UNIT 5

Fractions, Ratios,

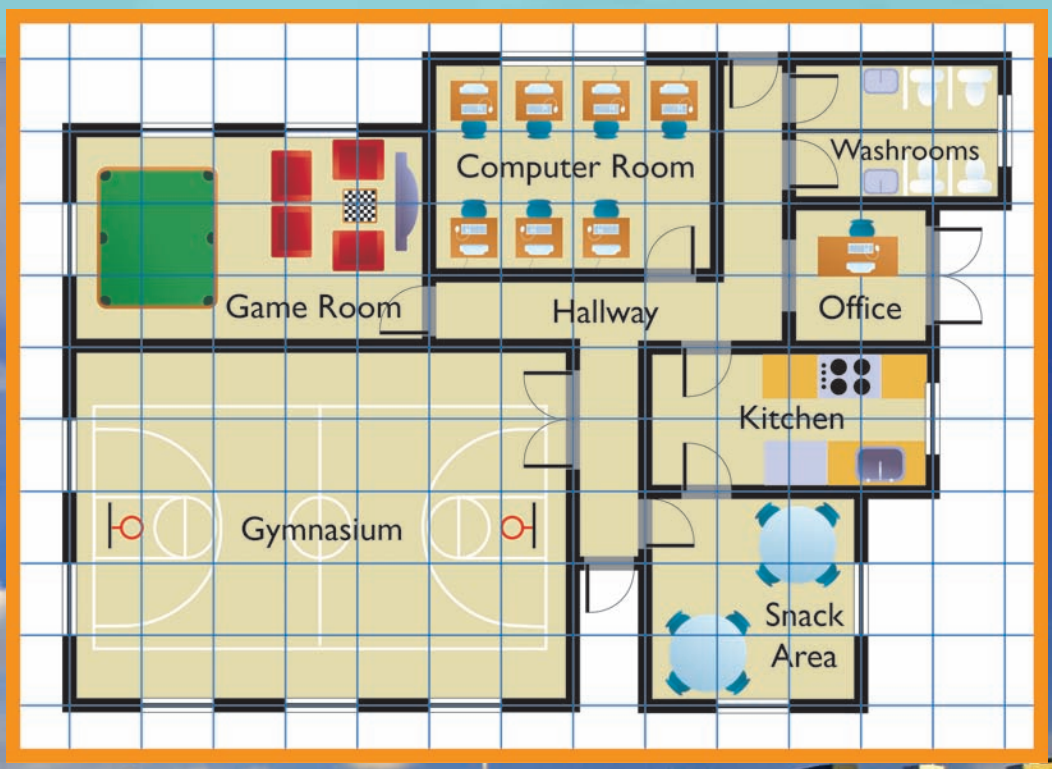
Designing a Floor Plan

This is a floor plan for a Youth Centre to be built in Vancouver, British Columbia. What is the total area of the floor plan?

Learning Goals

- relate improper fractions to mixed numbers
- compare mixed numbers and fractions
- use ratios for part-to-part and part-to-whole comparisons
- explore equivalent ratios
- explore percents
- relate percents to fractions and decimals

and Percents



Key Words

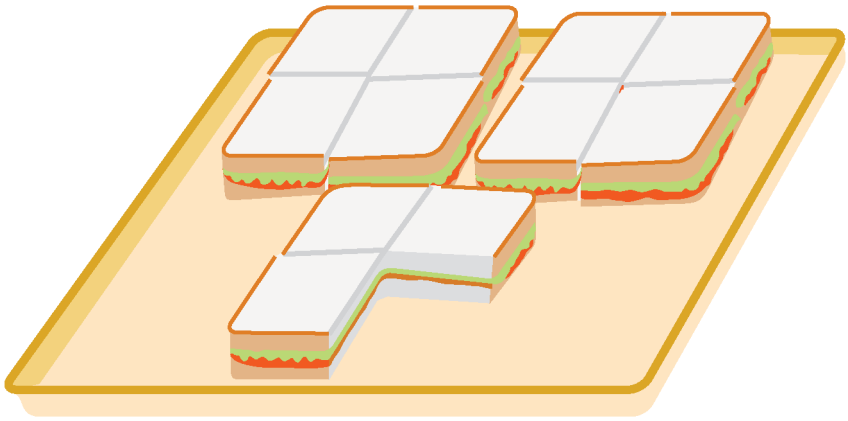
- improper fraction
- mixed number
- ratio
- part-to-part ratio
- part-to-whole ratio
- terms of a ratio
- equivalent ratios
- percent

- Which room takes up the most space? The least space?
  What fraction of the entire floor plan does each room cover?
- Which room takes up $\frac{15}{100}$ of the floor plan?
  What is an equivalent fraction for $\frac{15}{100}$?
- Which 2 rooms together take up 0.5 of the floor plan?
  What fraction of the floor plan is 0.5?
- Which room is one-half the size of the kitchen?

LESSON 1

Mixed Numbers

How would you describe the number of sandwiches on the tray?



Explore

You will need Pattern Blocks and triangular grid paper.
Use Pattern Blocks to show fractions greater than 1 whole.
Use the yellow Pattern Block as 1 whole.

- Take a handful of red, blue, and green Pattern Blocks. Choose a colour. Arrange the blocks to show how many yellow hexagons you could cover. Name the amount covered in different ways. Record your work on grid paper.
- Repeat the activity with another colour of Pattern Blocks.

Show *and* Share

Share your work with another pair of students.
Did you draw the same pictures? Explain.
How did you decide what to name the amounts covered?
Which Pattern Blocks did you not use? Why not?

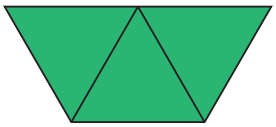
Connect

You can use whole numbers and fractions to describe amounts greater than 1.

Suppose the red trapezoid is 1 whole.

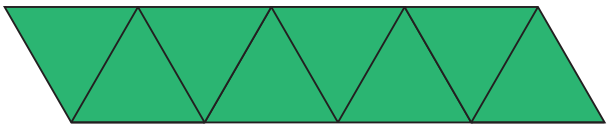
1 whole

Three green triangles cover the trapezoid.
So, each green triangle represents $\frac{1}{3}$.



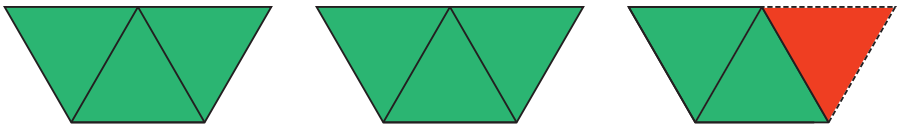
$\frac{3}{3}$ = 1 whole

Then, eight green triangles represent $\frac{8}{3}$.



$\frac{8}{3}$

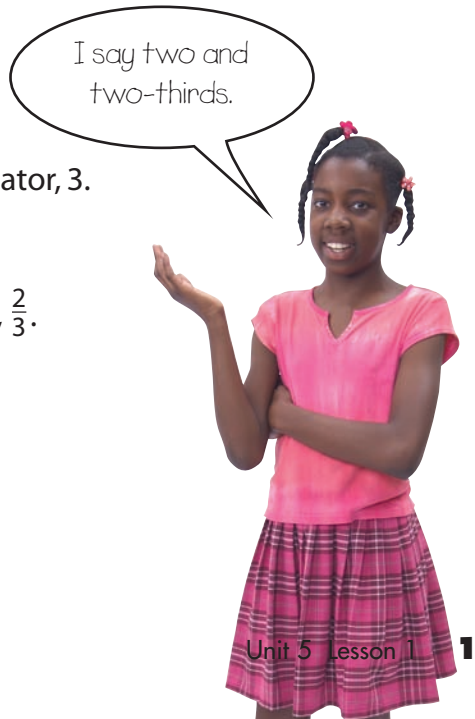
These triangles can be grouped to show that $\frac{8}{3}$ is equal to 2 and $\frac{2}{3}$.



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

We write 2 and $\frac{2}{3}$ as $2\frac{2}{3}$.

$\frac{8}{3}$ and $2\frac{2}{3}$ represent the same amount.
They are equivalent.
$\frac{8}{3} = 2\frac{2}{3}$



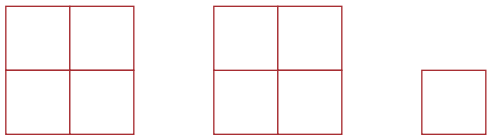
The numerator, 8, of $\frac{8}{3}$ is greater than the denominator, 3.
So, we call $\frac{8}{3}$ an **improper fraction**.

$2\frac{2}{3}$ has a whole number part, 2, and a fraction part, $\frac{2}{3}$.
So, we call $2\frac{2}{3}$ a **mixed number**.

Practice

1. Describe each picture as an improper fraction and as a mixed number.

a)



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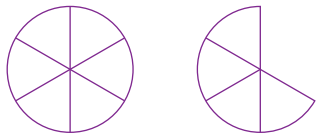

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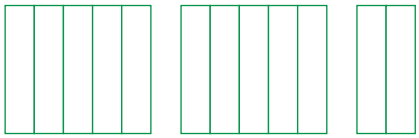

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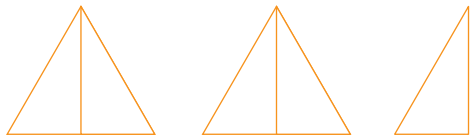

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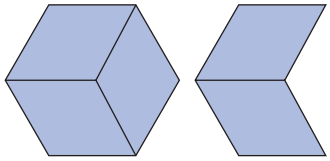

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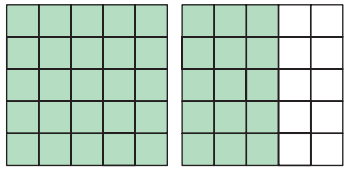


2. **a)** Match each improper fraction with a mixed number.
Draw pictures to record your work.

$\frac{5}{4}$ $\quad$ $\frac{9}{4}$ $\quad$ $\frac{7}{4}$ $\quad$ $2\frac{3}{4}$

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

b) Draw a picture to show an improper fraction for each mixed number that did not match.

3. Use Pattern Blocks. Are the numbers in each pair equivalent?
Show your work.

a) $3\frac{2}{3}$ and $\frac{11}{3}$ **b)** $\frac{8}{6}$ and $1\frac{1}{6}$ **c)** $2\frac{1}{2}$ and $\frac{5}{2}$

4. Which scoop would you use to measure each amount?
How many of that scoop would you need?

a) $1\frac{1}{6}$ cups **b)** $2\frac{1}{2}$ cups **c)** $1\frac{2}{3}$ cups **d)** $1\frac{5}{6}$ cups

5. The Fernandez family drank $3\frac{1}{2}$ pitchers of water on a picnic.
Draw pictures to show the amount, then write this mixed number as an improper fraction. Show your work.

6. Kendra mowed her lawn for $2\frac{1}{2}$ h.
Mario mowed his lawn for $\frac{1}{4}$ h, then stopped. He did this 7 times.
Who spent more time mowing the lawn?
How do you know?

7. Carlo baked pies for a party. He cut some pies into 6 pieces and some into 8 pieces.
After the party, more than $2\frac{1}{2}$ but less than 3 pies were left.
How much pie might have been left?
Show how you know.

8. Renée was making crepes by the dozen.
Renée's family ate $2\frac{1}{3}$ dozen crepes.
How many crepes did they eat? Show your work.

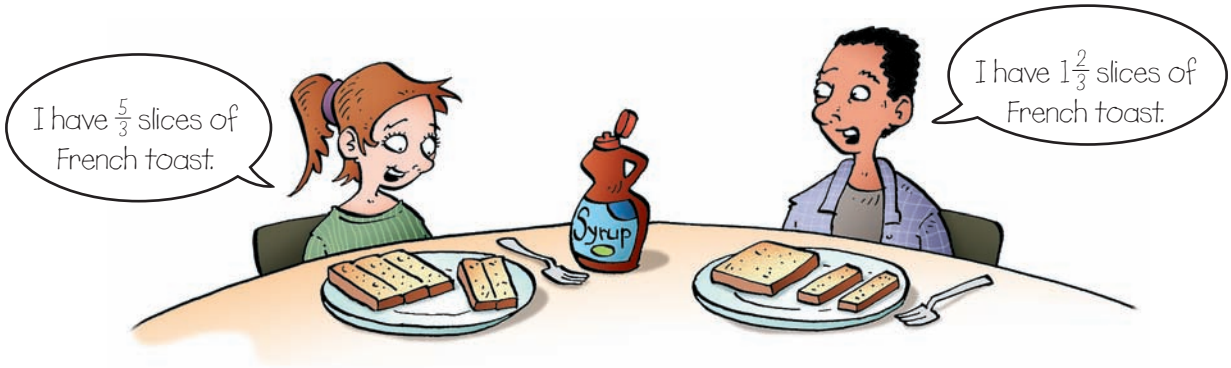
9. How can you find out if $2\frac{1}{2}$ and $\frac{10}{4}$ name the same amount?
Use words, numbers, and pictures to explain.

Reflect

Can $\frac{5}{6}$ be written as a mixed number?
Use words and pictures to explain.

LESSON 2

Converting between Mixed Numbers and Improper Fractions



How are $\frac{5}{3}$ and $1\frac{2}{3}$ related?

Explore

You will need Cuisenaire rods or strips of coloured paper.

Use the numbers given.

$1\frac{1}{4}$	$2\frac{1}{3}$	$\frac{9}{7}$
$\frac{11}{4}$	$3\frac{2}{5}$	$2\frac{1}{2}$
$1\frac{3}{10}$	$\frac{5}{3}$	$\frac{11}{8}$

- Choose a mixed number.
  Use Cuisenaire rods to model the mixed number.
  Write the mixed number as an improper fraction.
  Repeat for 2 different mixed numbers.
- Choose an improper fraction.
  Use Cuisenaire rods to model the improper fraction.
  Choose an appropriate rod to represent 1 whole.
  Write the improper fraction as a mixed number.
  Repeat for 2 different improper fractions.
- If you did not have Cuisenaire rods, how could you:
  - rewrite a mixed number as an improper fraction?
  - rewrite an improper fraction as a mixed number?

  Record each method.

Show *and* Share

Compare your methods with those of another pair of students.
Use Cuisenaire rods to show why your methods make sense.

Connect

➤ To write $2\frac{3}{4}$ as an improper fraction:

- Alison thinks about money.

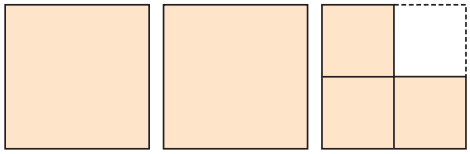
$2:

3 quarters:

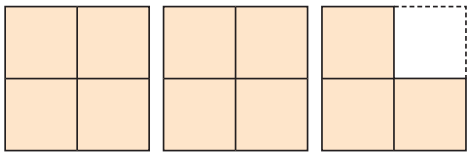
There are 11 quarters altogether.

So, $2\frac{3}{4} = \frac{11}{4}$

- Hiroshi draws a diagram to represent $2\frac{3}{4}$.

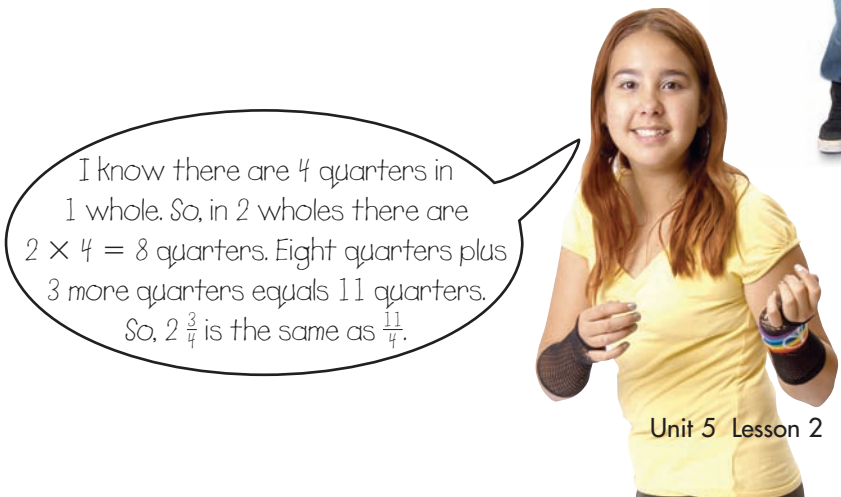


Hiroshi then divides each whole to show quarters.



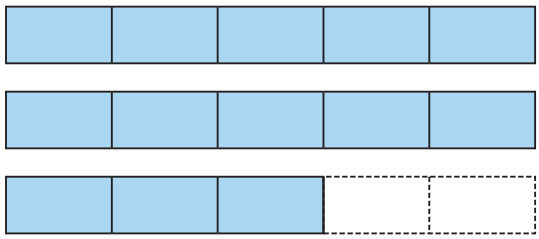
So, $2\frac{3}{4}$ is the same as $\frac{11}{4}$.

- Nadia uses mental math.



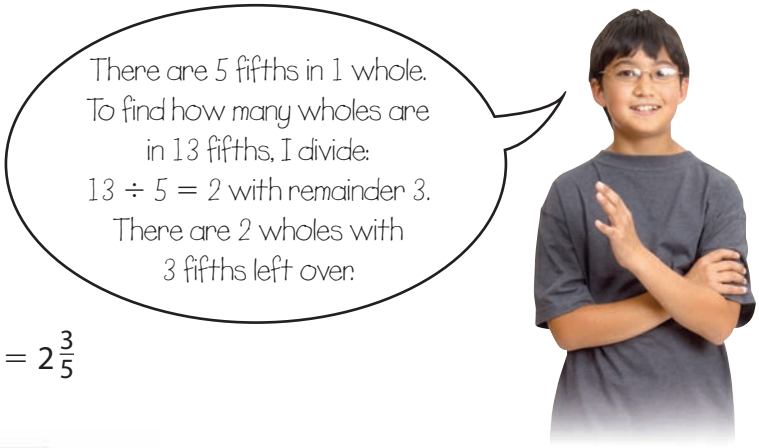
➤ To write $\frac{13}{5}$ as a mixed number:

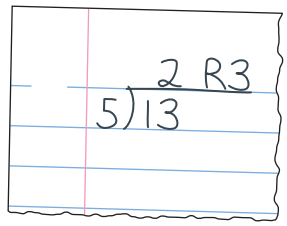
- Edna draws a diagram to show 13 fifths.



So, $\frac{13}{5}$ is the same as $2\frac{3}{5}$.

- Chioke gets the same result using division.





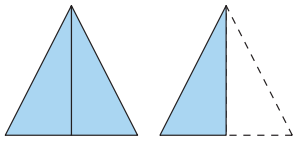
So, $\frac{13}{5} = 2\frac{3}{5}$

Practice

Use Cuisenaire rods or coloured strips when they help.

1. Write an improper fraction and a mixed number to describe each picture.

a)



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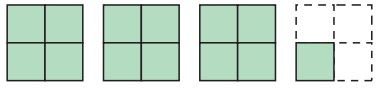

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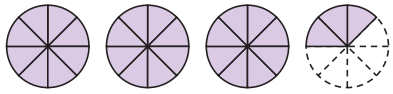


2. Draw a picture to represent each number.

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

3. Write each mixed number as an improper fraction.

a) $1\frac{1}{6}$ **b)** $4\frac{3}{8}$ **c)** $1\frac{3}{4}$ **d)** $3\frac{3}{5}$ **e)** $8\frac{1}{2}$ **f)** $7\frac{1}{4}$

4. Write each improper fraction as a mixed number.

a) $\frac{17}{5}$ **b)** $\frac{9}{4}$ **c)** $\frac{18}{4}$ **d)** $\frac{14}{3}$ **e)** $\frac{20}{3}$ **f)** $\frac{20}{6}$

5. Which of these improper fractions are between 4 and 5? How do you know?

a) $\frac{13}{3}$ **b)** $\frac{13}{4}$ **c)** $\frac{13}{5}$ **d)** $\frac{13}{6}$

6. Mary baked 5 round bannock for a bake sale at the Chief Kahkewistahaw Community School in Saskatchewan. She cut each bannock into 12 equal pieces. Mary sold 41 pieces of bannock.

a) How many bannock did Mary sell?
Give your answer 2 ways.

b) How many bannock are left?
Give your answer 2 ways.

7. Suppose you have 14 quarters.
Do you have $4? Explain.

8. The pizza at Kwame's party is cut into eighths.
Kwame eats 3 slices and the rest of the family eats 18 slices.
There are 3 slices left over.
How many pizzas had been ordered?

9. Maybelline has $3\frac{5}{6}$ loaves of bread in her diner in Regina.
The whole loaves are cut into 6 equal slices.
To how many customers can Maybelline serve a slice of bread?
Draw a diagram to show your solution.

10. Hair scrunchies come in packages of 5.
Suppose you have $2\frac{1}{5}$ of these packages to share among 4 friends.

a) Do you have enough scrunchies to give each friend three scrunchies? How do you know?

b) Do you have enough scrunchies to give each friend two? How do you know?

11. Suppose you get 0 as the remainder when you divide the numerator of an improper fraction by the denominator.
What does that tell you?
Use drawings and words to explain.

Reflect

What is the difference between a mixed number and an improper fraction?
Use pictures, words, and numbers to show how to rename an improper fraction as a mixed number.

Fraction Match Up

Your teacher will give you a set of game cards.

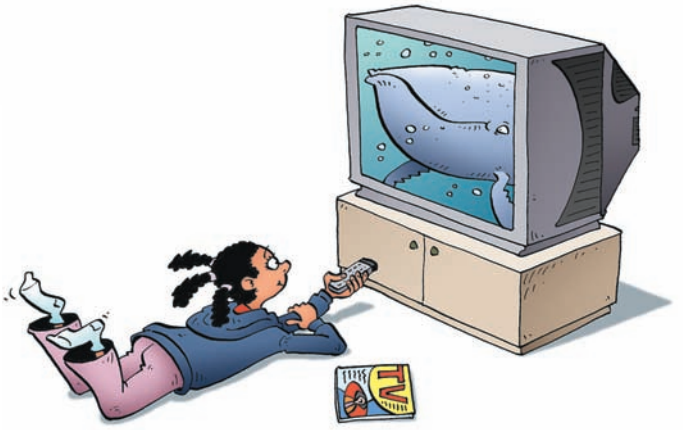
The object of the game is to find the most pairs of game cards with equivalent numbers.

- Shuffle the game cards.
  Arrange cards, face down, in 4 rows of 5 cards.
- Player 1 turns over two cards.
  If the numbers are equivalent, Player 1 keeps the cards.
  If the numbers are not equivalent, turn both cards face down again.
- Player 2 has a turn.
- Continue to play until all the cards have gone.
  The player with more cards wins.

LESSON 3

Comparing Mixed Numbers and Improper Fractions

Kenda watched a TV program for $1\frac{1}{2}$ h.
Garnet watched 5 half-hour programs.
Who watched TV for a longer time?



Explore

You will need Cuisenaire rods or strips of coloured paper.

Akna and Tootega shovelled snow to earn money to buy new snowshoes.
Akna shovelled snow for $1\frac{2}{3}$ h. Tootega shovelled snow for $\frac{3}{2}$ h.
Who spent more time shovelling snow?

Use Cuisenaire rods to find out.

Lesson Focus Use a number line to compare mixed numbers and fractions.

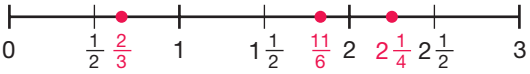
Show *and* Share

Share your solution with another pair of students.
How did you decide which rods to use to represent one whole, one-third, and one-half?
How did you find out which number was greater?
How could you compare $1\frac{2}{3}$ and $\frac{3}{2}$ without using rods?

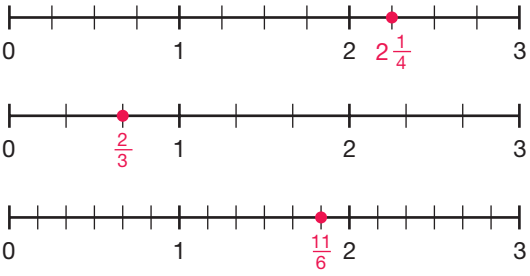
Connect

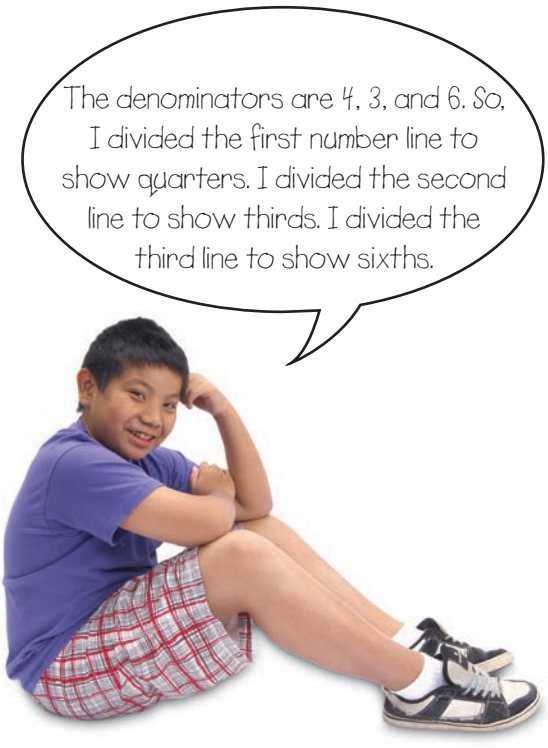
➤ Here are three strategies students used to place $2\frac{1}{4}$, $\frac{2}{3}$, and $\frac{11}{6}$ on a number line.

- Ella used benchmarks and estimation.
  $\frac{2}{3}$ is between $\frac{1}{2}$ and 1, but closer to $\frac{1}{2}$.
  $\frac{11}{6}$ is the same as $1\frac{5}{6}$. $1\frac{5}{6}$ is close to 2, but less than 2.
  $2\frac{1}{4}$ is halfway between 2 and $2\frac{1}{2}$.



- Rahim drew three number lines of equal length, each labelled from 0 to 3.

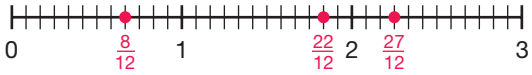




- Maggie wrote each number as an equivalent fraction with the same denominator, then placed the fractions on a number line.

  Maggie wrote $2\frac{1}{4}$ as an improper fraction: $2\frac{1}{4} = \frac{4}{4} + \frac{4}{4} + \frac{1}{4} = \frac{9}{4}$
  Since 12 is a multiple of 3, 4, and 6,
  she wrote each fraction with denominator 12.

$\frac{9}{4} \overset{\times 3}{=} \frac{27}{12}$ $\quad \frac{2}{3} \overset{\times 4}{=} \frac{8}{12}$ $\quad \frac{11}{6} \overset{\times 2}{=} \frac{22}{12}$



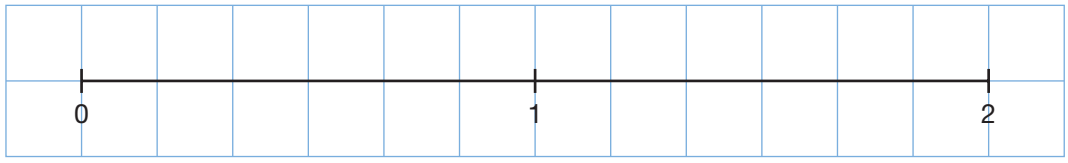
I drew a number line from 0 to 3. I divided the number line to show twelfths, then placed the fractions on the line.

We can use the placement of the numbers on the line to order the numbers.
The numbers increase from left to right.
So, the order from least to greatest is:
$\frac{8}{12}, \frac{22}{12}, \frac{27}{12}$ or $\frac{2}{3}, \frac{11}{6}, \frac{9}{4}$ or $\frac{2}{3}, \frac{11}{6}, 2\frac{1}{4}$

Practice

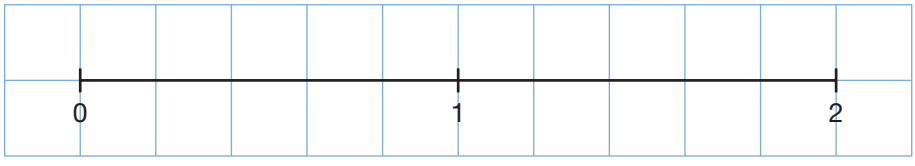
Your teacher will give you copies of number lines for questions 3, 6, and 7.

1. Use 1-cm grid paper.
Draw a 12-cm number line like the one below.



Place these numbers on the line: $\frac{5}{6}, 1\frac{1}{6}, \frac{9}{6}$

2. Use 1-cm grid paper.
Draw a 10-cm number line like the one below.



Place these numbers on the line: $1\frac{3}{5}, \frac{7}{5}, \frac{4}{5}$

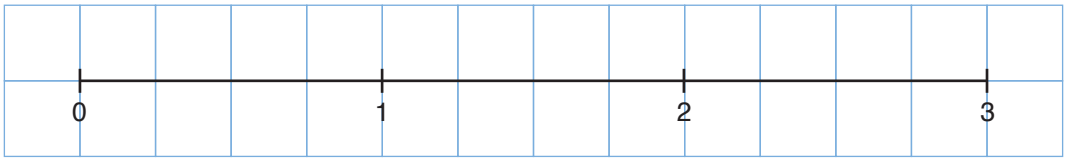
3. Find equivalent fractions so the fractions in each pair have the same denominator.
Place each pair of fractions on a number line.

a) $\frac{8}{3}$ and $\frac{6}{4}$ **b)** $\frac{12}{5}$ and $\frac{8}{3}$

c) $\frac{14}{6}$ and $\frac{17}{8}$ **d)** $\frac{11}{10}$ and $\frac{20}{15}$

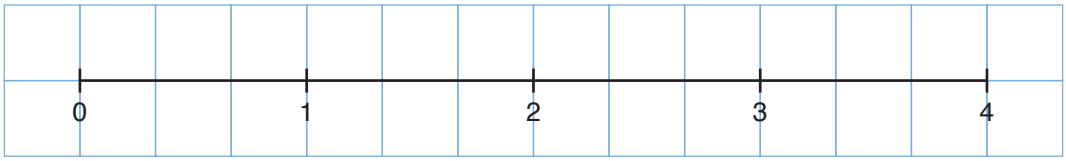
e) $\frac{9}{5}$ and $\frac{8}{6}$ **f)** $\frac{12}{9}$ and $\frac{11}{5}$

4. Use 1-cm grid paper.
Draw a number line with the benchmarks 0, 1, 2, and 3 as shown below.



Place these numbers on the number line:
$\frac{1}{2}$, $\frac{23}{8}$, $1\frac{3}{4}$

5. Use 1-cm grid paper.
Draw a number line with the benchmarks 0, 1, 2, 3, and 4 as shown below.



Place these numbers on the number line:
$\frac{5}{2}$, $\frac{2}{3}$, $1\frac{5}{6}$

6. For each pair of numbers below:

- Place the two numbers on a number line.
  Which strategy did you use?
- Which of the two numbers is greater?
  How do you know?

a) $\frac{5}{8}$; $\frac{7}{16}$ **b)** $\frac{3}{4}$; $\frac{9}{12}$ **c)** $2\frac{1}{2}$; $\frac{9}{2}$

d) $\frac{13}{10}$; $1\frac{1}{5}$ **e)** $\frac{29}{5}$; $6\frac{2}{10}$ **f)** $3\frac{5}{6}$; $3\frac{8}{12}$

7. Place the numbers in each set on a number line.
Show how you did it.
List the numbers from least to greatest.

a) $\frac{5}{6}$, $\frac{15}{9}$, $1\frac{5}{12}$ **b)** $\frac{9}{4}$, $2\frac{2}{3}$, $\frac{11}{6}$ **c)** $\frac{9}{10}$, $\frac{7}{5}$, $\frac{11}{4}$ **d)** $\frac{10}{3}$, $2\frac{1}{4}$, $\frac{3}{2}$

8. Hisa says that $\frac{17}{3}$ is greater than $5\frac{3}{4}$. Is she correct?
Use pictures, numbers, and words to explain.

9. Adriel watched a $1\frac{3}{4}$-h movie on TV.
Nadir watched 3 half-hour sitcoms.
Who watched more TV? How do you know?

10. Justine played a board game for $3\frac{1}{2}$ h.
Marty played the same board game for $\frac{37}{12}$ h.
Who played longer?
Sketch a number line to show how you know you are correct.

11. Ratu, Addie, and Penny cooked pancakes for their school's maple syrup festival in McCreary, Manitoba.
Ratu made $4\frac{1}{2}$ dozen pancakes,
Addie made $\frac{28}{6}$ dozen pancakes,
and Penny made $\frac{13}{3}$ dozen pancakes.
Who made the most pancakes?
Who made the least?
Sketch a number line to show how you know.

McCreary is the maple syrup capital of Manitoba.

12. Florence and her friends Rafael and Bruno race model cars.
Florence's car completed $2\frac{1}{4}$ laps of a track in 1 min.
Rafael's car completed $\frac{8}{3}$ laps of the track in 1 min.
Bruno's car completed $\frac{11}{12}$ laps of the track in 1 min.
Whose car was fastest? How do you know?

13. Use your ruler as a number line.
Visualize placing these fractions on your ruler: $4\frac{3}{5}, \frac{11}{2}, \frac{83}{10}$
Describe where you would place each fraction.
Which fraction is the greatest? The least?

Reflect

How do you use a number line to compare fractions and mixed numbers? Include an example.

LESSON 4

Exploring Ratios

On her bird-watching expedition in Elk Island National Park, Alberta, Cassie spotted 6 sapsuckers and 3 Baltimore orioles sitting on a fence.

Here are some ways Cassie compared the birds she saw.

- The number of sapsuckers compared to the number of orioles: 6 sapsuckers to 3 orioles
- The number of sapsuckers compared to the number of birds: 6 sapsuckers to 9 birds

Cassie could also have compared the birds using fractions. What fraction of the birds were sapsuckers? Orioles?

Explore

You will need twelve 2-colour counters and a paper cup.

➤ Put twelve 2-colour counters in the cup. Shake the cup and spill the counters onto the table.

➤ Compare the counters in as many ways as you can. Record each comparison.

Show *and* Share

Share your results with another pair of students.
In which result did you compare one part of the set to another part of the set?
In which result did you compare one part of the set to the whole set?

Connect

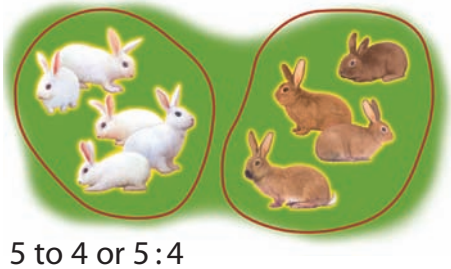
Mahit has 4 brown rabbits and 5 white rabbits.

A **ratio** is a comparison of 2 quantities with the same unit.

➤ You can use ratios to compare the numbers of white and brown rabbits.

The ratio of white rabbits to brown rabbits is 5 to 4.
The ratio 5 to 4 is written as 5 : 4.

white rabbits to brown rabbits:



5 to 4 or 5 : 4

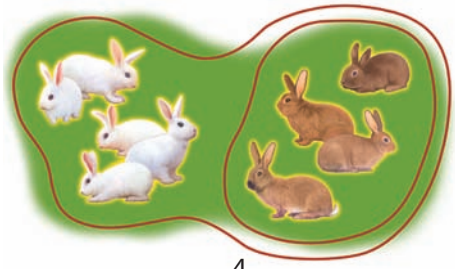
The ratio of brown rabbits to white rabbits is 4 to 5, or 4 : 5.

These are **part-to-part ratios**.

The numbers 4 and 5 are the **terms of the ratio**.
Order is important in a ratio.
5 to 4 is not the same as 4 to 5.

➤ You can also use ratios to compare the parts to the whole.

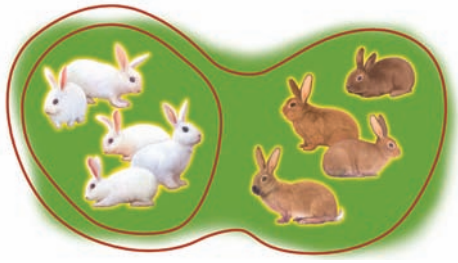
brown rabbits to all the rabbits:



4 to 9 or 4 : 9 or $\frac{4}{9}$

This is a **part-to-whole ratio**.

white rabbits to all the rabbits:



5 to 9 or 5 : 9 or $\frac{5}{9}$

This is a part-to-whole ratio.

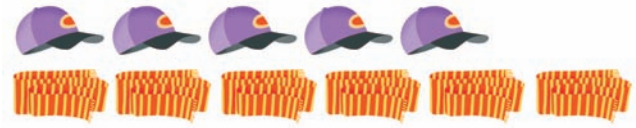
A ratio that compares
a part of a set to the whole set is a fraction.
When we read a ratio like $\frac{4}{9}$,
we say "four to nine."

Practice

1. Write each ratio 2 ways.

a) apples to pears

b) caps to scarves



c) roses to daisies

2. Write a ratio to show the numbers of:

a) ladybugs to ants

b) ants to ladybugs

c) ladybugs to insects

d) ants to insects

3. Write each ratio in as many ways as you can.

a) red marbles to green marbles

b) green marbles to all the marbles

c) green marbles to red marbles

d) red marbles to all the marbles

4. Ms. Zsabo has 13 girls and 11 boys in her class.
Write each ratio.

a) girls to boys **b)** boys to girls

c) boys to students **d)** girls to students

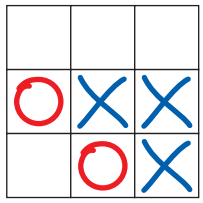
5. What is being compared in each ratio?

a) 3 : 4 **b)** $\frac{4}{7}$

c) 3 to 7 **d)** 4 : 3

6. Use counters to model the ratio 3 : 5 in 2 different ways.
Draw diagrams to record your work.
Explain each diagram.

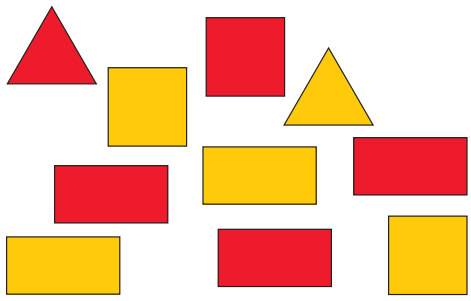
7. Write 4 different ratios for this picture.
Explain what each ratio compares.



8. A penny can show heads or tails.
Place 10 pennies in a cup. Shake and spill.
Write as many ratios as you can for the pennies.

9. Write a ratio to show the numbers of:

a) triangles to squares
b) squares to rectangles
c) triangles to all shapes
d) red shapes to yellow shapes
e) yellow triangles to yellow rectangles
f) red triangles to yellow squares



10. Write as many ratios as you can for the trail mix recipe.
Explain what each ratio compares.

TRAIL MIX
1 scoop raisins
3 scoops nuts
2 scoops dried papaya
1 scoop sunflower seeds

11. Use 11 counters to show each ratio.
Sketch counters to record your work.

a) 5 : 6 **b)** 8 to 3 **c)** $\frac{2}{11}$ **d)** 6 : 11

Reflect

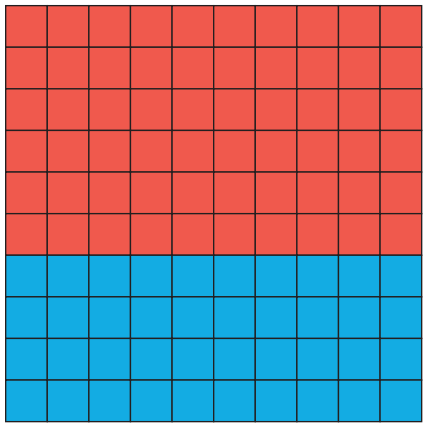
When you see a ratio, how can you tell
if it is a part-to-part or part-to-whole ratio?

LESSON 5

Equivalent Ratios

Explore

How many different ways can you write each ratio?
red squares : blue squares
red squares : all squares
blue squares : all squares



Show *and* Share

Compare your ratios with those of another pair of students.
What patterns do you see in the ratios?
Try to write more ratios that extend each pattern.

Connect

Kim is planting a border in her garden in Trail, BC.
She plants 5 yellow daisies for every 3 red petunias.
The ratio of daisies to petunias is 5 : 3.

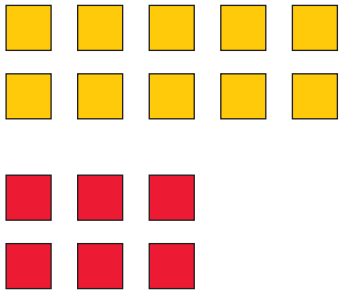
How many petunias would Kim plant for each number of daisies?

- 10 daisies
- 15 daisies
- 20 daisies

In each case, what is the ratio of daisies to petunias?

Here are 2 ways to solve the problem.

➤ You can use Colour Tiles to represent the plants.
Use yellow tiles to represent daisies.
Use red tiles to represent petunias.

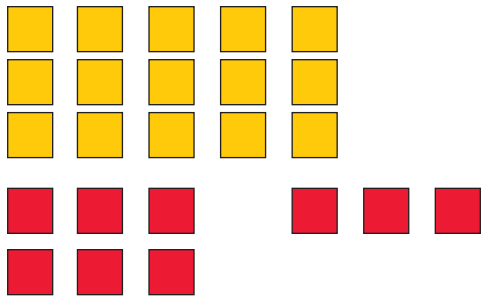


- Start with 10 yellow tiles.

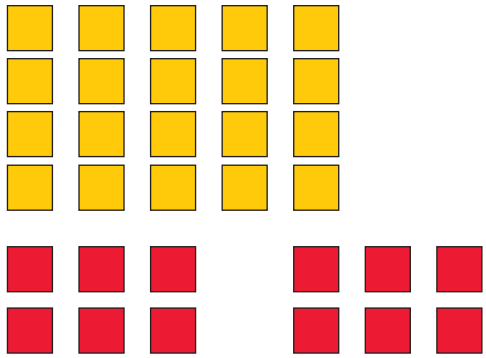
Think: For every 5 yellow tiles, you need 3 red tiles.
Arrange your yellow tiles into groups of 5 tiles.
You can make 2 groups.
So, you need 2 groups of 3 red tiles.

That makes a total of 6 red tiles.
These represent 6 petunias.
The ratio of daisies to petunias is 10 : 6.

- Add a group of 5 yellow tiles.
  You now have 15 yellow tiles.
  Add another group of 3 red tiles.
  You now have 9 red tiles.
  These represent 9 petunias.
  The ratio of daisies to petunias is 15 : 9.



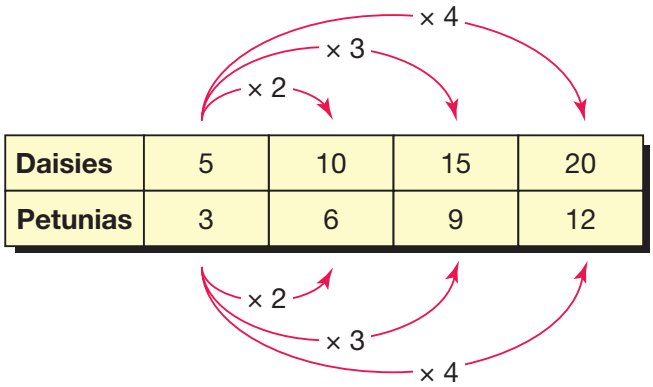
- Add a group of 5 yellow tiles.
  You now have 20 yellow tiles.
  Add another group of 3 red tiles.
  You now have 12 red tiles.
  These represent 12 petunias.
  The ratio of daisies to petunias is 20 : 12.



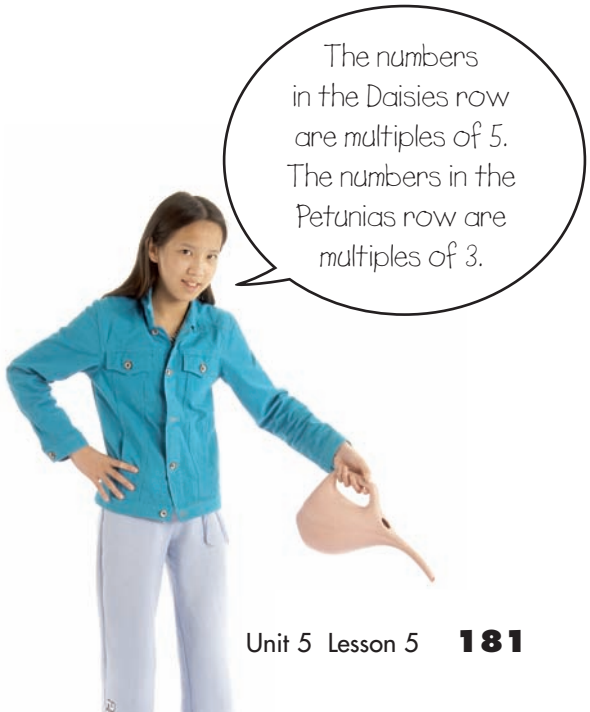
➤ You can use a table and patterns to find the ratios.

There are 5 daisies for every 3 petunias.
10 daisies are **2** groups of 5 daisies.
15 daisies are **3** groups of 5 daisies.
20 daisies are **4** groups of 5 daisies.

So, to keep the balance, you need the same numbers of groups of petunias.



The ratios of daisies to petunias are:
10 : 6, 15 : 9, and 20 : 12
Each ratio can be written as 5 : 3.
So, we say that 5 : 3, 10 : 6, 15 : 9, and 20 : 12 are **equivalent ratios**.



Practice

1. Write 2 equivalent ratios for each ratio.
   a) 3 : 1 **b)** 4 : 2 **c)** 1 : 2 **d)** 5 : 6 **e)** 3 : 5
   f) 4 : 9 **g)** 7 : 8 **h)** 8 : 3 **i)** 1 : 1 **j)** 2 : 5

2. Write an equivalent ratio with 20 as one of the terms.
   a) 4 : 5 **b)** 2 : 8 **c)** 7 : 4 **d)** 10 : 3

3. Are the ratios in each pair equivalent? Explain how you know.
   a) 7 to 14 and 1 to 2 **b)** 6 : 9 and 3 : 2 **c)** 1 to 10 and 4 to 40

4. The table shows the number of beads used to make a necklace.
   Ginger wants to make a smaller necklace using the same ratio of pink to white beads.
   How many different necklaces could Ginger make?
   How do you know?

Colour	Number
Pink	30
White	35

5. In a card game, each player is dealt 5 cards.
   Make a table to show the total number of cards dealt for each number of players from 3 to 6.
   Write each ratio of players to cards dealt.

Number of Players	Total Number of Cards Dealt

6. Ms. Olivieri's class plays a game in teams.
   Each team has the same number of students.
   The ratio of teams to players is 8 : 32.
   a) How many students are in Ms. Olivieri's class?
   b) How many students are on each team?

7. Atiba plays for the Linden Woods Vipers in the Winnipeg Youth Soccer League.
   The ratio of players to soccer balls at practice sessions is 5 : 2.
   How many soccer balls are needed for 20 players?

8. The word "fun" has a vowel-to-consonant ratio of 1 : 2.
   a) Find 3 words with a vowel-to-consonant ratio of 2 : 3.
   b) Choose a vowel-to-consonant ratio and find 3 words for it.

9. Su Mei's recipe for bean salad calls for 3 cans of lima beans, 2 cans of pinto beans, and 1 can of kidney beans.
Su Mei is making bean salad for her family reunion.
Suppose she uses 9 cans of lima beans.

a) How many cans of pinto beans will she use?

b) How many cans of kidney beans will she use?

10. Katherine has diabetes.
At each meal, she must estimate the mass in grams of carbohydrates she plans to eat, then inject the appropriate amount of insulin.
Katherine needs 1 unit of insulin for 15 g of carbohydrates.
Katherine's lunch has 60 g of carbohydrates.
How many units of insulin should Katherine inject?

11. To make a jug of plant fertilizer, Malaika uses 6 cups of water and 3 scoops of fertilizer.
Bart uses 8 cups of water and 5 scoops of fertilizer.
Will Malaika's and Bart's plant fertilizer have the same strength?
Explain.

12. Use counters to find all the ratios that are equivalent to 2 : 3 and have a second term that is less than 40. List the ratios.

Math Link

Your World

A contrast ratio is associated with televisions and computer monitors. It is a measure of the difference between the brightest and darkest colours displayed on a screen. A high contrast ratio, such as 800 : 1, delivers a better image than a low contrast ratio, such as 150 : 1.

Reflect

Write two ratios that are equivalent.
Explain how you know they are equivalent.
Write two ratios that are not equivalent.
Explain how you know they are not equivalent.

LESSON 6

Strategies Toolkit

Explore

A frog climbed up a tree 20 m tall.
Each day, the frog climbed up 4 m.
Each night, it slid back 2 m.
How many days did it take the frog to climb to the top of the tree?

Solve the problem.
Represent your thinking as many different ways as you can.

Show *and* Share

Share your work with another pair of students.
Compare the ways you represented your thinking.
Which way do you like best? Why?

Connect

Here are some ways to represent your thinking.

With words

A written explanation can give lots of information. You can use math language to describe the steps you followed, the patterns you noticed, and your ideas.

With a diagram

You can draw a diagram to show important details. Your diagram can show how you visualized the problem, what parts changed, or how they changed.

Strategies for Success

- Check and reflect.
- Focus on the problem.
- Represent your thinking.
- Explain your thinking.

Prepare for SUCCESS

With numbers

You can use numbers to show your thinking in a formal way.
The numbers may be in a table, in calculations, or in equations.

More than one way

Sometimes, the best way to represent your thinking is with words, diagrams, and numbers.

When you have completed your answer, ask yourself:

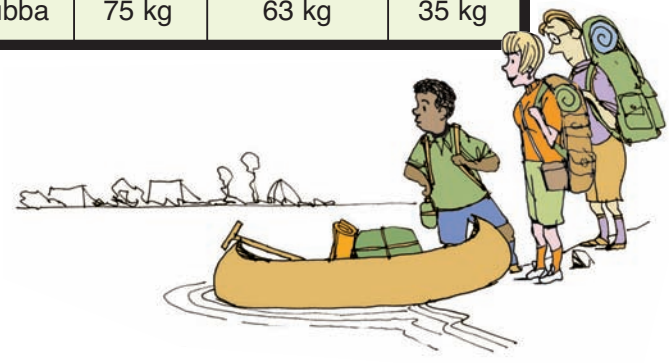
> Would someone else be able to understand my thinking by looking at my answer?
> What could I add to make my answer more clear?

Practice

Solve each problem. Each time, show your thinking at least 2 different ways.

1. Three hikers want to cross a river to get to a campsite on the other shore. The boat holds a maximum of 300 kg. Describe how the hikers can cross the river making the fewest trips.
Can they do this more than one way? Explain.

Name	Mass	Equipment	Food
Shawn	60 kg	38 kg	25 kg
Martha	56 kg	42 kg	33 kg
Bubba	75 kg	63 kg	35 kg



2. Suppose a yellow Pattern Block is worth $3.00, a red Pattern Block is worth $1.50, a blue Pattern Block is worth $1.00, and a green Pattern Block is worth $0.50.
Create 5 different designs that are each worth $10.00.

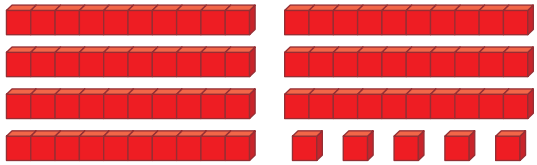
Reflect

Describe some ways you can represent your thinking.
Give an example of when you might use each way.

LESSON 7

Exploring Percents

Suppose a Base Ten flat represents 1 whole.
What fraction does this picture represent?
Which decimal names this amount?



Explore

You will need Base Ten Blocks.

A group of students was planning to go hiking in Dinosaur Provincial Park in Alberta.

The students were surveyed to find out which hike they would most like to take.

Hike	Number of Students
Camel's End Coulee Hike	21
Centrosaurus Bone Bed Hike	24
Great Badlands Hike	33
Fossil Safari Hike	22

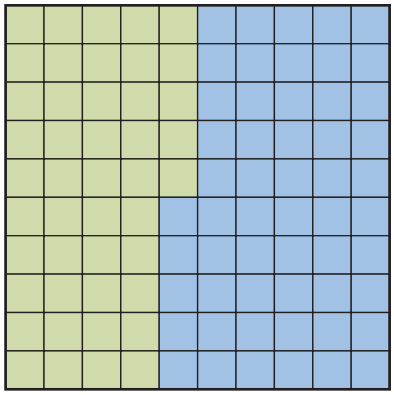
- How many students are in the group? How do you know?
- What fraction of the students chose each hike?
- How else can you name each amount? Use Base Ten Blocks to model each amount.
- What fraction of the students did not choose the Great Badlands Hike? How did you find out?

Show *and* Share

Compare strategies for renaming each amount with another pair of students. If you used the same strategy, work together to find a different way.

Connect

The hundredths grid represents 1 whole.



Here are 4 ways to describe the green part of the grid.

- Compare the number of green squares to the total number of squares:
  45 out of 100 squares are green
- Write a fraction.
  $\frac{45}{100}$ of the grid is green.
- Write a decimal.
  0.45 of the grid is green.
- Write a **percent**.
  45% of the grid is green.
  Percent is another name for *hundredths*.

% is the percent symbol.

A percent is a special ratio that compares a number to 100.
45% means "45 out of 100" or "45 per hundred."

We can describe the blue part of the grid in the same 4 ways.

- 55 out of 100 squares are blue.
- $\frac{55}{100}$ of the grid is blue.
- 0.55 of the grid is blue.
- 55% of the grid is blue.

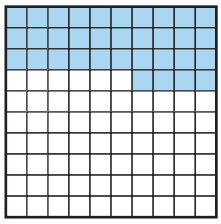
Practice

1. Write:

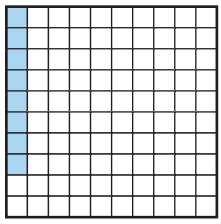
- a fraction with hundredths
- a decimal
- a percent

to name the shaded part of each grid.

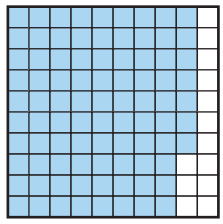
a)



b)



c)



2. Write:

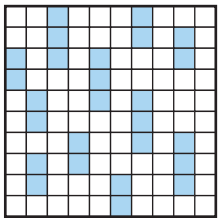
- a fraction with hundredths
- a decimal
- a percent

to name the unshaded part of each grid in question 1.

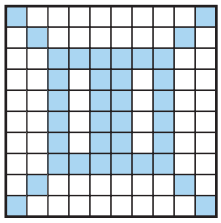
3. For each grid in question 1, add the percents you used to name the shaded and unshaded parts.
What do you notice? Why do you think this happens?

4. Estimate the percent of each grid that is shaded.
Then count the squares to check.

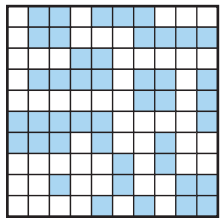
a)



b)



c)



5. Use Base Ten Blocks to show each percent.
Then write each percent as a decimal.

a) 84% **b)** 17% **c)** 25% **d)** 100%

6. **a)** Use a hundredths grid. Colour 20% red, 13% blue, 32% green, and 23% yellow.
b) Write a fraction to describe the part of the grid that is each colour.
c) Write a decimal and a percent to describe the part of the grid that is not coloured.

7. **a)** Use a hundredths grid. Choose a different colour for each hike in *Explore*.
Colour a section of the grid to show the fraction of students who chose that hike.
b) Write a percent to describe each section of the grid in part a.

8. Write as a percent. Then write as a decimal.

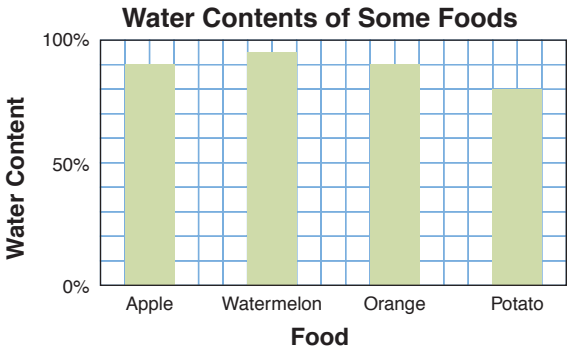
a) 64 out of 100 **b)** $\frac{50}{100}$ **c)** 1 out of 100 **d)** $\frac{17}{100}$

9. Write each percent as a fraction with hundredths. Then write as a decimal.

a) 13% **b)** 5% **c)** 79% **d)** 64%

10. Ninety-seven percent of Earth's water is salt water.
What percent is fresh water?
How do you know?

11. The graph shows the water contents of some foods.



a) About what percent of each food is water?
b) About what percent of each food is not water?
c) Write each percent in the graph as a fraction.

12. Janette bought a portable CD player on sale.
The regular price was $100. She was charged $89.
a) What percent of the regular price did Janette pay?
b) What percent of the regular price did she receive as a discount?

13. Salvo said that of the 100 singers in a children's choir in Whitehorse, 62% are girls and 48% are boys.
Is this possible?
Use words and pictures to explain.

Reflect

What does percent mean?
Use words and pictures to explain.

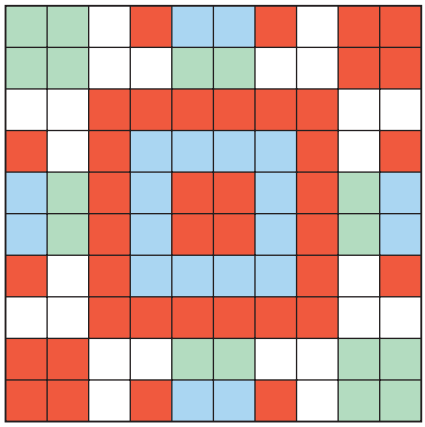
At Home

Percents are often used to describe discounts. Look through some flyers your family receives in the mail. List 3 different percents you see offered as discounts. Order the percents from greatest to least. Which is the best discount?

LESSON 8

Relating Fractions, Decimals, and Percents

How can you describe each part of this design?



Explore

You will need a 10-cm by 10-cm grid.

➤ Make a design on the grid.
Your design must follow these guidelines:
- The design must use only 4 colours:
  - orange
  - blue
  - green
  - red
- At least $\frac{7}{10}$ of the squares must be coloured.
- At least 4% of the squares must be coloured blue.
- No more than 8% of the squares can be coloured orange.
- At least 0.5 of the squares must be coloured green or red.

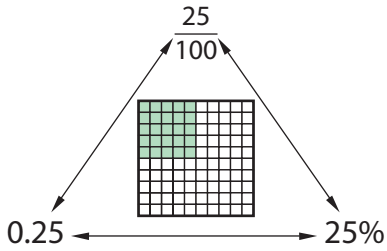
➤ Describe each colour of your design as a fraction, a decimal, and a percent.

Show *and* Share

Share your design with another pair of students.
How are your designs alike? How are they different?
What is the greatest percent of blank squares you could have in your design? Explain.

Connect

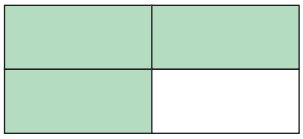
➤ Fractions, decimals, and percents are 3 ways to describe parts of one whole.



A fraction can be written as a decimal or a percent.
A decimal can be written as a fraction or a percent.
A percent can be written as a fraction or a decimal.

You can use a percent to describe any part of one whole.
1 whole = 100%

➤ What percent of this shape is shaded?



$\frac{3}{4}$ of the shape is shaded.

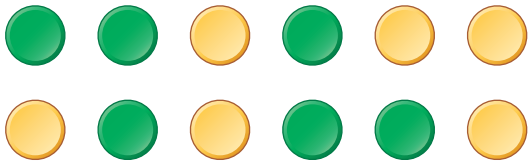
Think: Percent means "out of 100," so we need to write an equivalent fraction with hundredths.

$\frac{3}{4} = \frac{75}{100} = 75\%$ (×25 / ×25)

$\frac{75}{100}$ is the same as 0.75. So, 0.75 of the shape is shaded.

75% of the shape is shaded.

➤ What percent of this set of counters are yellow?



$\frac{6}{12}$ of the counters are yellow.
$\frac{6}{12} = \frac{1}{2}$
And, $\frac{1}{2} = 0.50 = 50\%$
50% of the counters are yellow.

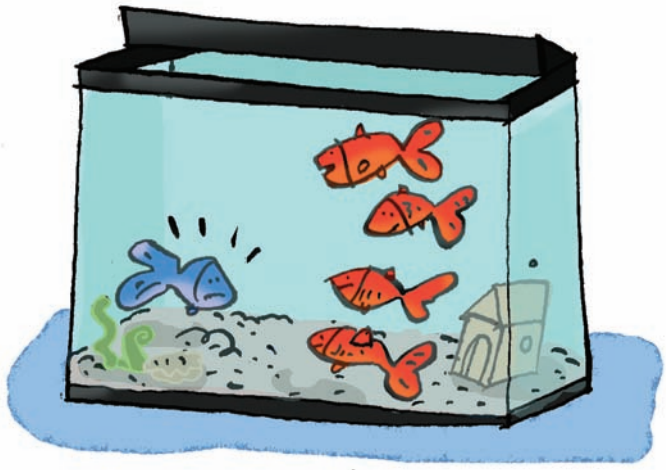
➤ A fish tank contains rainbow fish and goldfish.
The ratio of rainbow fish to goldfish in the tank is 1 : 4.
What percent of the fish are rainbow fish?

1 out of 5 fish are rainbow fish.

$\frac{1}{5} = 0.20$

And, $0.20 = 20\%$

20% of the fish are rainbow fish.



Practice

1. Draw Base Ten Blocks or shade a hundredths grid to represent each fraction.
Write each fraction as a percent and as a decimal.

a) $\frac{6}{100}$ **b)** $\frac{81}{100}$ **c)** $\frac{17}{50}$ **d)** $\frac{3}{10}$

e) $\frac{1}{50}$ **f)** $\frac{1}{5}$ **g)** $\frac{7}{20}$ **h)** $\frac{3}{4}$

2. Draw Base Ten Blocks or shade a hundredths grid to represent each decimal.
Write each decimal as a fraction and as a percent.

a) 0.97 **b)** 0.03 **c)** 0.16 **d)** 0.5

e) 0.65 **f)** 0.24 **g)** 0.09 **h)** 0.7

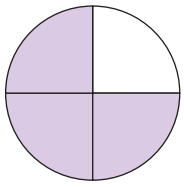
3. Draw Base Ten Blocks or shade a hundredths grid to represent each percent.
Write each percent as a fraction and as a decimal.

a) 14% **b)** 99% **c)** 25% **d)** 40%

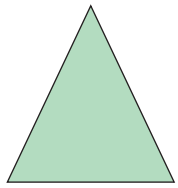
e) 35% **f)** 6% **g)** 90% **h)** 15%

4. What percent of each whole is shaded?
Show how you found your answers.

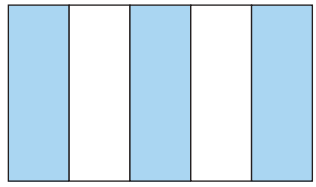
a)



b)

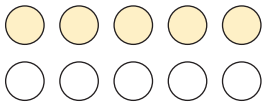


c)

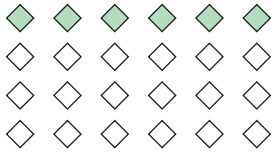


5. What percent of each set is shaded?
Show how you found your answers.

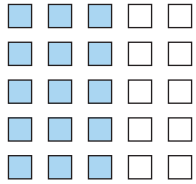
a)



b)



c)



6. Is each fraction greater than or less than 50%?
Explain how you know.

a) $\frac{7}{10}$ **b)** $\frac{3}{4}$ **c)** $\frac{11}{25}$ **d)** $\frac{6}{6}$

7. Luis used a calculator to find a decimal and a percent equal to $\frac{1}{4}$.
How might Luis have done this?

8. Use the data in the table. Is each statement true or false?
Explain how you know.

a) More than 50% of the audience were adults or seniors.
b) Of the audience, $\frac{58}{100}$ were children or teens.
c) More than $\frac{1}{4}$ of the audience were adults.
d) Less than 0.5 of the audience were teens or adults.

Members of the Audience

Age Group	Percent
Children	13%
Teens	45%
Adults	34%
Seniors	8%

9. Which is least? Which is greatest?
How do you know?

10% $\frac{1}{10}$ 0.01

10. Ravi got 18 out of 20 on a math quiz.
Karli got 85% on the quiz.
Whose mark was greater? How do you know?

11. Write a percent that represents:

a) a very little of something
b) almost all of something
c) a little more than $\frac{3}{4}$ of something
d) between 0.25 and 0.50 of something

How did you choose each percent?

Reflect

How are fractions, decimals, and percents alike?
How are they different?
Use examples in your explanations.

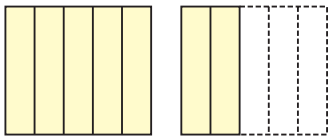
Unit 5 Show What You Know

LESSON

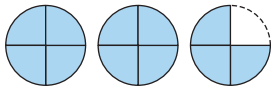
1

1. Use a mixed number and an improper fraction to describe each picture.

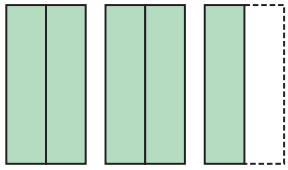
a)



b)



c)



2. Jolene is making a traditional ham dish for Le Banquet de la Cabane à Sucre. She has a $\frac{1}{2}$-cup measuring cup. How many times will Jolene have to fill it to measure $3\frac{1}{2}$ cups of maple syrup?
Draw a picture to show your solution.

2

3. Write each mixed number as an improper fraction.

a) $3\frac{1}{4}$ **b)** $7\frac{2}{3}$ **c)** $4\frac{1}{2}$ **d)** $2\frac{7}{8}$

4. Write each improper fraction as a mixed number.

a) $\frac{14}{5}$ **b)** $\frac{17}{8}$ **c)** $\frac{11}{3}$ **d)** $\frac{15}{6}$

1 2

5. A class ordered 12-slice pizzas for lunch.
The students ate 40 slices.

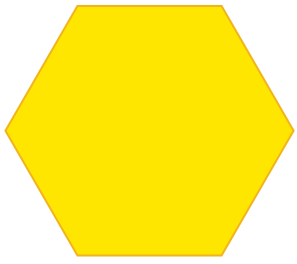
a) What is the least number of pizzas the class could have ordered?

b) Write an improper fraction and a mixed number for the number of pizzas the students ate.

c) Suppose the least number of pizzas were ordered. Write a fraction for how many pizzas were left over.

2 3

6. You will need triangular dot paper.
Use the yellow hexagon Pattern Block to represent one whole.



1 whole

a) Draw a picture to show each improper fraction.
$\frac{7}{3}$ $\frac{11}{6}$ $\frac{9}{2}$ $\frac{10}{3}$

b) Draw a picture to show each mixed number.
$2\frac{1}{6}$ $3\frac{2}{3}$ $5\frac{1}{2}$ $4\frac{5}{6}$

c) Order the improper fractions in part a from least to greatest.

d) Order the mixed numbers in part b from greatest to least.

LESSON

3

7. Place each pair of numbers on a number line.
Which strategy did you use?

a) $\frac{3}{2}; 1\frac{1}{2}$ **b)** $\frac{8}{5}; 1\frac{7}{10}$ **c)** $\frac{25}{8}; 2\frac{3}{4}$

8. Place the numbers in each set on a number line.
Show your work. List the numbers from least to greatest.

a) $\frac{9}{2}, 2\frac{1}{6}, \frac{2}{3}$ **b)** $\frac{7}{2}, 3\frac{1}{4}, \frac{3}{4}$ **c)** $\frac{7}{20}, 1\frac{1}{4}, \frac{15}{10}$

4 5

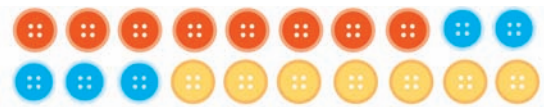
9. In a punch, 2 cups of orange juice are mixed with 3 cups of ginger ale.

a) Use grid paper.
Draw a diagram to show this ratio.

b) How much ginger ale is needed for 10 cups of orange juice?

c) How much orange juice is needed for 21 cups of ginger ale?

10. **a)** Write as many ratios as you can for the buttons.
Explain what each ratio means.



b) Suppose you doubled the number of each colour of buttons.
What would the ratio 40 : 16 describe?

7

11. What percent of the buttons in question 10 are red?

7 8

12. Use a hundredths grid.

a) Colour the grid so 14% is green, 45% is yellow, 17% is blue, and the rest is red.

b) Write a fraction with hundredths and a decimal to describe each colour of the grid.

c) What percent of the grid is red?

8

13. Conner got 23 out of 25 on a spelling test.
Rose got 88% on the test.
Whose mark was greater? How do you know?

UNIT 5 Learning Goals

- ✓ relate improper fractions to mixed numbers
- ✓ compare mixed numbers and fractions
- ✓ use ratios for part-to-part and part-to-whole comparisons
- ✓ explore equivalent ratios
- ✓ explore percents
- ✓ relate percents to fractions and decimals

Unit Problem

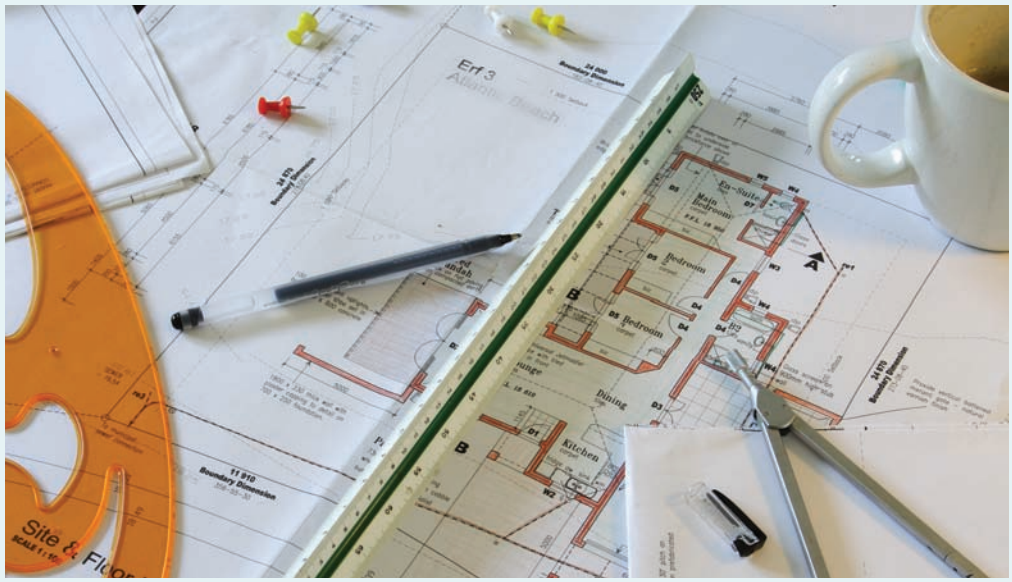
Designing a Floor Plan

Dr. Cowper plans to open a new animal clinic in Winnipeg, Manitoba.
You have been hired to design the floor plan for the clinic.

You will need a ruler, 1-cm grid paper, and coloured pencils or markers.

The floor plan must follow these guidelines:

- The floor can be of any shape, but it must have an area of 100 square units.
- The plan must include:
  - a waiting room and reception area
  - an x-ray room
  - two exam rooms
  - an operating room
  - a kennel room
  - a washroom
  - a grooming room
- The operating room should be $1\frac{1}{2}$ times the size of the x-ray room.
- The kennel room and grooming room together should occupy 40% of the floor plan.
- The exam rooms should occupy $\frac{1}{5}$ of the floor plan.
- The ratio of the area of the washroom to the area of the grooming room should be 2 : 5.



Draw the floor plan on grid paper.
Colour and label each room or section of the floor plan.
Use a table to show the floor space of each room or section as a fraction, decimal, and percent of the entire floor.

Room or Section	Fraction	Decimal	Percent

Include calculations to show how your plan meets the design guidelines.

Check List

Your work should show

- ☑ a floor plan drawn on grid paper that meets all the design guidelines
- ☑ each room or section coloured and clearly labelled
- ☑ a table that shows the floor space of each room or section as a fraction, decimal, and percent of the entire floor
- ☑ correct calculations

Reflect on Your Learning

Look back at the Learning Goals.
Which learning goal was easiest for you?
Which was most difficult?
Justify your choices.