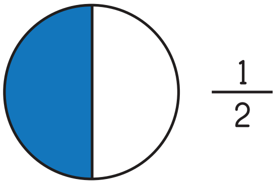
e) $3 \times \frac{1}{11} =$

4. Solve and match the product with correct answer.

a) $2 \times \frac{1}{3}$	$\frac{6}{7}$
b) $5 \times \frac{1}{6}$	$\frac{2}{3}$
c) $3 \times \frac{2}{7}$	$\frac{9}{13}$
d) $5 \times \frac{1}{11}$	$\frac{5}{6}$
e) $3 \times \frac{3}{13}$	$\frac{5}{11}$

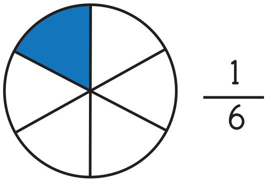
5.6 Division of a fraction by a whole number

Divide $\frac{1}{2}$ by 3.



We have to divide $\frac{1}{2}$ by 3.

Let's split $\frac{1}{2}$ into 3 equal groups.



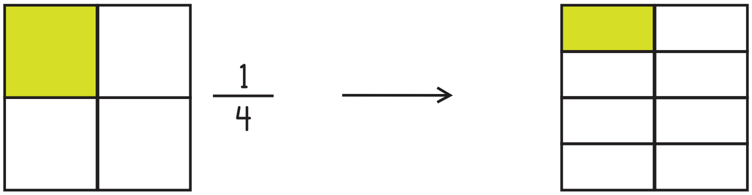
Each $\frac{1}{2}$ is now divided into 3 equal parts.

Now, the total parts are 6 and one part out of 6 is $\frac{1}{6}$.

So, $\frac{1}{2} \div 3 = \frac{1}{6}$

Which means if $\frac{1}{2}$ of a cake is divided into 3 children, each child will get $\frac{1}{6}$ of the whole cake.

Divide $\frac{1}{4}$ by 2.

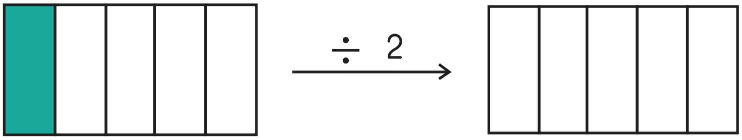


Divide each $\frac{1}{4}$ into two equal parts.

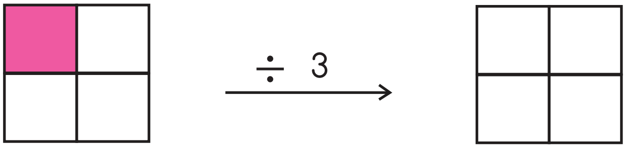
Each part now is $\frac{1}{8}$ of the whole.

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

Divide the fractions by the whole number and colour the figures.



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



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

We saw that: $\frac{1}{2} \div 3 = \frac{1}{6}$

If you multiply $\frac{1}{2}$ by $\frac{1}{3}$, you get $\frac{1}{6}$. This means dividing a number by another number is same as multiplying by the reciprocal of that number.

We can also say that multiplication is the inverse of division.

To divide $\frac{1}{2}$ by 3, we will take reciprocal of 3 and multiply the fractions.

The reciprocal of a number is 1 divided by the number.

Number → 5

Its reciprocal → $\frac{1}{5}$

Step 1 Take reciprocal of the whole number.

Reciprocal of 3 is $\frac{1}{3}$

Step 2 Multiply the fraction with the reciprocal of the whole number.

$$\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$$

Solve the following:

$\frac{1}{5} \div 4 = \_\_\_ \times \_\_\_ = \_\_\_$

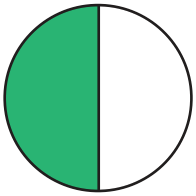
$\frac{1}{7} \div 2 = \_\_\_ \times \_\_\_ = \_\_\_$

5.7 Equivalent fractions

Look at the circle.

It is divided into 2 equal parts.

$\frac{1}{2}$ of the circle is coloured.

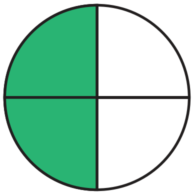


$\frac{1}{2}$

Now look at this circle.

It is divided into 4 equal parts.

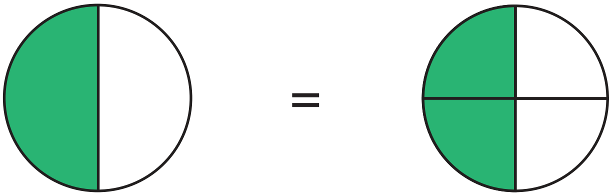
$\frac{2}{4}$ of the circle is coloured.



$\frac{2}{4}$

You can see that the area coloured in both circles is same.

This means $\frac{1}{2}$ and $\frac{2}{4}$ are equal.

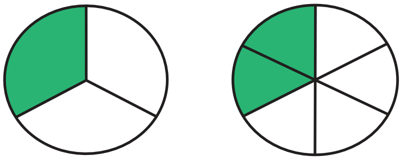


$\frac{1}{2} = \frac{2}{4}$

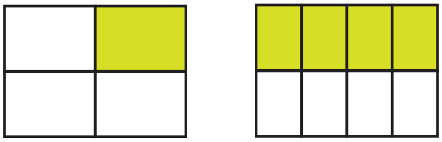
We call such fractions equivalent fractions.

> Equivalent fractions are fractions which have different numerators and denominators but have same value.

Which of these pairs show equivalent fractions?



$\frac{1}{3}$ $\frac{2}{6}$



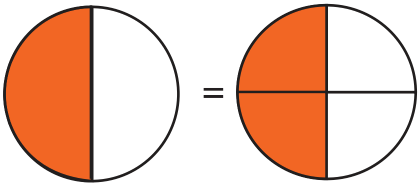
$\frac{1}{4}$ $\frac{4}{8}$

Look again at these fractions.

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

You can see that to go from $\frac{1}{2}$ to $\frac{2}{4}$, we just doubled the numerator and the denominator.

$$\begin{tikzcd} \frac{1}{2} \arrow[rr, bend left, "\times 2"] \arrow[rr, bend right, "\times 2"'] & = & \frac{2}{4} \end{tikzcd}$$

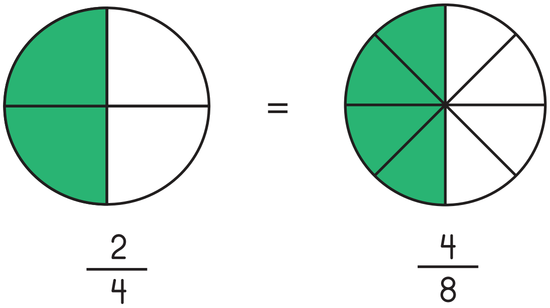


If you multiply $\frac{1}{2}$ by $\frac{2}{2}$, you get $\frac{2}{4}$, which is equivalent to $\frac{1}{2}$.
When you divide your circle in twice number of parts, you have to take twice number of parts out to get the same fraction.

This means we can multiply numerator and denominator of a fraction with same number and we will get an equivalent fraction.

Let's multiply $\frac{2}{4}$ by $\frac{2}{2}$.

$$\begin{tikzcd} \frac{2}{4} \arrow[rr, bend left, "\times 2"] \arrow[rr, bend right, "\times 2"'] & = & \frac{4}{8} \end{tikzcd}$$



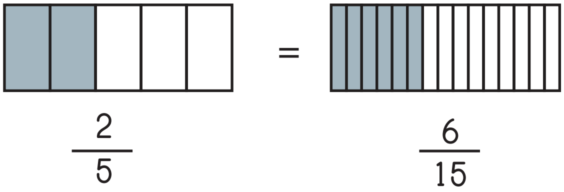
You can see that $\frac{2}{4}$ and $\frac{4}{8}$ also represent same fraction.

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

Find equivalent fraction of $\frac{2}{5}$.

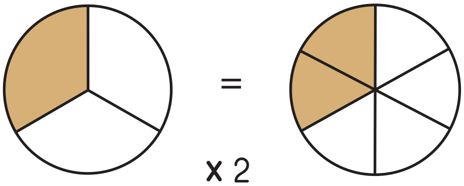
Let's multiply $\frac{2}{5}$ by $\frac{3}{3}$.

$$\begin{tikzcd}\frac{2}{5} \arrow[rr, bend left, "\times 3"] \arrow[rr, bend right, "\times 3"'] & = & \frac{6}{15}\end{tikzcd}$$



You can see that $\frac{2}{5}$ and $\frac{6}{15}$ represent **equivalent** fraction.

Find the equivalent fractions for the fractions given below and colour the figures.



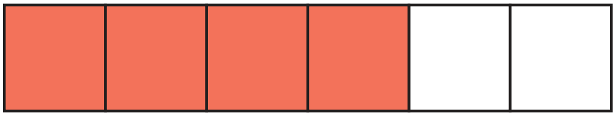
$$\begin{tikzcd}\frac{1}{3} \arrow[rr, bend left, "\times 2"] \arrow[rr, bend right, "\times 2"'] & = & \frac{\boxed{}}{6}\end{tikzcd}$$

$$\begin{tikzcd}\frac{1}{4} \arrow[rr, bend left, "\times 2"] \arrow[rr, bend right, "\times 2"'] & = & \frac{\boxed{}}{\boxed{}}\end{tikzcd}$$

$$\begin{tikzcd}\frac{3}{5} \arrow[rr, bend left, "\times 3"] \arrow[rr, bend right, "\times 3"'] & = & \frac{\boxed{}}{\boxed{}}\end{tikzcd}$$

$$\begin{tikzcd}\frac{3}{4} \arrow[rr, bend left, "\times 4"] \arrow[rr, bend right, "\times 4"'] & = & \frac{\boxed{}}{\boxed{}}\end{tikzcd}$$

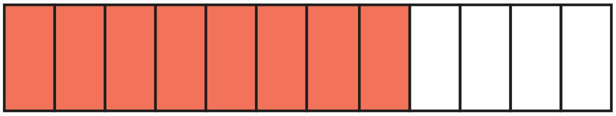
Let's find equivalent fraction of $\frac{4}{6}$.



We know that we can multiply the numerator and the denominator of a fraction by the same number and get an equivalent fraction.

Let's multiply $\frac{4}{6}$ by $\frac{2}{2}$.

$$\begin{tikzcd} \frac{4}{6} \arrow[r, phantom, "="] \arrow[r, bend left, "\times 2"] \arrow[r, bend right, "\times 2"'] & \frac{8}{12} \end{tikzcd}$$



Now, we have 12 parts and 8 out of them are coloured.

You can see that the coloured part in $\frac{4}{6}$ and $\frac{8}{12}$ is exactly the same.

We can also divide the numerator and denominator of a fraction by the same number and get an equivalent fraction.

$$\begin{tikzcd} \frac{4}{6} \arrow[r, phantom, "="] \arrow[r, bend left, "\div 2"] \arrow[r, bend right, "\div 2"'] & \frac{2}{3} \end{tikzcd}$$

Now, we have 3 parts and 2 of them are coloured.

You can see that the coloured part is the same.

$$\frac{2}{3} = \frac{4}{6} = \frac{8}{12}$$

Look at this equivalent fraction pair. Can you find the missing number?

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

We know that to find equivalent fractions, we multiply or divide numerator and denominator of a fraction by the same number.

Recall your tables. To get 6 from 3, we will multiply 3 by 2.

3 times 2 is 6.

$$\begin{tikzcd} \frac{1}{3} \arrow[rr, bend right] & = & \frac{\boxed{}}{6} \end{tikzcd}$$

Which means we will have to multiply numerator of the fraction by 2 as well.

$$\begin{tikzcd} \frac{1}{3} \arrow[rr, bend left, "\times 2"] \arrow[rr, bend right, "\times 2"'] & = & \frac{2}{6} \end{tikzcd}$$

1 times 2 is 2.

$\frac{2}{6}$ is the required equivalent fraction.

Find the missing number in each pair of the following fractions:

$\frac{1}{3} = \frac{\boxed{}}{9}$

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

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

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

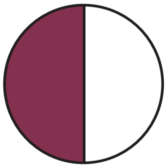
$\frac{2}{7} = \frac{\boxed{}}{14}$

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

Exercise 5.7

1. Find equivalent fractions of the following and colour the figures:

a)



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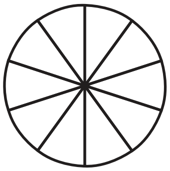
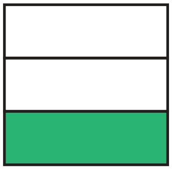


$$\frac{1}{2} = \frac{\square}{10}$$

b)



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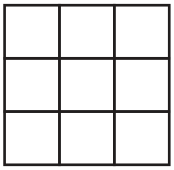


$$\frac{1}{3} = \frac{\square}{\square}$$

2. Find equivalent fractions for each of the following by multiplying or dividing the numbers given:

a)

$$\begin{tikzcd}\frac{1}{6} \arrow[r, bend left, "\times 2"] \arrow[r, bend right, "\times 2"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

b)

$$\begin{tikzcd}\frac{5}{7} \arrow[r, bend left, "\times 3"] \arrow[r, bend right, "\times 3"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

c)

$$\begin{tikzcd}\frac{3}{5} \arrow[r, bend left, "\times 4"] \arrow[r, bend right, "\times 4"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

d)

$$\begin{tikzcd}\frac{6}{9} \arrow[r, bend left, "\div 3"] \arrow[r, bend right, "\div 3"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

e)

$$\begin{tikzcd}\frac{4}{8} \arrow[r, bend left, "\div 4"] \arrow[r, bend right, "\div 4"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

f)

$$\begin{tikzcd}\frac{6}{15} \arrow[r, bend left, "\div 3"] \arrow[r, bend right, "\div 3"'] \arrow[r, phantom, "="] & \frac{\square}{\square}\end{tikzcd}$$

3. Find the missing numbers in the following pairs of equivalent fractions:

a) $\frac{1}{5} = \frac{5}{\square}$

b) $\frac{2}{8} = \frac{\square}{16}$

c) $\frac{1}{3} = \frac{10}{\square}$

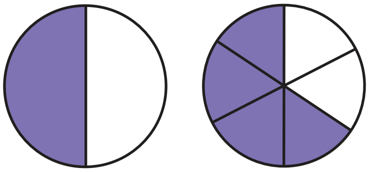
d) $\frac{6}{9} = \frac{36}{\square}$

e) $\frac{8}{9} = \frac{32}{\square}$

f) $\frac{6}{7} = \frac{\square}{35}$

5.8 Comparing unlike fractions

Which fraction is greater, $\frac{1}{2}$ or $\frac{4}{6}$?



$\frac{1}{2}$ $\frac{4}{6}$

$\frac{1}{2}$ and $\frac{4}{6}$ are unlike fractions.

To compare them, we will first convert them to like fractions, which means both of the fractions should have the same denominator.

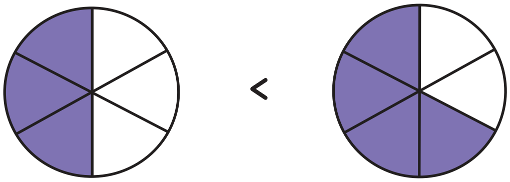
Look at the fractions again. $\frac{1}{2}$ $\frac{4}{6}$

2 is a multiple of 6.

Recall that 2 times 3 is 6.

This means we can write an equivalent fraction of $\frac{1}{2}$ which has the same denominator as $\frac{4}{6}$, by multiplying $\frac{1}{2}$ by $\frac{3}{3}$.

$$\begin{tikzcd}\frac{1}{2} \arrow[rr, bend left, "\times 3"] \arrow[rr, bend right, "\times 3"'] & = & \frac{3}{6}\end{tikzcd}$$



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

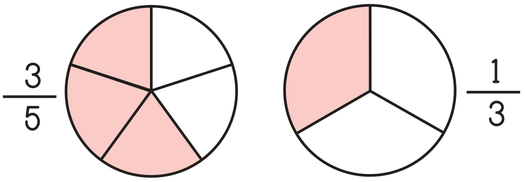
Now, we can compare $\frac{3}{6}$ and $\frac{4}{6}$.

$3 < 4$. So, $\frac{3}{6} < \frac{4}{6}$.

Therefore, we can say that $\frac{1}{2} < \frac{4}{6}$

Which fraction is greater, $\frac{3}{4}$ or $\frac{5}{8}$?

Which fraction is greater, $\frac{3}{5}$ or $\frac{1}{3}$?



$\frac{3}{5}$ and $\frac{1}{3}$ are unlike fractions.
We have to convert them to like fractions to compare them.

Let's try to find a common denominator for both fractions.

Look at the denominators 5 and 3.

Recall the first few multiples of 5 and 3.

Multiples of 5: 5, 10, ⑮, 20

Multiples of 3: 3, 6, 9, 12, ⑮, 18

15 is the Least Common Multiple. LCM will be the common denominator.

$$\frac{3}{5} = \frac{\square}{15} \quad \text{and} \quad \frac{1}{3} = \frac{\square}{15}$$

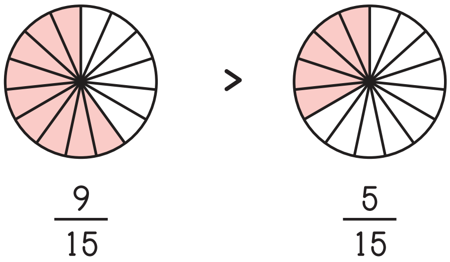
Let's find the missing numbers now.

$$\frac{3}{5} \overset{\times 3}{\underset{\times 3}{=}} \frac{9}{15} \quad \text{and} \quad \frac{1}{3} \overset{\times 5}{\underset{\times 5}{=}} \frac{5}{15}$$

Now, we can compare $\frac{9}{15}$ and $\frac{5}{15}$.

$\frac{9}{15} > \frac{5}{15}$

So, $\frac{3}{5} > \frac{1}{3}$



Exercise 5.8

1. Compare the fractions using symbols of "<" or ">".

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

b) $\frac{1}{2} \square \frac{5}{8}$

c) $\frac{2}{9} \square \frac{1}{3}$

d) $\frac{1}{2} \square \frac{2}{6}$

e) $\frac{1}{2} \square \frac{2}{3}$

f) $\frac{2}{3} \square \frac{3}{4}$

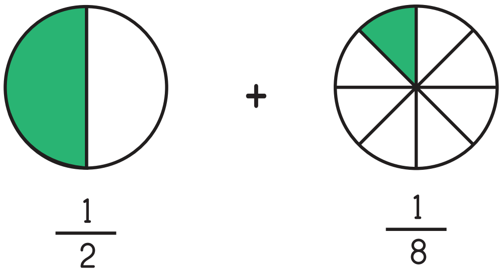
g) $\frac{4}{5} \square \frac{3}{4}$

h) $\frac{1}{5} \square \frac{1}{7}$

i) $\frac{2}{7} \square \frac{3}{5}$

5.9 Addition and subtraction of unlike fractions

What is $\frac{1}{2} + \frac{1}{8}$?



Recall that same sized or like fractions can simply be added by counting the number of parts in the numerators.

Look at the figures. Parts in both shapes are of different sizes.
So, we cannot simply add them. We will first have to convert them to same sized parts or like fractions.

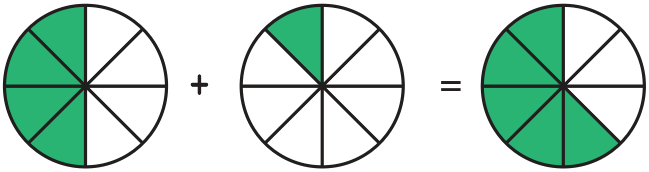
$$\begin{tikzcd} \frac{1}{2} \arrow[r, bend left, "\times 4"] \arrow[r, bend right, "\times 4"'] \arrow[r, phantom, "="] & \frac{4}{8} \end{tikzcd}$$

LCM of 2 and 8 is 8.

Since, $\frac{1}{2} = \frac{4}{8}$. We can add $\frac{4}{8}$ and $\frac{1}{8}$.

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

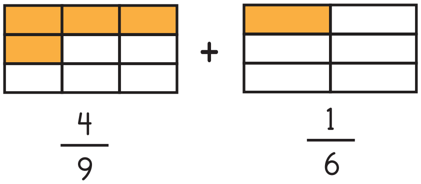
So, $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$



Add $\frac{1}{3}$ and $\frac{2}{15}$.

Let's add $\frac{4}{9}$ and $\frac{1}{6}$.

Since, the fractions are unlike fractions, we will convert them to like fractions.



Step 1

Let's find LCM of 9 and 6.

Multiples of 9: 9, ⑱, 27, 36

Multiples of 6: 6, 12, ⑱, 24

Step 2

18 is the LCM, which will be the common denominator.

$$\frac{4}{9} = \frac{\square}{18} \quad \text{and} \quad \frac{1}{6} = \frac{\square}{18}$$

Step 3

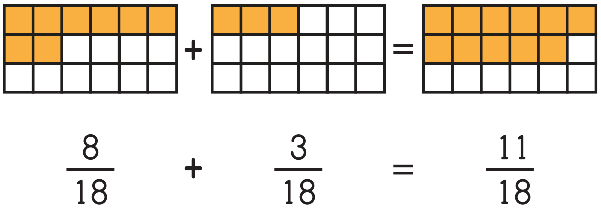
Let's find the missing numbers.

$$\frac{4}{9} \overset{\times 2}{\underset{\times 2}{=}} \frac{8}{18} \qquad \frac{1}{6} \overset{\times 3}{\underset{\times 3}{=}} \frac{3}{18}$$

$\frac{8}{18}$ and $\frac{3}{18}$ are like fractions.

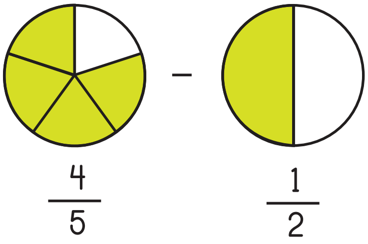
$$\frac{8}{18} + \frac{3}{18} = \frac{11}{18}$$

So, $\frac{4}{9} + \frac{1}{6} = \frac{11}{18}$



Add $\frac{1}{3}$ and $\frac{2}{5}$.

Let's subtract $\frac{1}{2}$ from $\frac{4}{5}$.



The shapes do not have equal sized parts. So, we cannot subtract $\frac{1}{2}$ from $\frac{4}{5}$ directly.

We will first convert them to shapes with equal sized parts or like fractions.

Let's find equivalent fraction for both $\frac{4}{5}$ and $\frac{1}{2}$ such that they have a common denominator.

Multiples of 5: 5, ⑩, 15, 20, 25

Multiples of 2: 2, 4, 6, 8, ⑩

10 is the LCM. So, 10 will be the common denominator.

$$\frac{4}{5} = \frac{\square}{10} \quad \text{and} \quad \frac{1}{2} = \frac{\square}{10}$$

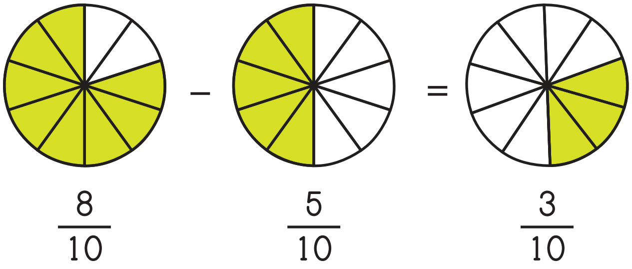
Let's find the missing numbers.

$$\begin{tikzcd} \frac{4}{5} \arrow[r, bend left, "\times 2"] \arrow[r, bend right, "\times 2"'] \arrow[r, phantom, "="] & \frac{8}{10} \end{tikzcd} \quad \text{and} \quad \begin{tikzcd} \frac{1}{2} \arrow[r, bend left, "\times 5"] \arrow[r, bend right, "\times 5"'] \arrow[r, phantom, "="] & \frac{5}{10} \end{tikzcd}$$

Now, we can subtract $\frac{5}{10}$ from $\frac{8}{10}$ by just subtracting the numerators.

$$\frac{8}{10} - \frac{5}{10} = \frac{3}{10}$$

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



Exercise 5.9

1. Find the sum of the following unlike fractions:

a) $\frac{2}{9} + \frac{1}{3} = \square$

b) $\frac{1}{4} + \frac{3}{8} = \square$

c) $\frac{2}{7} + \frac{1}{2} = \square$

d) $\frac{3}{4} + \frac{1}{3} = \square$

2. Find the difference of the following unlike fractions:

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

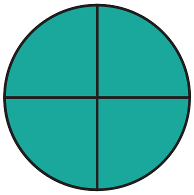
b) $\frac{5}{8} - \frac{1}{4} = \square$

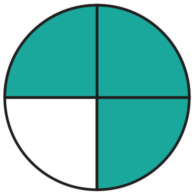
c) $\frac{3}{5} - \frac{1}{2} = \square$

d) $\frac{3}{4} - \frac{2}{5} = \square$

5.10 Improper fractions and mixed numbers

Look at the following shapes.





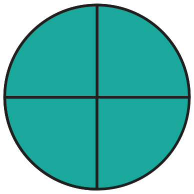
$$\frac{4}{4} + \frac{3}{4} = \frac{7}{4}$$

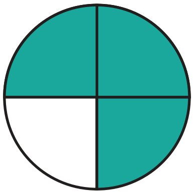
In fraction $\frac{7}{4}$, numerator is greater than the denominator. Such fractions are called improper fractions. $\frac{7}{4}$ is an improper fraction.

A **proper fraction** has a numerator that is smaller than its denominator.

An **improper fraction** has a numerator that is greater than its denominator.

Look at the shapes again.

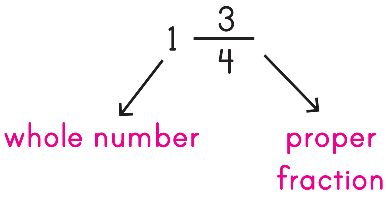




$\frac{4}{4}$ $\frac{3}{4}$

This is 1 whole circle.

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



We can also write it as a mixed number.

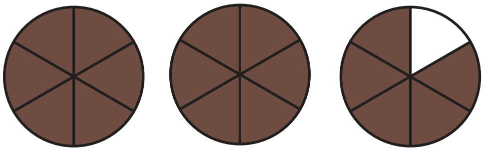
There is 1 whole circle and $\frac{3}{4}$ of a circle.

$1\frac{3}{4}$ is an example of a mixed number.

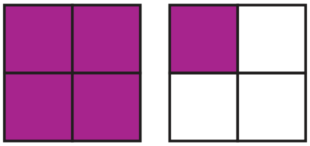
A **mixed number** is made up of a whole number and a proper fraction.

Exercise 5.10

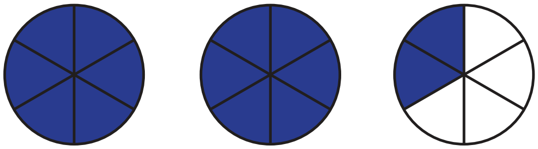
1. Write the improper fraction and mixed number for each of the following.

a) 

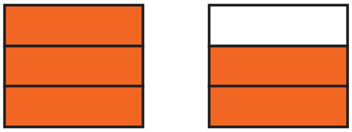
$\frac{17}{6} = 2\frac{5}{6}$

b) 

$\frac{\square}{\square} = \square\frac{\square}{\square}$

c) 

$\frac{\square}{\square} = \square\frac{\square}{\square}$

d) 

$\frac{\square}{\square} = \square\frac{\square}{\square}$

e) 

$\frac{\square}{\square} = \square\frac{\square}{\square}$

5.11 Converting fractions

Let's convert a mixed number $2\frac{1}{2}$ to an improper fraction directly.

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

We will convert the whole numbers into fractions with same denominators as that of proper fraction and add all fractions.

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

We can also do it mathematically by following these steps.

Step 1 Multiply the whole number part by the denominator of the fraction.

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

Step 2 Add the product to the numerator.

$$2\frac{1}{2} \longrightarrow 4 + 1 = 5$$

Step 3 Write the result as a numerator over the same denominator.

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

Convert the following mixed numbers into improper fractions:

$3\frac{1}{4} = \frac{13}{\square}$

$5\frac{7}{8} = \frac{\square}{\square}$

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

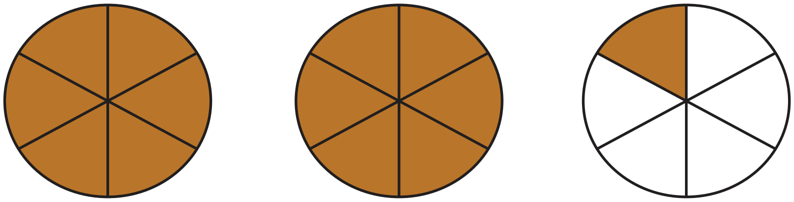
$2\frac{2}{3} = \frac{\square}{\square}$

$3\frac{4}{7} = \frac{\square}{\square}$

$4\frac{3}{5} = \frac{\square}{\square}$

Let's see how we convert improper fraction to mixed number.

Look at the circles below.



$\frac{13}{6}$ of the circles are coloured.

Let's convert this improper fraction to mixed number.

Divide the numerator by the denominator.

$\frac{13}{6} = 2$ with a remainder of 1

$$\begin{array}{r} 2 \\ 6\,\overline{)\,13} \\ -\,12 \\ \hline 1 \\ \hline \end{array}$$

Write down the quotient as a whole number.

Write remainder as a numerator over the same denominator.

$$\frac{13}{6} = 2\frac{1}{6}$$

Convert the following improper fractions into mixed numbers:

$\frac{13}{2} = 6\frac{\square}{\square}$

$\frac{7}{6} = \square\frac{\square}{\square}$

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

$\frac{34}{7} = \square\frac{\square}{\square}$

$\frac{22}{5} = \square\frac{\square}{\square}$

$\frac{23}{4} = \square\frac{\square}{\square}$