3.3 Estimating and comparing fractions

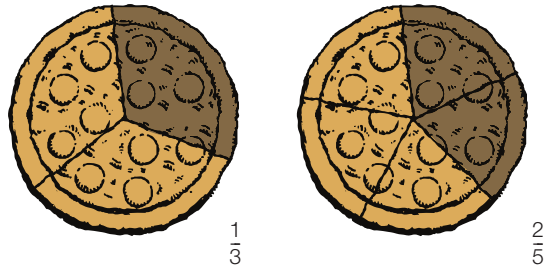
Comparing fractions by using the Lowest Common Denominator (LCD)

If two fractions have the same denominator, it is clear which fraction is bigger.

$\frac{2}{8}$ of a pizza is obviously more pizza than $\frac{1}{8}$ of a pizza. (It is twice as big.)

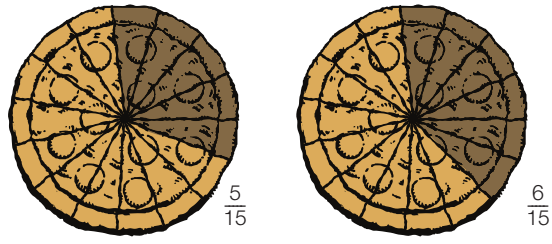
Comparing fractions with different denominators is harder. Having different denominators is like having different-sized pieces of pizza.

For example, which is larger, $\frac{1}{3}$ or $\frac{2}{5}$?



We need to rewrite the fractions so they have the same denominator. This is like cutting the pizza pieces into smaller, but equal-sized pieces. One way to do this is to find the **Lowest Common Denominator (LCD)**. The LCD is the lowest common multiple of the denominators.

Here, the LCD is 15. We cut both pizzas into 15 pieces, then count how many pieces we have of each:



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

$\frac{2}{5}$ is the larger fraction, so we write $\frac{2}{5} > \frac{1}{3}$.

To compare fractions by using the lowest common denominator (LCD):

- find the lowest common multiple of the denominators
- rewrite each fraction as an equivalent fraction with this multiple as the new denominator
- write '>' (greater than), '<' (less than) or '=' (equal to) between the fractions.

If working with mixed numbers, write them as improper fractions first.

Worked Example 9 WE9

By finding the LCD, determine which fraction in each of the following pairs is larger.

(a) $\frac{3}{5}$ or $\frac{4}{7}$ **(b)** $\frac{15}{6}$ or $2\frac{7}{12}$

Thinking			Working
(a)	**1**	Write the list of multiples for each denominator.	(a) $\frac{3}{5}$ or $\frac{4}{7}$ Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40, ... Multiples of 7: 7, 14, 21, 28, 35, 42, 49, ...
	2	Find the lowest common multiple of these denominators (LCD).	LCD = 35
	3	Multiply each fraction to get an equivalent fraction with the LCD as the denominator.	$\frac{3}{5} \times \frac{7}{7} = \frac{21}{35}$ $\frac{4}{7} \times \frac{5}{5} = \frac{20}{35}$
	4	Use < or > to show which of the two fractions is larger.	$\frac{21}{35} > \frac{20}{35}$
	5	Use < or > to show which of the original fractions is larger.	So, $\frac{3}{5} > \frac{4}{7}$
(b)	**1**	Write any mixed numbers as improper fractions.	(b) $2\frac{7}{12} = \frac{31}{12}$ $\frac{15}{6}$ or $\frac{31}{12}$
	2	Find the LCD.	LCD = 12
	3	Multiply to get equivalent fractions with the LCD as the denominator. (Only one fraction needs to be multiplied here.)	$\frac{15}{6} \times \frac{2}{2} = \frac{30}{12}$
	4	Use < or > to show which of the two fractions is larger.	$\frac{30}{12} < \frac{31}{12}$
	5	Use < or > to show which of the original fractions is larger.	So, $\frac{15}{6} < 2\frac{7}{12}$

Comparing fractions by estimating and visualising

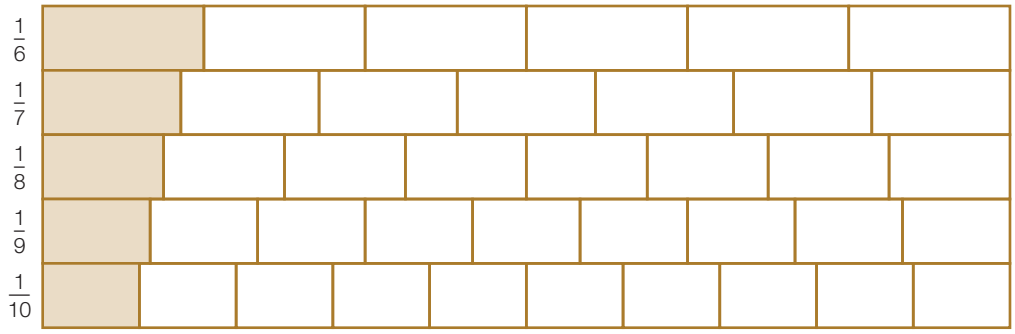
Often, we do not need to know an exact value of a fraction—it is enough to have an estimate. Similarly, when we compare two fractions, we only need to know which fraction is larger, not how much larger it is.

The following strategies can help us visualise what fractions 'look like', so we can estimate and compare them.

Strategy 1 – Compare the denominators

The fraction wall is very useful for comparing fractions. A section of the fraction wall on page 116 is shown here. It shows that as we divide a whole into more parts, the sizes of the parts (the 'bricks' in the wall) get smaller. (You are possibly already aware of this—the more people you share a pizza with, the smaller the amount that each person gets!)

The shaded parts of each layer of the fraction wall demonstrate that: $\frac{1}{6} > \frac{1}{7} > \frac{1}{8} > \frac{1}{9} > \frac{1}{10}$.



Looking at the fraction wall, we can see that:

$\frac{2}{6}$ is slightly larger than $\frac{2}{7}$, and much larger than $\frac{2}{9}$

$\frac{5}{6}$ is larger than $\frac{5}{8}$ and also larger than $\frac{6}{8}$.

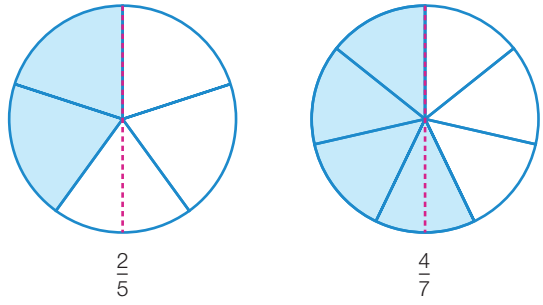
As the denominator numbers get larger, the fraction sizes get smaller.

If two fractions have the same numerator but different denominators, the *larger fraction* is the one with the *smaller number as the denominator*. For example, $\frac{5}{9} > \frac{5}{12}$, $\frac{3}{7} > \frac{3}{8}$.

Strategy 2 – Compare to a common number

Visualise what a common number such as $\frac{1}{2}$, $\frac{1}{4}$, 1 or 2 'looks like' by imagining a shape, such as a circle or a rectangle, with that fraction shaded in. How would your fraction look in comparison? Would it be bigger or smaller?

For example, we can see that $\frac{2}{5} < \frac{4}{7}$ if we compare them to $\frac{1}{2}$.



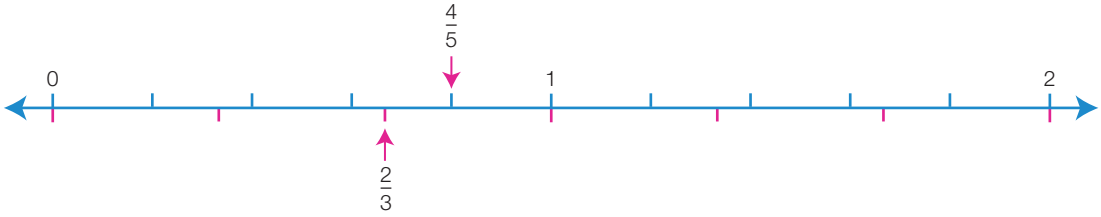
$\frac{2}{5}$ is slightly less than $\frac{1}{2}$ and $\frac{4}{7}$ is slightly greater than $\frac{1}{2}$, so $\frac{2}{5} < \frac{4}{7}$.

Strategy 3 – Compare by using a number line

One number is larger than another if it lies to the right of it on the number line.

It is not always necessary to measure up the number line exactly—sometimes an accurate sketch will be sufficient.

For example, we can show that $\frac{4}{5} > \frac{2}{3}$ by sketching a number line and dividing one side into fifths, and the other side into thirds. We can then show that $\frac{4}{5}$ lies to the right of $\frac{2}{3}$, which means $\frac{4}{5}$ is larger than $\frac{2}{3}$.



3.3 Estimating and comparing fractions

Navigator

Q1 Columns 1–3, Q2, Q3 Columns 1 & 2, Q5, Q7, Q8, Q9, Q10, Q12, Q13, Q15, Q17	Q1 Columns 2 & 3, Q2, Q3 Columns 1–3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q12, Q13, Q14, Q15, Q17	Q1 Column 4, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q16, Q17

Answers page 636

Fluency

WE9

1 By finding the LCD, determine which fraction in each of the following pairs is larger.

(a) $\frac{3}{5}, \frac{7}{15}$ **(b)** $\frac{13}{12}, \frac{5}{4}$ **(c)** $\frac{7}{8}, \frac{5}{6}$ **(d)** $\frac{5}{9}, \frac{7}{12}$

(e) $\frac{2}{3}, \frac{5}{7}$ **(f)** $\frac{1}{6}, \frac{2}{9}$ **(g)** $\frac{3}{8}, \frac{5}{12}$ **(h)** $\frac{7}{4}, \frac{11}{6}$

(i) $1\frac{3}{4}, \frac{11}{8}$ **(j)** $\frac{5}{2}, 2\frac{1}{4}$ **(k)** $\frac{16}{7}, 2\frac{1}{5}$ **(l)** $2\frac{2}{7}, 2\frac{4}{9}$

2 Use the fraction wall on page 116 or 126 to determine which fraction in each of the following pairs is larger.

(a) $\frac{3}{7}$ or $\frac{3}{10}$ **(b)** $\frac{7}{9}$ or $\frac{7}{8}$ **(c)** $\frac{4}{5}$ or $\frac{5}{6}$ **(d)** $\frac{1}{3}$ or $\frac{2}{5}$

(e) $\frac{9}{12}$ or $\frac{3}{4}$ **(f)** $\frac{5}{11}$ or $\frac{4}{9}$ **(g)** $\frac{6}{7}$ or $\frac{7}{8}$ **(h)** $\frac{3}{5}$ or $\frac{7}{11}$

3 Copy the following fraction pairs. Use any appropriate strategy to decide which fraction is larger, and place < or > between them. If the fractions are equivalent, write = between them.

(a) $\frac{2}{7}$ _____ $\frac{5}{7}$ **(b)** $\frac{4}{5}$ _____ $\frac{4}{7}$ **(c)** $\frac{1}{2}$ _____ $\frac{5}{8}$ **(d)** $\frac{8}{11}$ _____ $\frac{9}{10}$

(e) $\frac{2}{4}$ _____ $\frac{3}{6}$ **(f)** $\frac{6}{12}$ _____ $\frac{7}{10}$ **(g)** $\frac{3}{7}$ _____ $\frac{5}{8}$ **(h)** $\frac{5}{9}$ _____ $\frac{2}{5}$

(i) $\frac{5}{6}$ _____ $\frac{7}{8}$ **(j)** $\frac{7}{11}$ _____ $\frac{8}{10}$ **(k)** $\frac{6}{10}$ _____ $\frac{3}{5}$ **(l)** $\frac{4}{5}$ _____ $\frac{6}{9}$

(m) $\frac{2}{4}$ _____ $\frac{4}{2}$ **(n)** $\frac{24}{6}$ _____ $\frac{8}{2}$ **(o)** $\frac{18}{11}$ _____ $\frac{9}{5}$ **(p)** $\frac{9}{7}$ _____ $\frac{11}{9}$

Understanding

4 **(a)** Draw a number line from 0 to 2. Indicate the approximate positions of the following fractions on the number line, then use the number line to write the fractions in ascending order (smallest to largest). $\frac{3}{4}, \frac{2}{3}, \frac{6}{4}, 1\frac{1}{3}$

(b) Draw a number line from 0 to 3. Indicate the approximate positions of the following fractions on the number line, then use the number line to write the fractions in descending order (largest to smallest). $\frac{5}{2}, \frac{1}{2}, \frac{4}{10}, 1\frac{7}{10}$

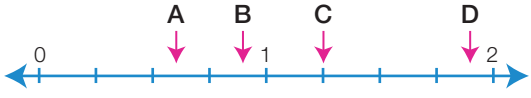
5 Ali gets 7 out of 8 shots at goal in the basket. Joseph gets 10 out of 12 shots in. By comparing fractions, determine who is the more accurate shooter.

6 In a box containing 16 chocolates, 5 of them contain nuts. A larger box with 64 of the same brand of chocolates contains 23 nut chocolates. Which box contains the greater fraction of chocolates with nuts?

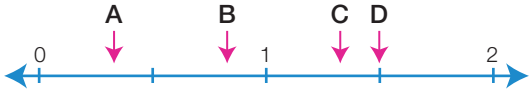
7 Use the fraction wall on page 116 to determine which fraction or fractions on the wall lie in-between the following (include all equivalent fractions).

(a) $\frac{9}{10}$ and $\frac{11}{12}$ **(b)** $\frac{5}{8}$ and $\frac{7}{10}$ **(c)** $\frac{3}{8}$ and $\frac{4}{9}$ **(d)** $\frac{2}{11}$ and $\frac{3}{11}$

8 **(a)** Which arrow is pointing closest to the location of $\frac{9}{10}$ on this number line?



(b) Which arrow is pointing closest to the location of $1\frac{1}{3}$?



9 **(a)** Which one of the following is closest to $\frac{5}{8}$?

A $\frac{2}{9}$ **B** $\frac{1}{3}$ **C** $\frac{1}{2}$ **D** $\frac{7}{8}$

(b) Which one of the following is closest to 2?

A $\frac{11}{12}$ **B** $\frac{3}{2}$ **C** $\frac{7}{4}$ **D** $\frac{7}{3}$

Reasoning

10 Write each of these lists in ascending order (from smallest to largest). Explain using a series of brief points, or steps, how you decided the order.

(a) $\frac{2}{3}, \frac{5}{6}, \frac{7}{8}, \frac{1}{2}, \frac{3}{4}, \frac{10}{11}$

(b) $\frac{4}{7}, 1, \frac{7}{4}, \frac{6}{7}, \frac{7}{8}, 0$

11 Write each of these lists in descending order (from largest to smallest). Explain briefly how you decided the order.

(a) $\frac{4}{7}, \frac{2}{9}, \frac{2}{3}, 1, \frac{11}{21}, \frac{45}{63}$

(b) $\frac{21}{16}, 1\frac{3}{80}, \frac{5}{4}, 1\frac{7}{20}, \frac{39}{40}, 1\frac{3}{10}$

12 **(a)** Estimate the fraction of the Australian flag that is blue.

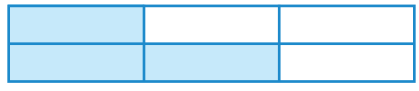
(b) Estimate the fraction of Australia that is taken up by the state of Queensland.

(c) Estimate the fraction of this jug that has cordial in it.

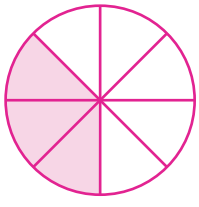
13 For each of the following pairs of identical shapes, state whether the fraction of the shape that is shaded is larger in **A** or in **B**. If the fraction shaded is the same in **A** and in **B** write 'same'.

(a) **A**

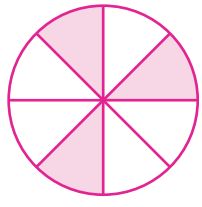
B



(b) **A**



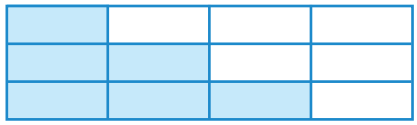
B



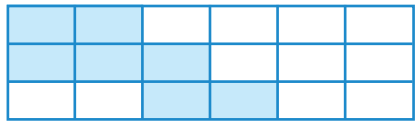
(c) **A**

B

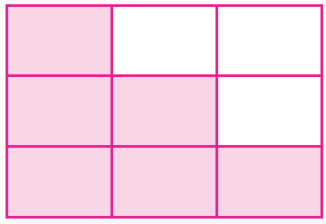
(d) A



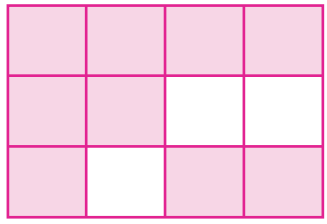
B



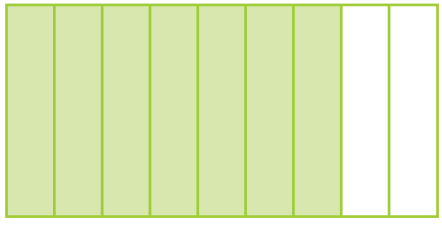
(e) A



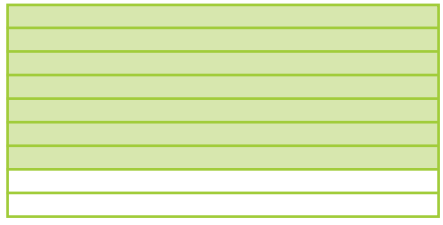
B



(f) A



B



14 Angus has 100 mL left of his 500 mL bottle of cola. Gianni has 50 mL left in his 300 mL bottle.

(a) Who has drunk more cola?

(b) Who has drunk a greater fraction of the cola in their bottle?

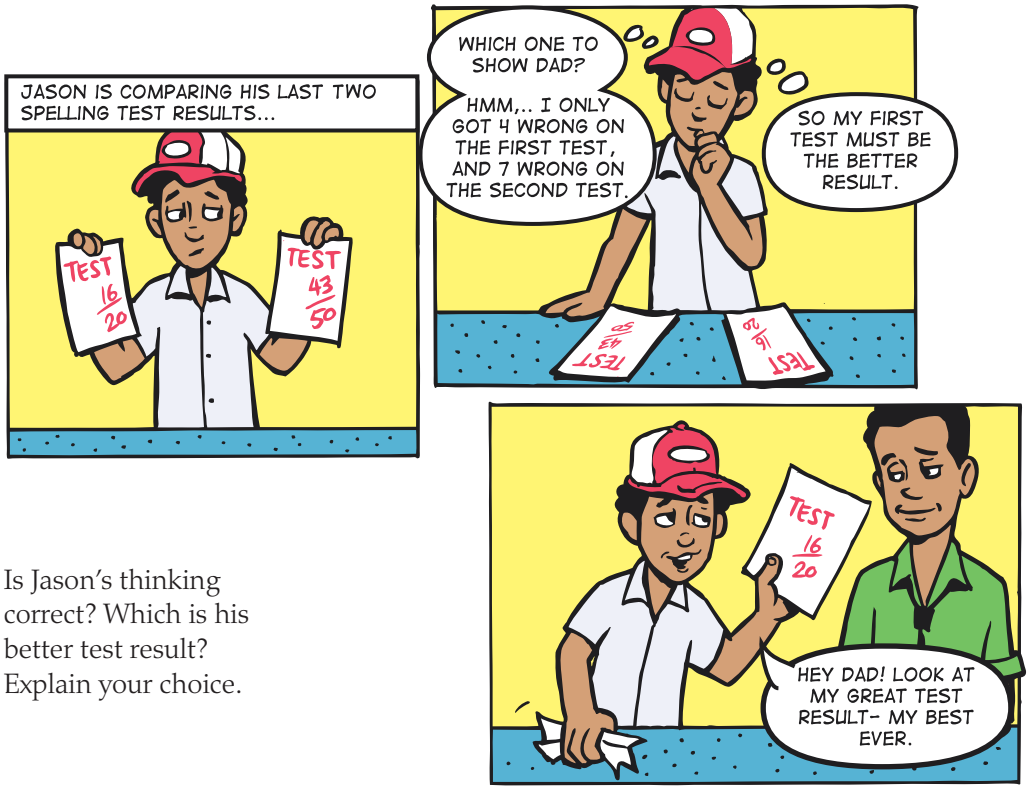
Open-ended

15 **(a)** A proper fraction is greater than $\frac{3}{4}$ but less than 1. What might the fraction be? Give two possibilities.

(b) An improper fraction is greater than 2 but less than 3. What might the fraction be? Give two possibilities.

16 Write three fractions that are greater than $\frac{3}{5}$ and less than $\frac{4}{5}$.

17



Is Jason's thinking correct? Which is his better test result? Explain your choice.

Outside the Square Game

Flatlining

Equipment required: 2 brains, 1 die, small counters of two different colours or pieces of paper marked with different colours or the players' initials

How to win:
The first player to get three circles in a row on the number line is the winner.

How to play:
Decide who will go first.

Either use the number line shown or draw an accurate copy in your book.

On your turn, roll the die and look up the number you rolled in the table. Choose one of the fractions from the list. Locate that fraction's approximate position on the number line and occupy the circle above it with one of your counters or pieces of paper.

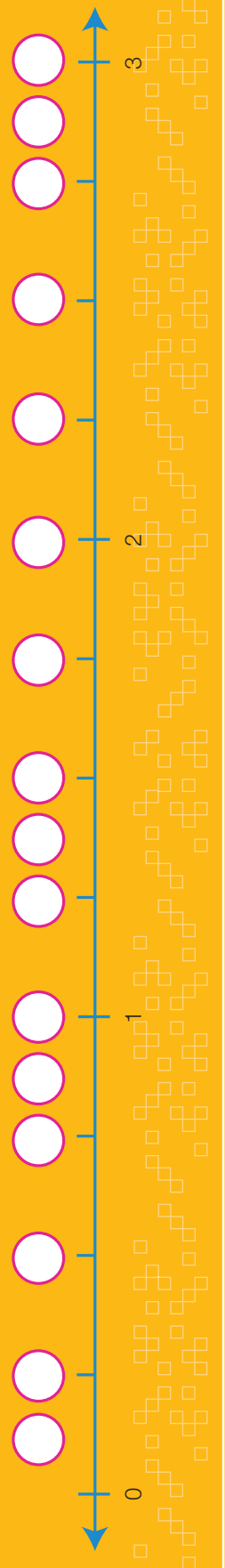
If you can't occupy a circle you miss your turn.

Make sure your opponent locates their fraction correctly.

Once a circle is filled it cannot be taken by another player.

If all of the circles have been occupied and neither player has three circles in a row, then the game is a draw.

Dice roll	Fractions to choose from		
1	$\frac{1}{4}$	$1\frac{1}{2}$	$\frac{7}{4}$
2	$\frac{1}{2}$	$\frac{5}{4}$	$2\frac{4}{5}$
3	$\frac{4}{3}$	$\frac{3}{4}$	$\frac{9}{4}$
4	3	$\frac{4}{5}$	$\frac{5}{2}$
5	2	$\frac{11}{4}$	$\frac{3}{3}$
6	1	$\frac{1}{5}$	$1\frac{3}{4}$

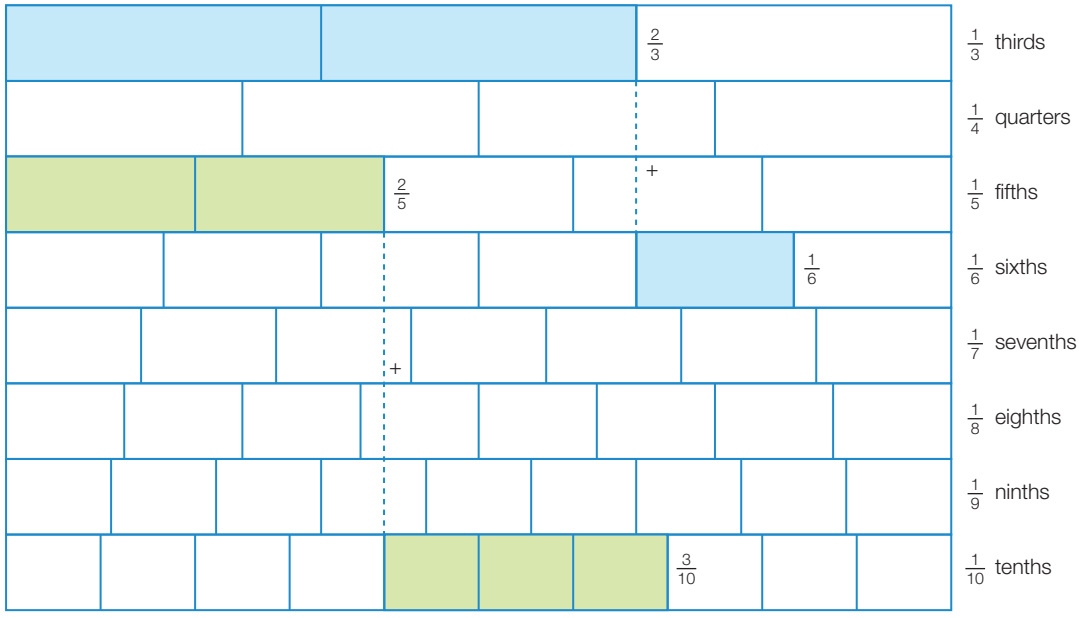


3.4 Adding and subtracting fractions

The fraction wall can be useful for learning to add fractions.

For example, we can show $\frac{2}{3} + \frac{1}{6}$ by moving along the wall to $\frac{2}{3}$, then along $\frac{1}{6}$ to arrive at $\frac{5}{6}$. This sum is shaded in blue on the fraction wall below.

We can also show $\frac{2}{5} + \frac{3}{10}$ by moving along the wall to $\frac{2}{5}$, then along $\frac{3}{10}$ to arrive at $\frac{7}{10}$. This sum is shaded in green on the fraction wall below.



These additions are quite straightforward as the second fraction joins exactly onto the end of the first. This is because the denominators of the two fractions are related—we can write one of the fractions as an equivalent fraction with the same denominator as the second fraction.

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

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

To add or subtract fractions, we must have fractions with the same denominator. If the denominators are the same, the size of the fraction parts is the same, and we can simply count how many of each part we have.

For example: $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$ $\frac{3}{7} - \frac{2}{7} = \frac{1}{7}$.

Adding or subtracting fractions with different, unrelated denominators requires some additional steps. Before we can add, we need to change both fractions into equivalent fractions with the same denominator. This new denominator will be a multiple of the denominators of the original fractions. The lowest common denominator (LCD) is often the most efficient one to use.

For example: $\frac{1}{3} + \frac{2}{5}$ LCD = 15

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

Each fraction is now written in fifteenths, so we can count how many fifteenths there are:

$\frac{5}{15} + \frac{6}{15} = \frac{11}{15}$

Estimating answers to fraction problems

To check whether your answer to a fraction addition or subtraction is 'reasonable', estimate the answer before doing the calculation.

For example, the answer to $\frac{3}{5} + \frac{3}{7}$ will be approximately 1, as $\frac{3}{5}$ is slightly bigger than $\frac{1}{2}$ and $\frac{3}{7}$ is slightly smaller. (The actual answer is $\frac{36}{35}$ or $1\frac{1}{35}$, which is very close to 1.)

Worked Example 10

WE 10

Calculate the following, giving your answers in simplest form. Use estimation to judge whether your answers are reasonable.

(a) $\frac{2}{3} + \frac{3}{4}$ **(b)** $\frac{7}{10} - \frac{1}{5}$

Thinking		Working
(a)	**1** Estimate the answer first. (Here, both fractions are greater than $\frac{1}{2}$ but less than 1. The answer should lie between 1 and 2.)	(a) Estimate: between 1 and 2
	2 Rewrite the fractions with the LCD as the denominator by multiplying the numerators and denominators by the necessary factors. (In this case, 4 and 3.)	$\frac{2}{3} + \frac{3}{4}$ LCD = 12 $= \frac{8}{12} + \frac{9}{12}$
	3 Add the numerators.	$= \frac{17}{12}$
	4 Write the answer as a mixed number if appropriate.	$= 1\frac{5}{12}$
	5 Check your answer against your estimate. Is it reasonable?	Reasonable

(b) **1**	Estimate the answer first. (Here, we are subtracting $\frac{1}{5}$ from a fraction that is less than 1, so the answer will be about $\frac{1}{2}$.)	(b) Estimate: about $\frac{1}{2}$
2	Rewrite the fractions with the LCD as the denominator by multiplying the numerators and denominators by the necessary factors. (Here, only one fraction needs to be rewritten.)	$\frac{7}{10} - \frac{1}{5}$ LCD = 10 $= \frac{7}{10} - \frac{2}{10}$
3	Subtract the numerators.	$= \frac{5}{10}$
4	Simplify the answer.	$= \frac{1}{2}$
5	Check your answer against your estimate. Is it reasonable?	Exact

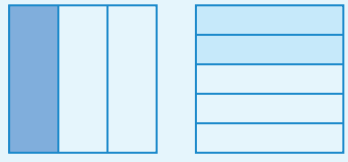
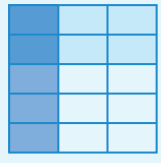
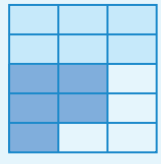
The grid method

The grid method is a visual way of adding fractions, as demonstrated in the following Worked Example (however, it does not work so well for subtracting fractions).

Worked Example 11

WE11

Add $\frac{1}{3}$ and $\frac{2}{5}$ by using the grid method.

Thinking	Working
1 Draw two identical squares or rectangles. Divide them up and shade in each fraction.	$\frac{1}{3} + \frac{2}{5}$ 
2 Lay one square or rectangle on top of the other to form a grid.	
3 Where the grid squares are shaded twice due to overlap, shade an equal number of blank grid squares to 'remove' the overlap. The resultant shaded grid represents the fraction sum.	
4 Write the answer to the fraction sum.	$\frac{11}{15}$

Adding and subtracting mixed numbers

To add or subtract mixed numbers, we can either:

- add or subtract the whole number parts and fraction parts separately (Method 1), or
- convert the mixed numbers to improper fractions, then add or subtract them in the usual way (Method 2).

Worked Example 12 WE12

Calculate $4\frac{5}{6} + 2\frac{3}{4}$. Write your answer as a mixed number in simplest form.

Method 1: Add wholes and fractions separately

Thinking	Working
1 Estimate the answer first. Here, we have 6 wholes, and 2 fractions that are each bigger than $\frac{1}{2}$. The answer lies between 7 and 8.	Estimate: between 7 and 8 $4\frac{5}{6} + 2\frac{3}{4}$
2 Rearrange the addition by separating the whole numbers from the fractions.	$= 4 + 2 + \frac{5}{6} + \frac{3}{4}$
3 Add the whole numbers.	$= 6 + \frac{5}{6} + \frac{3}{4}$
4 Rewrite the fractions with the LCD as the denominator.	$= 6 + \frac{10}{12} + \frac{9}{12}$
5 Add the fractions and simplify if possible.	$= 6 + \frac{19}{12}$
6 If the fraction sum is an improper fraction, convert it to a mixed number.	$= 6 + 1\frac{7}{12}$
7 Add the whole numbers.	$= 7\frac{7}{12}$
8 Check your answer against your estimate. Is it reasonable?	Reasonable

Method 2: Use improper fractions

Thinking	Working
1 Estimate the answer first. Here, we have 6 wholes, and 2 fractions that are bigger than $\frac{1}{2}$. The answer lies between 7 and 8.	Estimate: between 7 and 8 $4\frac{5}{6} + 2\frac{3}{4}$
2 Write the mixed numbers as improper fractions.	$= \frac{29}{6} + \frac{11}{4}$
3 Rewrite the fractions with the LCD as the denominator.	$= \frac{58}{12} + \frac{33}{12}$
4 Add the numerators, simplify if possible.	$= \frac{91}{12}$
5 Convert to a mixed number.	$= 7\frac{7}{12}$

Worked Example 13

WE13

Calculate $6\frac{5}{8} - 2\frac{3}{4}$. Write your answer as a mixed number in simplest form.

Method 1: Subtract wholes and fractions separately

Thinking	Working
1 Estimate the answer first. Here, we are subtracting $2\frac{3}{4}$ from a number less than $6\frac{3}{4}$, so the answer will be less than 4.	Estimate: less than 4 $6\frac{5}{8} - 2\frac{3}{4}$
2 Rearrange the subtraction by separating the whole numbers from the fractions.	$= 6 - 2 + \frac{5}{8} - \frac{3}{4}$
3 Subtract the whole numbers.	$= 4 + \frac{5}{8} - \frac{3}{4}$
4 Rewrite the fractions with the LCD as the denominator.	$= 4 + \frac{5}{8} - \frac{6}{8}$
5 Subtract the fractions. If you cannot do the subtraction without getting a negative answer, 'borrow' 1 whole. (Here, 1 whole is $\frac{8}{8}$.)	$= 3 + \frac{8}{8} + \frac{5}{8} - \frac{6}{8}$ $= 3 + \frac{13}{8} - \frac{6}{8}$
6 Write the answer and simplify it if possible.	$= 3\frac{7}{8}$
7 Check your answer against your estimate. Is it reasonable?	Reasonable

Method 2: Use improper fractions

Thinking	Working
1 Make an estimate of the answer first, as for Method 1.	Estimate: less than 4 $6\frac{5}{8} - 2\frac{3}{4}$
2 Write the mixed numbers as improper fractions.	$= \frac{53}{8} - \frac{11}{4}$
3 Rewrite the fractions with the LCD as the denominator (only one fraction needs to be rewritten here).	$= \frac{53}{8} - \frac{22}{8}$ LCD = 8
4 Subtract the numerators.	$= \frac{31}{8}$
5 Simplify, if possible, and write your answer as a mixed number.	$= 3\frac{7}{8}$
6 Check your answer against your estimate. Is it reasonable?	Reasonable

Working with fractions on a calculator

The key that can be used for entering fractions into your calculator will often look something like this $\square\!\!\square$. To enter a fraction, press $\square\!\!\square$, then key in the numerator and the denominator, using the cursor keys to move between them. To enter a mixed number, press SHIFT $\square\!\!\square$.

On some calculators, the key looks like this: $a\,b/c$, or this a/b. To enter a fraction, such as $\frac{5}{6}$, type 5 $a\,b/c$ 6. You may need to press = for the fraction to be displayed on the screen. To enter a mixed number, such as $4\frac{3}{8}$, press 4 $a\,b/c$ 3 $a\,b/c$ 8.

The screen will use symbols such as ⌐, ⌙, or _ to separate the whole numbers, numerator and denominator.

Check that you can work with fractions correctly on your calculator by entering some additions and subtractions for which you already know the answers. For example, if you enter $\frac{3}{8} + 1\frac{2}{3}$ correctly, the answer of $2\frac{1}{24}$ will appear on the screen.

If you want to convert a mixed number that you have already entered to an improper fraction, press SHIFT and the $a\,b/c$ key, or SHIFT and the S⇔D key. (You might need to press = to see the result.)

You will also notice that pressing the S⇔D key, or pressing the $a\,b/c$ key twice converts a fraction to its decimal form.

3.4 Adding and subtracting fractions

Navigator

Q1 Columns 1 & 2, Q2, Q3 Columns 1 & 2, Q4 Columns 1 & 2, Q5 Column 1, Q6, Q7, Q8, Q10, Q13, Q14, Q16, Q17	Q1 Columns 2 & 3, Q2, Q3 Columns 2 & 3, Q4 Columns 2 & 3, Q5 Column 2, Q6, Q8, Q9, Q10, Q11, Q13, Q14, Q15, Q16, Q17	Q1 Column 4, Q3 Columns 3 & 4, Q4 Columns 3 & 4, Q5 Column 3, Q6, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17

Answers page 637

Fluency

WE10

1 Calculate the following, giving your answers in simplest form. Use estimation to judge whether your answers are reasonable.

(a) $\frac{5}{14} + \frac{1}{7}$ (b) $\frac{2}{5} - \frac{7}{20}$ (c) $\frac{5}{8} - \frac{7}{40}$ (d) $\frac{4}{55} + \frac{2}{11}$

(e) $\frac{5}{6} + \frac{1}{3}$ (f) $\frac{15}{49} + \frac{5}{7}$ (g) $\frac{3}{5} + \frac{13}{20}$ (h) $\frac{3}{4} + \frac{1}{5}$

(i) $\frac{1}{4} - \frac{1}{6}$ (j) $\frac{5}{9} + \frac{3}{4}$ (k) $\frac{1}{6} + \frac{3}{7}$ (l) $\frac{11}{15} + \frac{7}{20}$

(m) $\frac{11}{12} + \frac{3}{10}$ (n) $\frac{23}{30} - \frac{7}{20}$ (o) $\frac{3}{5} + \frac{9}{14}$ (p) $\frac{41}{45} - \frac{11}{18}$

WE11

2 Add the following fractions by using the grid method.

(a) $\frac{2}{3}+\frac{1}{2}$ (b) $\frac{3}{4}+\frac{1}{7}$

WE12

3 Calculate the following. Write your answers as mixed numbers in simplest form.

(a) $3\frac{1}{7}+4\frac{2}{7}$ (b) $8\frac{1}{9}+5\frac{5}{9}$ (c) $2\frac{3}{8}+7\frac{1}{4}$ (d) $6\frac{7}{10}+1\frac{1}{5}$

(e) $1\frac{3}{4}+1\frac{1}{2}$ (f) $3\frac{1}{5}+2\frac{9}{10}$ (g) $4\frac{1}{2}+2\frac{3}{4}$ (h) $1\frac{7}{12}+7\frac{2}{3}$

(i) $6\frac{4}{5}+5\frac{1}{2}$ (j) $3\frac{8}{9}+7\frac{1}{6}$ (k) $1\frac{4}{11}+3\frac{2}{5}$ (l) $1\frac{4}{25}+2\frac{3}{20}$

WE13

4 Calculate the following. Write your answers as mixed numbers in simplest form.

(a) $3\frac{5}{7}-2\frac{1}{7}$ (b) $3\frac{2}{9}-2\frac{5}{9}$ (c) $5\frac{7}{9}-1\frac{1}{3}$ (d) $7\frac{11}{12}-6\frac{1}{4}$

(e) $3\frac{1}{12}-1\frac{5}{6}$ (f) $4\frac{7}{10}-2\frac{1}{5}$ (g) $4\frac{1}{10}-2\frac{4}{5}$ (h) $6\frac{1}{18}-4\frac{1}{6}$

(i) $2\frac{1}{9}-1\frac{1}{6}$ (j) $2\frac{1}{4}-1\frac{2}{5}$ (k) $2\frac{1}{8}-1\frac{1}{6}$ (l) $5\frac{1}{8}-2\frac{2}{3}$

Did you know?
5 out of 4 people don't understand jokes about fractions!

5 Find the following. You might like to use your calculator to check your answers.

(a) $\frac{3}{8}+\frac{1}{6}+\frac{1}{3}$ (b) $\frac{1}{2}+\frac{3}{4}-\frac{1}{3}$ (c) $\frac{7}{10}+\frac{4}{5}-\frac{1}{2}$

(d) $1\frac{1}{2}+\frac{2}{5}+2\frac{3}{10}$ (e) $2\frac{1}{3}+5\frac{3}{4}-1\frac{2}{5}$ (f) $3\frac{1}{4}+2\frac{1}{5}-3\frac{1}{3}$

6 (a) $\frac{5}{8}-\frac{1}{3}=$

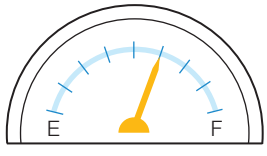
A $\frac{4}{24}$ B $\frac{7}{24}$ C $\frac{4}{5}$ D $\frac{23}{24}$

(b) $1\frac{2}{3}+\frac{3}{20}=$

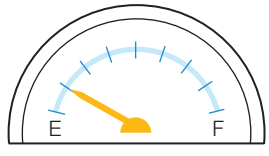
A $1\frac{1}{17}$ B $1\frac{5}{23}$ C $1\frac{5}{20}$ D $1\frac{49}{60}$

Understanding

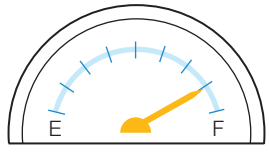
7 When Eric got in his car and started driving, his fuel gauge looked like this:



Eric stopped to get petrol when his fuel gauge looked like this:



After putting some petrol in his car, Eric's fuel gauge looked like this:



Write a fraction addition or a subtraction to answer the following.

(a) What fraction of the tank of fuel did Eric use between the first two gauge readings? Write your answer in simplest form.

(b) What fraction of the tank of petrol did Eric add when he was at the petrol station? Write your answer in simplest terms.

8 What fraction of a large pizza was eaten if Steven had $\frac{5}{12}$ of the pizza and Lara had $\frac{1}{3}$ of it? Write your answer in simplest form.

9 Jaydeep, Corey and Isaac were sharing the driving on a trip along the coast. If Jaydeep drove $\frac{3}{5}$ of the distance and Isaac drove $\frac{3}{20}$, what fraction of the total distance did Corey drive?

10 Belinda worked part-time at a fast food restaurant. Her hours for the three days she worked one week were: $2\frac{1}{4}$, $3\frac{1}{2}$ and $4\frac{1}{3}$. Calculate the total number of hours she worked for the week.

11 Five large packets of cereal were bought for a Year 7 camp. On the first day $1\frac{1}{3}$ packets were eaten, on the second day $\frac{3}{4}$ of a packet was eaten and on the third day $2\frac{1}{6}$ packets were eaten. How much cereal was available for the fourth day?

Reasoning

12 A fraction is added to $\frac{3}{5}$. The lowest common denominator for the two fractions is 40. Which of the following fractions was added?

A $\frac{2}{6}$ **B** $\frac{3}{8}$ **C** $\frac{13}{20}$ **D** $\frac{11}{15}$

13 A fraction is added to $\frac{3}{10}$. Which of the following would give an improper fraction as the result?

A $\frac{7}{15}$ **B** $\frac{7}{12}$ **C** $\frac{3}{5}$ **D** $\frac{18}{25}$

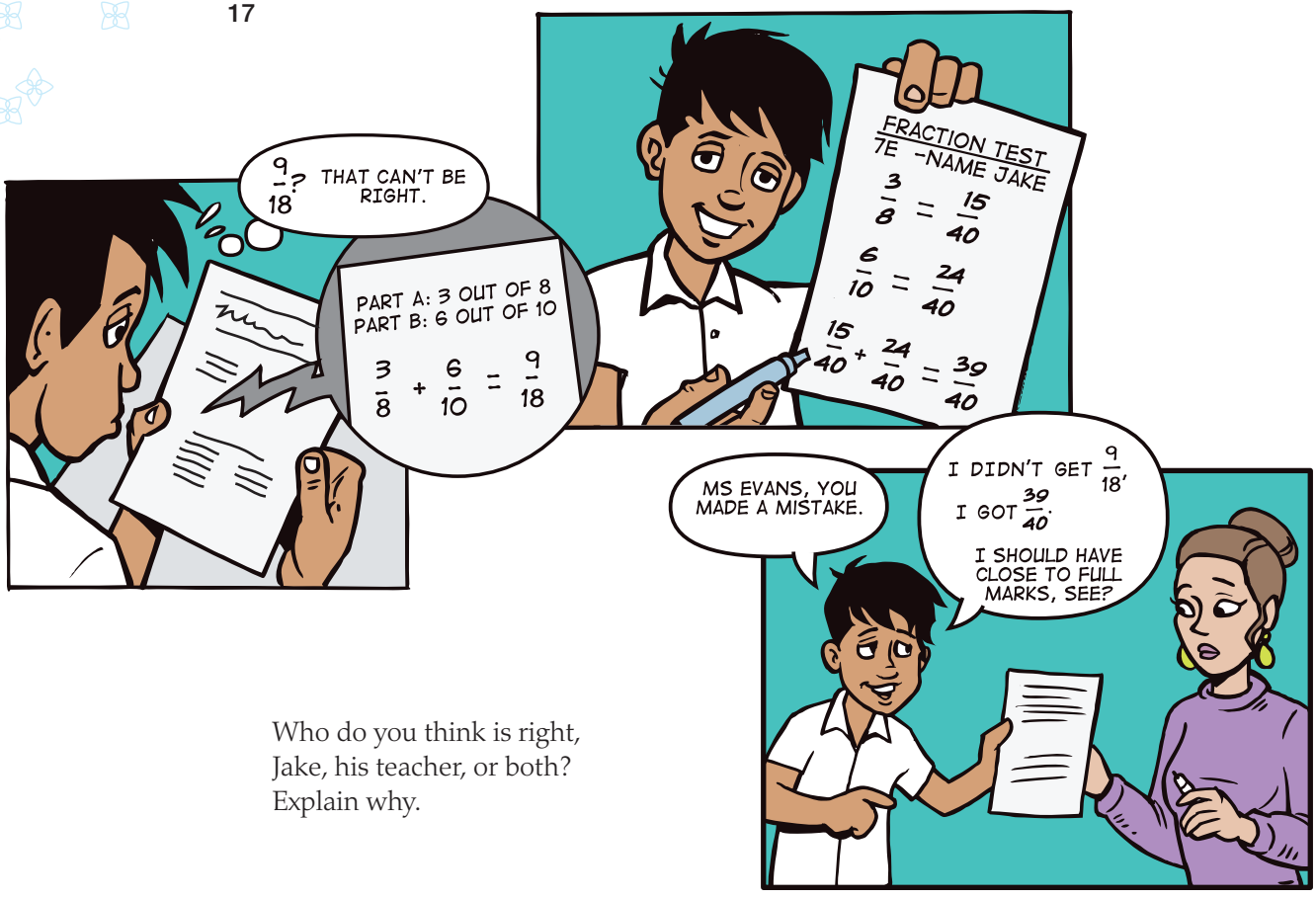
Open-ended

14 This question appeared on a Year 7 maths test: 'What whole number is $\frac{7}{8} + \frac{12}{13}$ approximately equal to?' Several students answered 19 or 21, both of which are incorrect. How might the students have arrived at their incorrect answers? Describe how you could use estimation to arrive at the correct answer.

15 Find two fractions that add to $\frac{3}{4}$ and do not have a denominator of 4.

16 Use a diagram to help you explain why $\frac{3}{10} + \frac{4}{10} = \frac{7}{10}$, not $\frac{7}{20}$. Why do we add the numerators, but not the denominators?

17



Who do you think is right, Jake, his teacher, or both? Explain why.

Outside the Square Game

Race to 10

Equipment required: 2 brains, 2 dice

How to win:
The aim is to be the person to get to a total as close to 10 as possible. Beware, because if you go over 10 you are out!

How to play:

On your turn, roll both dice. Choose one number to represent the numerator of a fraction and the other to represent the denominator. It is your choice whether you make a proper or an improper fraction.

For example: Die A rolls 5, Die B rolls 4, so the fraction is either $\frac{5}{4}$ or $\frac{4}{5}$.

Take it in turns to roll and keep a running total by adding your fractions as you go. When your total is as close to 10 as you dare, say 'I'll sit' when it comes to your turn. If you choose to roll and your total goes over 10, you are out.

Play the best of three games.

Half-time 3

1 There are 15 cookies in a bag.

Ex.3.1

(a) If I eat 7 cookies, what fraction of the total cookies is this?

(b) If I eat $\frac{2}{5}$ of the cookies in the bag, how many cookies do I eat?

2 Simplify the following.

Ex.3.2

(a) $\frac{18}{48}$ **(b)** $\frac{9}{36}$ **(c)** $3\frac{9}{12}$ **(d)** $7\frac{35}{50}$

3 Convert the following improper fractions to whole numbers or mixed numbers.

Ex.3.2

(a) $\frac{27}{4}$ **(b)** $\frac{40}{8}$ **(c)** $\frac{50}{10}$ **(d)** $\frac{37}{7}$

4 Determine which fraction in each of these pairs is the larger number, and write a < or > sign between them. If they are equivalent, write an '=' sign between them.

Ex.3.3

(a) $\frac{5}{8}$ ____ $\frac{2}{3}$ **(b)** $\frac{4}{9}$ ____ $\frac{15}{27}$ **(c)** $\frac{48}{56}$ ____ $\frac{6}{7}$ **(d)** $\frac{11}{5}$ ____ $\frac{9}{4}$

5 Draw a number line from 0 to 2. Divide the bottom side of the number line into quarters and the top side into eighths.

Ex.3.1, 3.2, 3.3

(a) Show the positions of these fractions with a labelled arrow: $\frac{3}{4}, \frac{5}{8}, \frac{5}{4}, \frac{9}{8}, \frac{7}{4}, \frac{14}{8}$.

(b) Identify five pairs of equivalent fractions that are shown on the number line.

(c) Use the number line to determine which fraction out of the following pairs is larger.

(i) $\frac{5}{4}$ or $\frac{9}{8}$ **(ii)** $\frac{11}{8}$ or $\frac{7}{4}$.

6 Calculate the following, writing your answers in simplest form.

Ex.3.4

(a) $\frac{3}{8}+\frac{3}{4}$ **(b)** $\frac{7}{15}-\frac{3}{10}$ **(c)** $\frac{7}{9}+\frac{5}{6}$ **(d)** $\frac{11}{18}-\frac{5}{12}$

7 Place the following in ascending order by first locating them on a number line.

Ex.3.3

$\frac{1}{3}, \frac{6}{3}, \frac{7}{4}, -\frac{3}{4}, 1\frac{2}{3}$

8 7 pizzas were each sliced into 6 equal pieces.

Ex.3.2

(a) If $4\frac{5}{6}$ of the pizzas were eaten, how many slices was that?

(b) If $3\frac{1}{2}$ of the pizzas were eaten, how many slices were left over?

9 Calculate the following.

Ex.3.4

(a) $2\frac{7}{12}+2\frac{1}{10}$ **(b)** $1\frac{16}{25}+2\frac{13}{20}$ **(c)** $2\frac{13}{20}-1\frac{3}{100}$ **(d)** $3\frac{9}{10}-2\frac{8}{25}$

10 Dave is leading a group of 12 people on a bushwalk. He has brought 30 L of water to supply the group.

Ex.3.1, 3.2

(a) How many litres does each group member receive? Write your answer as both an improper fraction and as a mixed number in simplest form.

Ex.3.4

(b) One of the group members has drunk $\frac{3}{4}$ of a litre by lunchtime. How many litres do they have left?