Cheat Sheet

Here is a summary of the things you need to remember for fractions

Proper fractions
Represent parts of a whole number or object. The numerator is smaller than or equal to the denominator.

\[
\begin{align*}
\text{numerator} & \quad \frac{1}{2} \quad \text{number of equal parts you have} \\
\text{denominator} & \quad \text{total number of equal parts}
\end{align*}
\]

Equivalent proper fractions
These are fractions with different numbers that represent the same amount.

\[
\therefore \frac{4}{8} = \frac{2}{4} = \frac{1}{2} = \text{Equivalent fractions}
\]

Improper fractions and mixed numbers

\[
\begin{align*}
\frac{3}{2} & \quad \text{Improper fractions} \\
\frac{5}{4} & \quad \text{Mixed numbers}
\end{align*}
\]

\[
\begin{align*}
\text{numerator} > \text{denominator} & \quad A \text{ ‘mix’ of whole numbers and proper fractions.}
\end{align*}
\]

Fractions on the number line

\[
\begin{align*}
0 & \quad \frac{1}{2} \quad \text{number of equal steps taken between 0 and 1} \\
\frac{3}{4} & \quad \frac{3}{2} \quad \text{number of equal steps towards the next whole number}
\end{align*}
\]

Reciprocal fractions

Original fraction \(\longrightarrow\) \(\frac{2}{5}\) \(\longrightarrow\) \(\frac{5}{2}\) \(\longrightarrow\) Reciprocal fraction

Mixed number \(\longrightarrow\) \(3\frac{1}{2}\) \(\longrightarrow\) \(\frac{7}{2}\) \(\longrightarrow\) \(\frac{7}{2}\) \(\longrightarrow\) \(\frac{2}{7}\) \(\longrightarrow\) Reciprocal fraction

Comparing fractions
Write equivalent fractions by changing the denominators to their LCM, then compare the numerators

\[
\frac{1 \times 3}{2 \times 3} \longrightarrow \frac{3}{6} > \frac{2}{6} \longrightarrow \frac{1 \times 2}{3 \times 2}
\]

Adding and subtracting fractions
If the denominators (bottom) are the same, then simply add or subtract the numerators (tops).
If the denominators are different, change to equivalent fractions with the same denominators using the LCM. Then add or subtract the numerators of the new fractions.

Multiplying and dividing fractions
To multiply fractions, just remember: Multiply the numerators (top) and the denominators (bottom).
To divide an amount by a fraction, just remember: flip the second fraction (reciprocal) then multiply.

Fractions of an amount
‘of’ means ‘\(\times\)’ \(\therefore\) Find \(\frac{2}{5}\) of 2 means calculate \(\frac{2}{5} \times 2\)

Two amounts as a fraction
2 out of 5 as a fraction is \(\frac{2}{5}\). If the two amounts are in different units, change the larger amount into the smaller units. Eg, 200 g out of 2 kg becomes 200 g out of 2000 g.
**Equivalent proper fractions**

These are fractions with different numbers that represent the same amount. For example, two fitness teams do three sessions of training in the same park.

**Session 1:** Grouped in pairs

![Session 1 Diagram](Image)

- \( \frac{4}{8} \)

**Session 2:** In groups of four

![Session 2 Diagram](Image)

- \( \frac{2}{4} \)

**Session 3:** Grouped as a whole team

![Session 3 Diagram](Image)

- \( \frac{1}{2} \)

Fraction of training groups wearing striped (or plain) shirts in each session.

The **groups change size** but the total **number of people** training **remains the same**

\[ \therefore \frac{4}{8} = \frac{2}{4} = \frac{1}{2} = \text{Equivalent fractions} \]

We find equivalent fractions by dividing/multiplying the numerator and denominator by the same number.

Write an equivalent fraction for each of these using the multiplication or division given in square brackets

(i) \( \frac{3}{5} \times [3] \)

\[ \frac{3 \times 3}{5 \times 3} = \frac{9}{15} \]

\( \therefore \frac{3}{5} \text{ and } \frac{9}{15} = \text{equivalent fractions} \)

(ii) \( \frac{12}{32} \div [4] \)

\[ \frac{12 \div 4}{32 \div 4} = \frac{3}{8} \]

\( \therefore \frac{12}{32} \text{ and } \frac{3}{8} = \text{equivalent fractions} \)

Simplify these fractions by dividing the numerator and denominator by the greatest common factor (GCF)

(i) \( \frac{3}{9} \)

GCF for 3 and 9 is: 3

\[ \therefore \frac{3 \div 3}{9 \div 3} = \frac{1}{3} \]

\( \therefore \frac{1}{3} \text{ is the simplest equivalent fraction to } \frac{3}{9} \)

(ii) \( \frac{18}{24} \)

GCF for 18 and 24 is: 6

\[ \therefore \frac{18 \div 6}{24 \div 6} = \frac{3}{4} \]

\( \therefore \frac{3}{4} \text{ is the simplest equivalent fraction to } \frac{18}{24} \)
Improper fractions and mixed numbers

An improper fraction has a bigger numerator (top) than denominator (bottom).

\[ \frac{3}{2} \quad \text{Improper fractions} \quad \frac{5}{4} \]

\( > \) means “bigger than”

Mixed numbers have a whole number and a proper fraction.

\[ 1 \frac{1}{2} \quad \text{Mixed numbers} \quad 1 \frac{1}{4} \]

a “mix” of whole numbers and proper fractions

Mixed numbers are simplified improper fractions.

Simplify these:

**Improper fractions to mixed numbers**

(i) \( \frac{5}{3} \)

\[ \frac{5}{3} = 5 \div 3 \]

\[ = 1 \text{ r } 2 \]

\[ = 1 \frac{2}{3} \quad \text{same denominator} \]

Whole number answer

(ii) \( \frac{14}{4} \)

\[ \frac{14}{4} = \frac{7}{2} = 7 \div 2 \quad \text{Simplify if possible} \]

\[ = 3 \text{ r } 1 \]

\[ = 3 \frac{1}{2} \quad \text{same simplified denominator} \]

Whole number answer

**Mixed numbers to improper fractions**

(i) \( 1 \frac{2}{3} \)

\[ \frac{2}{3} = \frac{3 \times 1 + 2}{3} \]

\[ = \frac{5}{3} \quad \text{same denominator} \]

(ii) \( 2 \frac{1}{5} \)

\[ \frac{1}{5} = \frac{5 \times 2 + 1}{5} \]

\[ = \frac{11}{5} \quad \text{same denominator} \]
Improper fractions and mixed numbers

1. Write the mixed numbers represented by these shaded diagrams:

   a. \[ \frac{3}{2} \]
   b. \[ \frac{4}{3} \]
   c. \[ \frac{5}{4} \]
   d. \[ \frac{6}{5} \]
   e. \[ \frac{7}{6} \]
   f. \[ \frac{8}{7} \]

   Make sure you write the fraction in simplest form where possible.

2. Simplify these improper fractions by writing them as mixed numbers.

   a. \[ \frac{12}{5} \]
   b. \[ \frac{14}{3} \]
   c. \[ \frac{23}{2} \]

3. Write these fractions in simplest form first, then change to mixed numbers.

   a. \[ \frac{15}{9} \]
   b. \[ \frac{21}{14} \]
   c. \[ \frac{18}{16} \]

4. Write the equivalent improper fraction for these mixed numbers.

   a. \[ 1 \frac{1}{2} \]
   b. \[ 2 \frac{3}{4} \]
   c. \[ 4 \frac{4}{5} \]

5. Write the equivalent improper fraction for these mixed numbers after first simplifying the fraction parts.

   a. \[ 4 \frac{2}{12} \]
   b. \[ 2 \frac{6}{24} \]
   c. \[ 25 \frac{24}{72} \]
How does it work?

Fractions

Reciprocal fractions

Original fraction $\frac{2}{5} \rightarrow$ swap $\rightarrow \frac{5}{2}$ Reciprocal fraction

Write the reciprocal of these fractions

(i) $\frac{3}{4} \rightarrow \frac{3}{4} \rightarrow$ swap $\rightarrow \frac{4}{3}$ Reciprocal fraction

(ii) $\frac{18}{8} = \frac{9}{4} \rightarrow \frac{9}{4} \rightarrow$ swap $\rightarrow \frac{4}{9}$ Reciprocal fraction

For mixed numbers, change to an improper fraction first then write the reciprocal.

Mixed number $\rightarrow 3\frac{1}{2} \rightarrow \frac{7}{2} \rightarrow \frac{7}{2} \rightarrow$ swap $\rightarrow \frac{2}{7}$ Reciprocal fraction

Whole/mixed number examples: Always write as a fraction first.

Write the reciprocal of these

(i) $3 = \frac{3}{1} \rightarrow \frac{3}{1} \rightarrow$ swap $\rightarrow \frac{1}{3}$ Reciprocal fraction

(ii) $2\frac{3}{4} \rightarrow \frac{11}{4} \rightarrow \frac{11}{4} \rightarrow$ swap $\rightarrow \frac{4}{11}$ Reciprocal fraction

(iii) $4\frac{9}{15} \rightarrow \frac{4}{5} \rightarrow \frac{23}{5} \rightarrow \frac{23}{5} \rightarrow$ swap $\rightarrow \frac{5}{23}$ Reciprocal fraction

We will see why we find the reciprocal a little later on in this booklet.

It is used when dividing an amount by a fraction.
How does it work?  Your Turn  Fractions

Reciprocal fractions

1. Write the reciprocal for these fractions:
   - a) \( \frac{2}{3} \)
   - b) \( \frac{11}{7} \)
   - c) \( \frac{6}{19} \)
   - d) \( \frac{15}{4} \)

2. Write the reciprocal, then simplify these fractions:
   - a) \( \frac{6}{10} \)
   - b) \( \frac{14}{8} \)
   - c) \( \frac{12}{18} \)
   - d) \( \frac{25}{10} \)

3. Write the reciprocal of these:
   - a) \( \frac{1}{5} \)
   - b) \( \frac{1}{9} \)
   - c) \( 2 \)
   - d) \( 4 \)

4. Write the reciprocal of these mixed numbers:
   - a) \( 2 \frac{1}{3} \)
   - b) \( 3 \frac{2}{5} \)
   - c) \( 1 \frac{5}{9} \)

5. Write the reciprocal of these mixed numbers after first writing as a fraction:
   - a) \( 3 \frac{2}{10} \)
   - b) \( 1 \frac{10}{12} \)
   - c) \( 2 \frac{9}{21} \)

6. Write the reciprocal of these fractions as a simplified mixed number:
   - a) \( \frac{10}{48} \)
   - b) \( \frac{12}{66} \)
   - c) \( \frac{15}{115} \)
Comparing fractions

This is where we see which fractions are larger than others.

\[ \frac{1}{2} \quad \text{or} \quad \frac{1}{3} \]

Write equivalent fractions by changing the denominators to their LCM.

\[ \frac{1 \times 3}{2 \times 3} \quad \rightarrow \quad \frac{3}{6} \quad \text{or} \quad \frac{2}{6} \quad \rightarrow \quad \frac{1 \times 2}{3 \times 2} \]

Since they have the same denominator, now just compare their numerators.

\[
\text{bigger} \quad > \quad \text{smaller} \\
\frac{3}{6} \quad > \quad \frac{2}{6} \\
\therefore \quad \frac{1}{2} \quad > \quad \frac{1}{3}
\]

Compare the size of these fractions

(i) \[ \frac{2}{3}, \quad \frac{3}{4} \quad \text{and} \quad \frac{5}{12} \]

\[ \frac{2}{3} \quad , \quad \frac{3}{4} \quad \text{and} \quad \frac{5}{12} \]

LCM of denominators = 12

\[ \frac{2 \times 4}{3 \times 4} \quad \rightarrow \quad \frac{8}{12} \quad , \quad \frac{9}{12} \quad \rightarrow \quad \frac{3 \times 3}{4 \times 3} \quad \text{and} \quad \frac{5}{12} \]

\[ \frac{5}{12} \quad < \quad \frac{8}{12} \quad < \quad \frac{9}{12} \]

\[ \therefore \quad \frac{5}{12} \quad < \quad \frac{2}{3} \quad < \quad \frac{3}{4} \]

Compare numerators

Order fractions by size

If comparing improper fractions, use the same method but leave the answer as a mixed number.

(ii) \[ \frac{11}{4} \quad \text{and} \quad \frac{13}{5} \]

\[ \frac{11}{4} \quad , \quad \frac{13}{5} \]

LCM of denominators = 20

\[ \frac{11 \times 5}{4 \times 5} \quad \rightarrow \quad \frac{55}{20} \quad , \quad \frac{52}{20} \quad \rightarrow \quad \frac{13 \times 4}{5 \times 4} \]

\[ \frac{55}{20} \quad > \quad \frac{52}{20} \]

\[ \therefore \quad 2 \frac{3}{4} \quad > \quad 2 \frac{3}{5} \]

Write in simplest form
Comparing fractions

1. Compare the size of these fractions:
   a. \( \frac{2}{5} \) and \( \frac{1}{3} \)
   b. \( \frac{3}{4} \) and \( \frac{5}{7} \)

2. Compare the size of the fractions in each of these groups:
   a. \( \frac{3}{5} \), \( \frac{1}{2} \) and \( \frac{11}{20} \)
   b. \( \frac{9}{12} \), \( \frac{2}{3} \) and \( \frac{5}{6} \)

3. Compare the size of these improper fractions:
   a. \( \frac{9}{4} \) and \( \frac{16}{7} \)
   b. \( \frac{14}{3} \), \( \frac{15}{4} \) and \( \frac{21}{8} \)
Adding and subtracting fractions with the same denominator

\[ \frac{1}{4} + \frac{2}{4} = \frac{3}{4} \]

one quarter and two quarters equals three quarters

\[ \frac{2}{3} - \frac{1}{3} = \frac{1}{3} \]

two thirds less one third equals one third

If the denominator (bottom) is the same, just add or subtract the numerators (top).

Simplify these fractions with the same denominator

(i) \[ \frac{2}{9} + \frac{5}{9} = \frac{2+5}{9} = \frac{7}{9} \]

Add the numerators only

(ii) \[ \frac{6}{7} - \frac{2}{7} = \frac{6-2}{7} = \frac{4}{7} \]

Subtract the numerators only

(iii) \[ \frac{2}{3} + \frac{5}{3} = \frac{2+5}{3} = \frac{7}{3} = 2\frac{1}{3} \]

Add the numerators only

(iv) \[ \frac{3}{5} - \frac{1}{5} + \frac{4}{5} = \frac{3-1+4}{5} = \frac{6}{5} = 1\frac{1}{5} \]

Subtract/add the numerators only

Always write answers in simplest form
Adding and subtracting fractions with the same denominator

1. Simplify these without the aid of a calculator:
   - a. $\frac{1}{3} + \frac{1}{3}$
   - b. $\frac{3}{5} - \frac{1}{5}$
   - c. $\frac{5}{9} + \frac{2}{9}$
   - d. $\frac{8}{11} - \frac{6}{11}$
   - e. $\frac{11}{15} - \frac{4}{15}$
   - f. $\frac{3}{8} + \frac{5}{8}$

2. Simplify these without the aid of a calculator:
   - a. $\frac{1}{2} + \frac{4}{2}$
   - b. $\frac{8}{5} - \frac{2}{5}$
   - c. $\frac{2}{3} + \frac{5}{3}$
   - d. $\frac{10}{4} - \frac{1}{4}$
   - e. $\frac{11}{7} + \frac{4}{7}$
   - f. $\frac{15}{2} - \frac{8}{2}$

3. Simplify these without the aid of a calculator, remembering to write the answer in simplest form:
   - a. $\frac{11}{4} - \frac{5}{4}$
   - b. $\frac{13}{6} + \frac{19}{6}$
   - c. $\frac{9}{8} + \frac{13}{8}$

4. Simplify these without the aid of a calculator:
   - a. $\frac{4}{9} + \frac{1}{9} + \frac{2}{9}$
   - b. $\frac{20}{3} - \frac{10}{3} - \frac{4}{3}$
   - c. $\frac{1}{2} + \frac{1}{2} - \frac{1}{2}$
   - d. $\frac{1}{5} + \frac{4}{5} - \frac{2}{5}$
   - e. $\frac{8}{7} - \frac{4}{7} + \frac{6}{7}$
   - f. $\frac{13}{6} + \frac{11}{6} - \frac{9}{6}$
Where does it work?

Fractions

**Adding and subtracting fractions with a different denominator**

\[
\begin{align*}
\frac{1}{4} + \frac{1}{2} &= \frac{3}{4} \\
\text{one quarter and one half equals three quarters}
\end{align*}
\]

Simplify these expressions, which have fractions with different denominators:

(i) \( \frac{2}{3} + \frac{1}{5} \)  

For \( \frac{2}{3} \) and \( \frac{1}{5} \)  

\[
\begin{align*}
\therefore \frac{2}{3} + \frac{1}{5} &= \frac{2 \times 5}{3 \times 5} + \frac{1 \times 3}{5 \times 3} \\
&= \frac{10 + 3}{15} \\
&= \frac{13}{15}
\end{align*}
\]

(ii) \( \frac{7}{8} - \frac{1}{2} + \frac{3}{4} \)  

For \( \frac{7}{8}, \frac{1}{2}, \text{and } \frac{3}{4} \)  

\[
\begin{align*}
\frac{7}{8} - \frac{1}{2} + \frac{3}{4} &= \frac{7 - 1 \times 4 + 3 \times 2}{8 \times 2 \times 4} \\
&= \frac{7 - 4 + 6}{8} \\
&= \frac{9}{8} \\
&= 1 \frac{1}{8}
\end{align*}
\]
Adding and subtracting fractions with a different denominator

1. Fill in the spaces for these calculations:
   
   a. \( \frac{1}{3} + \frac{1}{6} \) The LCM of the denominators is: ______
   
   \[ \therefore \frac{1}{3} + \frac{1}{6} = \frac{1 \times 2}{3 \times 2} + \frac{1}{6} \]
   
   = \[ \frac{2}{6} + \frac{1}{6} \]
   
   = \[ \frac{3}{6} \]
   
   = \[ \frac{1}{2} \] simplest form
   
   b. \( \frac{4}{7} - \frac{1}{5} \) The LCM of the denominators is: ______
   
   \[ \therefore \frac{4}{7} - \frac{1}{5} = \frac{4 \times 5}{7 \times 5} - \frac{1 \times 7}{5 \times 7} \]
   
   = \[ \frac{20}{35} - \frac{7}{35} \]
   
   = \[ \frac{13}{35} \] simplest form

2. Simplify these without the aid of a calculator:
   
   a. \( \frac{1}{3} + \frac{1}{2} \)
   
   b. \( \frac{5}{6} - \frac{1}{2} \)
   
   c. \( \frac{2}{5} - \frac{1}{4} \)
   
   d. \( \frac{1}{6} + \frac{3}{4} \)
   
   e. \( \frac{6}{7} - \frac{2}{3} \)
   
   f. \( \frac{3}{5} + \frac{3}{8} \)
Adding and subtracting fractions with a different denominator

Simplify these expressions without the aid of a calculator, remembering to write the answer in simplest form.

a) \( \frac{1}{2} + \frac{4}{5} \)

b) \( \frac{13}{8} - \frac{3}{5} \)

c) \( \frac{1}{2} + \frac{3}{8} - \frac{1}{4} \)

d) \( \frac{3}{5} + \frac{3}{10} - \frac{3}{4} \)

e) \( \frac{2}{3} - \frac{1}{4} + \frac{5}{6} \)

f) \( \frac{7}{12} - \frac{1}{3} + \frac{11}{24} \)
Adding and subtracting fractions with a different denominator

The same rules apply for questions with a mix of whole numbers and fractions. Here are some examples:

<table>
<thead>
<tr>
<th>Expression</th>
<th>Simplified</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) $3 + \frac{1}{4}$</td>
<td>$3 + \frac{1}{4} = 3\frac{1}{4}$</td>
<td>Write the fraction after the whole number</td>
</tr>
<tr>
<td>(ii) $1 - \frac{2}{5}$</td>
<td>$1 - \frac{2}{5} = \frac{5}{5} - \frac{2}{5} = \frac{3}{5}$</td>
<td>Write the whole number as a fraction with same denominator, then subtract the numerators only</td>
</tr>
<tr>
<td>(iii) $4 - \frac{2}{7}$</td>
<td>$4 - \frac{2}{7} = \frac{28}{7} - \frac{2}{7} = \frac{26}{7} = 3\frac{5}{7}$</td>
<td>Write the whole number as a fraction with same denominator, then subtract the numerators only, then simplify the fraction</td>
</tr>
</tbody>
</table>

Simplify these expressions:

- $2 + \frac{1}{2}$
- $1 + \frac{3}{4}$
- $1 - \frac{2}{3}$
- $1 - \frac{3}{8}$
- $2 - \frac{3}{5}$
- $4 - \frac{1}{4}$
- $3 - \frac{5}{3}$
- $5 - \frac{5}{2}$
Multiplying and dividing fractions

To multiply fractions, just remember: Multiply the numerators (top) and the denominators (bottom)

\[
\text{of } \times \quad \frac{1}{3} \text{ of } \frac{2}{5} = \frac{1}{3} \times \frac{2}{5} = \frac{1 \times 2}{3 \times 5} = \frac{2}{15}
\]

To divide an amount by a fraction, just remember: flip the second fraction then multiply

\[
\frac{1}{3} \div \frac{2}{5} = \frac{1}{3} \times \frac{5}{2}
\]

Only flip the second fraction

Change the ‘\(\div\)’ to a ‘\(\times\)’

\[
= \frac{1 \times 5}{3 \times 2}
= \frac{5}{6}
\]

Remember: A flipped fraction is called the reciprocal fraction

Simplify these:

We can use shaded diagrams to calculate the multiplication of two fractions

(i) \(\frac{2}{3} \text{ of } \frac{4}{5}\)

Draw a grid using the denominators as the dimensions

\[
\begin{array}{c}
3 \\
5
\end{array}
\]

3

\[
\begin{array}{c}
2 \\
5
\end{array}
\]

Use the numerators to shade columns/rows

\[
\frac{8}{15}
\]

Write where they overlap as a fraction

\[
\therefore \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}
\]

If whole numbers are involved, write them as a fraction

(ii) \(28 \div \frac{2}{7}\)

\[
\therefore \quad \frac{28}{\frac{2}{7}} = 28 \times \frac{7}{2}
\]

Flip the second fraction and change sign to ‘\(\times\)’

\[
= \frac{28}{1} \times \frac{7}{2}
= \frac{196}{2}
= \frac{98}{1}
= 98
\]

Write the whole number as a fraction

Simplify
Multiplying and dividing fractions

2. Simplify these without the aid of a calculator:

a. \( \frac{1}{2} \times \frac{1}{3} \)

b. \( \frac{3}{5} \times \frac{1}{4} \)

c. \( \left( \frac{2}{3} \right)^2 \) psst: this is just \( \frac{2}{3} \times \frac{2}{3} \)

d. \( \left( \frac{3}{5} \right)^2 \)

e. \( \frac{1}{3} \div \frac{3}{2} \)

f. \( \frac{2}{11} \div \frac{1}{4} \)

g. \( \frac{5}{6} \div 4 \)

h. \( \frac{3}{4} \div 8 \)

i. \( 10 \times \frac{4}{5} \)

j. \( 24 \times \frac{3}{8} \)

k. \( 12 \div \frac{3}{5} \)

l. \( 2 \div \frac{2}{13} \)
Where does it work?  Your Turn  Fractions

Multiplying and dividing fractions

3. Simplify these without the aid of a calculator, remembering to write the answer in simplest form.

   a. \( \left( \frac{2}{8} \right)^2 \)  
   b. \( \frac{3}{4} \times \frac{3}{2} \)

   c. \( \frac{3}{8} \div \frac{5}{4} \)  
   d. \( \frac{2}{3} \div \frac{5}{3} \)

   e. \( \frac{9}{10} \div \frac{8}{5} \)  
   f. \( \frac{3}{4} \times \frac{2}{3} \times \frac{1}{2} \) psst: same as the others!

   g. \( \frac{2}{5} \times \frac{3}{6} \times \frac{1}{3} \)  
   h. \( \frac{1}{2} \div \frac{4}{1} \div \frac{1}{2} \) psst: work left to right!

4. Is \( \frac{2}{3} \) of \( \frac{4}{6} \) exactly the same as \( \frac{2}{3} \div \frac{12}{8} \)? Explain your answer.
Where does it work?

**Operations with mixed numbers**

Just change to improper fractions then use the same methods as shown earlier.

**Simplify these calculations involving mixed numbers**

### Addition and subtraction

(i) \(1\frac{2}{3} + 2\frac{1}{6}\)

\[
1\frac{2}{3} + 2\frac{1}{6} = \frac{5}{3} + \frac{13}{6}
\]

Change to improper fractions

\[
= \frac{10}{6} + \frac{13}{6}
\]

Equivalent fractions with LCM denominators

\[
= \frac{23}{6}
\]

\[
= 3\frac{5}{6}
\]

Simplify to mixed number

Or just add the whole numbers and the fractions separately.

\[
1 + 2 = 3 \\
\frac{2}{3} + \frac{1}{6} = \frac{5}{6}
\]

(ii) \(4\frac{1}{5} - 1\frac{1}{2}\)

\[
4\frac{1}{5} - 1\frac{1}{2} = \frac{21}{5} - \frac{3}{2}
\]

Change to improper fractions

\[
= \frac{42}{10} - \frac{15}{10}
\]

Equivalent fractions with LCM denominators

\[
= \frac{27}{10}
\]

\[
= 2\frac{7}{10}
\]

Simplify to mixed number

### Multiplication and division

(iii) \(1\frac{3}{4} \times 2\frac{1}{3}\)

\[1\frac{3}{4} \times 2\frac{1}{3} = \frac{7}{4} \times \frac{7}{3}\]

Change to improper fractions

\[
= \frac{49}{12}
\]

Multiply tops and bottoms together

\[
= 4\frac{1}{12}
\]

Simplify to mixed number

(iv) \(1\frac{1}{6} \div 2\)

\[
1\frac{1}{6} \div 2 = \frac{7}{6} \div \frac{2}{1}
\]

Change to improper fractions

\[
= \frac{7}{6} \times \frac{1}{2}
\]

Flip second fraction and change to multiply

\[
= \frac{7}{12}
\]

Multiply numerators and denominators together

Remember

\[
2 = \frac{2}{1}, 3 = \frac{3}{1}, \text{ etc}
\]
Operations with mixed numbers

1. Simplify these additions and subtractions without the aid of a calculator:
   a. \(2 \frac{1}{4} + 4 \frac{2}{3}\)
   b. \(2 \frac{1}{4} - 1 \frac{3}{5}\)
   c. \(5 \frac{3}{5} - 2 \frac{1}{2}\)
   d. \(3 \frac{1}{6} + 1 \frac{1}{7}\)

2. Simplify these without the aid of a calculator:
   a. \(4 \times 1 \frac{2}{5}\)
   b. \(4 \frac{3}{7} \times 2\)
   c. \(1 \frac{3}{4} \times 3 \frac{1}{2}\)
   d. \(5 \frac{1}{3} \times 1 \frac{4}{5}\)

3. Simplify these divisions without the aid of a calculator:
   a. \(3 \div 2 \frac{1}{2}\)
   b. \(1 \frac{2}{3} \div 3\)
   c. \(2 \frac{2}{5} \div 1 \frac{1}{2}\)
   d. \(5 \frac{1}{2} \div 1 \frac{2}{3}\)
Combining all the operations

Earn yourself an awesome passport stamp by trying these trickier questions without using a calculator.

1. Simplify \( \frac{1}{7} + 6 \frac{3}{5} \times 1 \frac{1}{2} \) psst: remember your order of operations

2. Simplify \( 4 \frac{1}{2} \div 3 \frac{5}{6} \times 5 \frac{1}{3} \) psst: work left to right... so do the division first

3. Simplify this shaded diagram into a single fraction. psst: write as fractions, then work left to right

\[
\begin{align*}
\begin{array}{c}
\text{\includegraphics{circle}} & \times & \text{\includegraphics{circle}} & + & \text{\includegraphics{circle}}
\end{array}
\end{align*}
\]
Fractions of an amount

How many links are there in $\frac{2}{5}$ of a chain made using a total of 20 links?

Simplified, this question is just: Find $\frac{2}{5}$ of 20.

\[
\therefore \frac{2}{5} \text{ of } 20 = \frac{2}{5} \times 20 = \frac{2}{5} \times \frac{20}{1} = \frac{40}{5} = 8
\]

\[\therefore \frac{2}{5} \text{ of the 20 links} = 8 \text{ links}\]

Here are some questions that calculate fractions of an amount.

(i) Juliet lost $\frac{1}{4}$ of the 116 songs she had downloaded when a computer virus infected the files. How many songs were not affected by the virus?

\[
\frac{1}{4} \text{ of } 116 \text{ songs} = \frac{1}{4} \times 116 = \frac{1}{4} + \frac{116}{1} = \frac{116}{4} = 29
\]

\[\therefore 116 - 29 = 87 \text{ songs not affected by the virus}\]

(ii) How long is $\frac{7}{10}$ of 1 hour?

\[
\frac{7}{10} \text{ of 1 hour} = \frac{7}{10} \times 60 \text{ minutes} = \frac{7}{10} \times \frac{60}{1} = \frac{420}{10} = 42
\]

\[\therefore \frac{7}{10} \text{ of 1 hour} = 42 \text{ minutes}\]
Fractions of an amount

1. Calculate the amount for each of these, showing all working:
   - \( \frac{1}{5} \) of 20
   - \( \frac{3}{4} \) of 32
   - \( \frac{2}{3} \) of 24
   - \( \frac{5}{6} \) of 42

2. Calculate the amount for each of these by first making the mixed number an improper fraction:
   - psst: the answers will be bigger than the given whole number
   - \( 2 \frac{1}{2} \) of 4
   - \( 1 \frac{4}{5} \) of 15
   - \( 3 \frac{2}{7} \) of 14
   - \( 4 \frac{2}{3} \) of 36

3. Calculate these fractions of quantities, showing all working:
   - How many hours is \( \frac{3}{4} \) of 1 day?
     - 1 day = 24 hours
   - How many grams is \( \frac{3}{10} \) of 2 kilograms?
     - 1 kg = 1000 grams
Fractions of an amount

3 How long is $\frac{5}{6}$ of 2 hours?
1 hour = 60 minutes

4 How far is $\frac{1}{5}$ of 3 kilometres?
1 km = 1000 metres

4 In an orchestra of 60 musicians, $\frac{1}{5}$ were in the brass section. How many brass section players were there?

psst: remember to include a statement answering the question at the end

5 Krista and her team mates each receive $\frac{1}{5}$ of a $900 prize for winning a competition. How much does Krista receive?

6 Hank bought $\frac{2}{7}$ of the 28 towels that were on sale in a shop. How many towels were not bought by Hank?

7 The lead in one brand of HB pencil is $\frac{8}{11}$ graphite. How many grams of non-graphite material are there in this brand if every pencil contains 33 grams of lead?