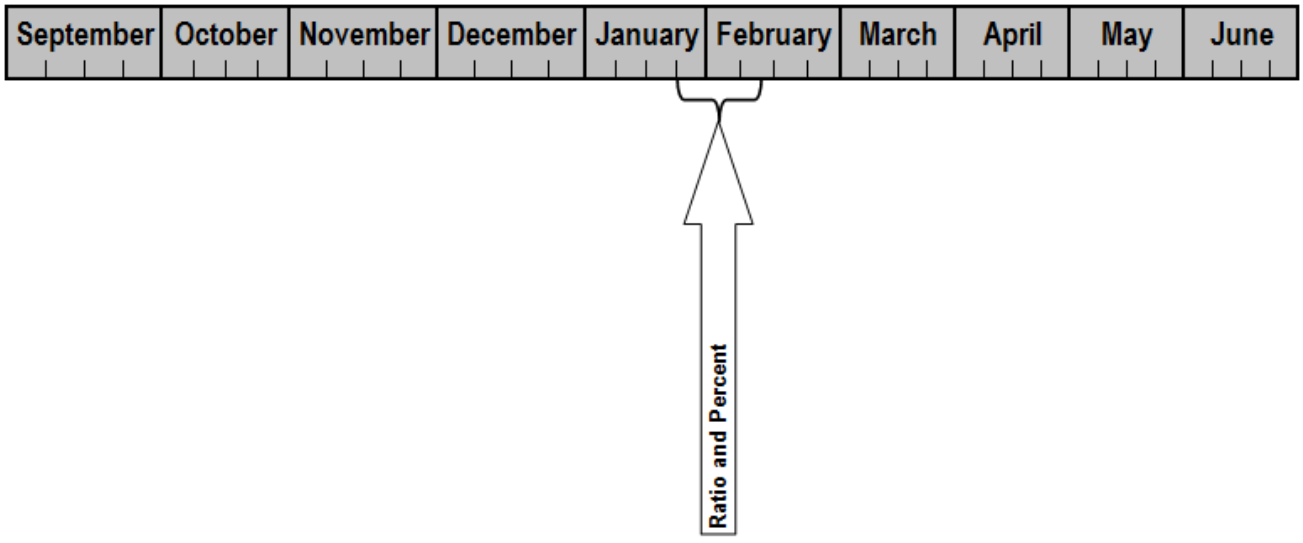
Ratio and Percent

Suggested Time: $2\frac{1}{2}$ Weeks



Unit Overview

Focus and Context

"Students can develop a deep understanding of numbers through experiences with a variety of models, such as fraction strips, number lines, 10×10 grids, area models and objects. These models offer students concrete representations of abstract ideas and support students' meaningful use of representations and their flexible movement among them to solve problems." *Principles and Standards for School Mathematics.* (2000)

Math Connects

Students will encounter fractions, decimals, percentages and ratios in everyday situations. Being able to make sense of these concepts is necessary to be informed citizens and consumers to work in today's technological society. As students make the necessary connections between decimals, fractions, ratios and percentages, it enhances their knowledge of and flexibility in thinking about number. The opportunities for students to work with these numbers and see these numbers in everyday situations is limitless. Going to the store and seeing 20% off, sharing pizza with their friends, understanding various sporting statistics such as batting averages, and making sense of what this information means to the sport are just some examples of when students would use these skills.

Process Standards Key

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[ME]	Mental Mathematics and Estimation	[T]	Technology
		[V]	Visualization

Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Number	6N5 Demonstrate an understanding of ratio, concretely, pictorially and symbolically.	[C, CN, PS, R, V]
Number	6N6 Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially and symbolically.	[C, CN, PS, R, V]

Strand: Number

Outcomes

Students will be expected to

6N5 Demonstrate an understanding of ratio, concretely, pictorially and symbolically.

[C, CN, PS, R, V]

Achievement Indicator:

6N5.1 Provide a concrete or pictorial representation for a given ratio.

Elaborations—Strategies for Learning and Teaching

Work involving ratios and percents will be new to Grade 6 students. As they begin to work on ratios and percents, it is necessary to show students how ratios and percents can also be represented by decimals and fractions. Connecting these four concepts is essential in the development of student's number sense. Throughout the year, there will be many different opportunities where these concepts can be discussed.

In Grade 5, students explored the connections between fractions and decimals. This work will help them to now connect this with ratios and percents. Students should be able to fluently move between naming a number as a fraction, ratio, percent and decimal. For example, when given a number such as 0.50, students should see this as 50%, $\frac{5}{10}$, 5:10 but also see this as one half.

Students may need review with fraction concepts, which would be beneficial in beginning work on ratios and percentages. Ask students to represent examples of different fractions in a variety of ways.

A ratio is a comparison of any two quantities. When investigating the concept of ratios, provide students with various concrete materials to represent these ratios. Using things like snap or linking cubes, pattern blocks, buttons or candy can help students see the part-to-part and part-to-whole relationships.

Models used to represent fractions can also be used when working with ratios.

Give students a ratio, for example, 2:5. Ask them to create a design to represent this ratio using pattern blocks and explain how they know their design represents this ratio.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask students to select 20 tiles of four different colours so that pairs of colours show the following ratios: 4 to 3, 2:1. (6N5.1)

- Provide students with a problem such as:

  The Easter Bunny left 6 Hershey Kisses and some Jujubes. The ratio of kisses to jujubes was 3:2. Altogether, how many Hershey Kisses and Jujubes did the Easter Bunny leave? Explain your answer pictorially, symbolically and concretely. (6N5.1)

Journal

- Tell students that John's family has a mother, father, 2 daughters and John. The part-to-part ratio of male to female is 2:3. The part-to-whole ratio (males:whole family) is 2:5. Ask students to represent these ratios using counters. (6N5.1)

Resources/Notes

Math Focus 6

Lesson 1: Ratios

6N5

TG pp. 13 – 17

Strand: Number

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **6N5 Continued** **Achievement Indicators:**	
6N5.2 Write a ratio from a given concrete or pictorial representation.	Use the students themselves, counters, or other simple models to illustrate the concept of ratio as a comparison between two numbers (or among three or more numbers) Encourage the use of appropriate language. (e.g., Students should read the ratio "3:2" as "3 to 2" or "3 __ for every 2 __") Through exploration and making meaningful connections, ratios can be related to everyday situations (e.g., the ratio of water to concentrate to make orange juice is 3:1 or "3 to 1") or in relation to other topics in mathematics (e.g., students can explore the ratio of the length of one side of a rectangle to the perimeter). Ask students to create a poster on ratios found in the classroom. They could include such ratios as: • boys:girls • teacher:pupils • desks:students • tables:students • pencils:students
6N5.3 Express a given ratio in multiple forms, such as 3:5, or 3 to 5.	As students continue to work with ratios, provide them with many opportunities to show and understand that ratios can be written in many forms. It is beneficial for students to be able to move easily among different forms when expressing a number. Throughout this unit it is suggested that students get daily practice using the different forms of ratios. Ask students to create a book where each page represents a different ratio. Ask them to draw pictures to show the ratio and then demonstrate the related fraction, percentage and decimal.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Read the book *Math Curse* by Jon Cieszka. Ask students to draw the shirts and then create ratios to represent the shirts in the main character's closet. (6N5.2)

- Invite your students to a mathematical yogurt party. Everyone should bring a single-serving container of a favourite flavour of yogurt. Look on the carton to find out how many calories each yogurt has and how many of those are from fat. Write the ratio of fat calories to total calories as a fraction, then convert the fraction to a percent. Compare the percent of fat in your yogurt with the values obtained by others. Does the information on the containers explain the differences? What might account for caloric differences? Discuss why you think the ratios differ. (6N5.2)

- Ask students to find body ratios such as wrist size: ankle size, wrist size: neck size, hand width: hand length, arm span: body height. Ask students to compare their results with others and express the ratios in multiple forms. (6N5.2, 6N5.3)

Paper and Pencil

- Ask students to find and record the ratio of odd numbers to even numbers in their home phone number. (6N5.2)

Student-Teacher Dialogue

- Give students a handful of two or three different coloured snap cubes. Ask them to describe all possible ratios that exist using these cubes. (6N5.2)

- Ask: Why might you describe the data set below as 4:1? As 1:4? Are there other ratios that you can use to describe the boys and girls?

  B B B B G

  B= boy G=girl (6N5.2)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Ratios

6N5

TG pp. 13 – 17

Children's Literature (provided):
Cieszka, Jon. *Math Curse*.

Strand: Number

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **6N5 Continued** **Achievement Indicators:** *6N5.4 Identify and describe ratios from real-life contexts, and record them symbolically.*	A scale on a map provides a real life example of ratios. Discuss with students the need for this scale, or ratio (it is impossible to show the actual size and/or distances on a map). Another example of a ratio in the real world is in mixing gas and oil for chain saws and snowmobiles. The gas:oil ratio might be 50:1. This means that for every 50 L of gas there would be 1 L of oil needed.
6N5.5 Explain the part/whole and part/part ratios of a set; e.g., for a group of 3 girls and 5 boys, explain the ratios 3:5, 3:8 and 5:8.	To illustrate the difference between part-to-part and part-to-whole ratios of the set, provide small groups of students with a bag containing two different colored counters. Ask students to compare the counters in as many ways as they can. Invite groups of students to share their findings. They can describe their comparisons by explaining if their ratio is a part-part or part-whole ratio. Discuss part-to-part and part-to-whole ratios with students identifying examples of each type. Once the ratio is given, students could be told to represent it as a part-to-part ratio or it could be left open where students choose which ratio type to use. After creating their representations, encourage students to explain why they chose to represent the ratio the way they did.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- Give students the following information and ask them to write/read ratio comparisons (including part-to-part and part-to-whole ratios) and to identify those that can be expressed as fractions.

  4 cats, 3 goldfish, 2 hamsters (6N5.5)

- Ask students whether or not he/she believes that the ratio of the population of any city in Canada to the total population of Canada could be 1:2. Students should explain their responses. (6N5.4)

- Ask students to model two situations which could each be described by the ratio 3:4. Specify that the situations must involve a different total number of items. (6N5.4)

Performance

- Ask students to explore the ratios of the different colors in a box of Smarties®, bag of Skittles®, or a set of pattern blocks.

  (6N5.2, 6N5.5)

- Ask students to write their full name indicating the ratio of vowels to consonants, vowels to all letters, consonants to vowels and consonants to all letters. (6N5.5)

Performance

- Ask students to use snap cubes to show the ratio 5:6. Then ask them to use more cubes to create an equivalent ratio. (6N5.6)

- Ask students to use counters to display a ratio of 3:5. Ask them to show an equivalent ratio and justify their answers. (6N5.1, 6N5.6)
- Provide students with a problem such as:

  Donald's punch recipe calls for 3 L of ginger ale, 1 L of strawberry juice and 2 L of orange juice. Suppose Donald uses 9 L of ginger ale, how much strawberry juice and orange juice should he use? Justify your answer.

  (6N5.6)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Ratios

6N5

TG pp. 13 – 17

Strand: Number

Outcomes

Students will be expected to

6N5 Continued

Achievement Indicators:

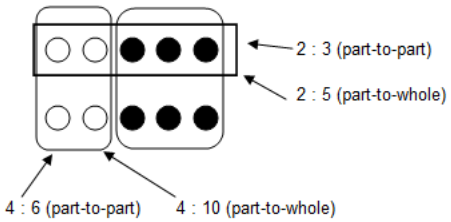
6N5.6 Demonstrate an understanding of equivalent ratios.

Elaborations—Strategies for Learning and Teaching

Many students will recognize the similarity between equivalent ratios and equivalent fractions.

Using pattern blocks, ask students to explore equivalent ratios by seeing that when the yellow hexagon is one whole, one blue rhombus represents 1:3 or $\frac{1}{3}$ of the hexagon. To create an equivalent ratio, students could use the green triangles to match the same area as one blue rhombus. They will see that it takes 2 green triangles to create a blue rhombus, therefore the ratio of triangles to the whole is 2:6 and this clearly illustrates that 1:3 is equivalent to 2:6. Ask students to explore other equivalent ratios using the pattern blocks.

Students have worked with equivalent fractions in Grade 5 and should be able to use this concept to help them understand equivalent ratios. E.g., in the diagram below, $\frac{2}{5}$ of the counters in the top row are white, which also illustrates the ratio 2:5. In total $\frac{4}{10}$ of the counters are white or 4:10, so $\frac{2}{5} = \frac{4}{10}$. Therefore, the ratios 2:5 and 4:10 are also equivalent. If 2 of every 5 counters are white, then 4 of every 10 would also be white.



To help students visualize the concept of equivalent ratios, ask them to create a given ratio using two different colored snap cubes. E.g., when given the ratio of 3:5, students can build a model using 3 black cubes and 2 white cubes (part-to-whole) . When looking at the ratio of black to the whole, they would see 3 black to 5 in all or 3:5. Demonstrate for students an equivalent ratio for 3:5 by replicating the original model. We now have an equivalent ratio for 3:5, which is 6:10. By continuing to replicate their original model, they can create additional equivalent ratios.

Students can use equivalent ratios to make predictions. E.g., in a large bag of marbles, the ratio of blue marbles to the total number of marbles is 4:10 (i.e., 4 out of every 10 marbles are blue). Use this to predict the number of blue marbles you would expect in 100 selections.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Presentation

- Ask students to draw a picture of them and their families at the park. Ask students to write a part-to-part ratio and a part-to-whole ratio to describe their picture (e.g., Number of arms to legs and number of children to people) and allow time for them to share their pictures and ratios with the class. Next, ask students to switch pictures. Give each student a strip of paper and ask them to write a word problem involving equivalent ratios to go with their classmate's picture. Display the pictures and word problems around the classroom. Allow students time to solve all the problems by having students do a gallery walk in pairs. (6N5.2, 6N5.6)

Paper and Pencil

- Present the following diagram to students:

  x x x o

  x x x o

  x x x o

  Ask students to write equivalent ratios demonstrated through this diagram and to explain their thinking. (6N5.2, 6N5.6)

Performance

- For each of the following ratios, ask students to find an equivalent ratio in which one of the terms is 20.

  4:6 10:30 3:5 4:5 (6N5.6)

- Ask students to list:
  - five ratios that are equivalent to 1:2
  - three ratios that are equivalent to 8:6.

  (6N5.6)

Student-Teacher Dialogue

- Ask students to explain how a multiplication chart can be used to generate equivalent ratios. (6N5.6)

- Ask students: Why do you get an equivalent ratio by multiplying both terms of a ratio by 3?" (6N5.6)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Ratios

6N5

TG pp. 13 – 17

Math Focus 6

Lesson 2: Equivalent Ratios

6N5

TG pp. 18 – 22

Strand: Number

Outcomes

Students will be expected to

6N5 Continued

Achievement Indicators:

6N5.6 Continued

Elaborations—Strategies for Learning and Teaching

Multiplication tables can be used to look for equivalent ratios. Ratios equivalent to 2:4 (4:8, 6:12, etc.) are found by looking at numbers in the same column of the table.

X	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7
2	0	2	4	6	8	10	12	14
3	0	3	6	9	12	15	18	21
4	0	4	8	12	16	20	24	28
5	0	5	10	15	20	25	30	35
6	0	6	12	18	24	30	36	42
7	0	7	14	21	28	35	42	49

While it is not a requirement to ask students to represent ratios in the simplest form, it is suggested that students explore the idea of writing ratios in the simplest form.

Ask students to work in pairs or small groups to discuss all possible ratios, including equivalent ratios, that could be represented by the following situation:

During a student council election, Sue received 36 votes and Sam received 9 votes. Students should recognize the following ratios:

36:9 or 4:1 (Sue received 4 votes for every 1 vote Sam received.)

9:36 or 1:4 (Sam received 1 vote for every 4 Sue received.)

36:45 or 4:5 (Sue received 4 votes for every 5 votes cast.)

9:45 or 1:5 (Sam received 1 vote for every 5 cast.)

Allow students time to write their own scenarios that would demonstrate equivalent ratios.

Ask students to use fraction strips to represent the ratio 1:2. For example, the '1 whole' strip could be used with the $\frac{1}{2}$ strip where it could be seen that it takes two $\frac{1}{2}$ to make up 1 whole.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Journal

- Tell students that in a class of 30 students, there are 20 girls. Ask them to explain why the ratio of boys to girls is 1:2. (6N5.6)

- Ask students to create a picture representing various groups of items and write two equivalent ratios that can be found in the picture. Ask them to explain their thinking. (6N5.2, 6N5.6)

Resources/Notes

Math Focus 6

Lesson 2 (Cont'd): Equivalent Ratios

6N5

TG pp. 18 – 22

Strand: Number

Outcomes

Students will be expected to

6N6 Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially and symbolically.

[C, CN, PS, R, V]

Achievement Indicator:

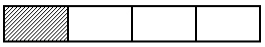
6N6.1 Explain that "percent" means "out of 100."

Elaborations—Strategies for Learning and Teaching

This is the first time Grade 6 students will work with percents.

Percent is a ratio and, therefore, another name for a fraction. Percent should be viewed as a part-to-whole ratio that compares a number to a whole divided into 100 equal parts. Students may note the connection to the word "cent" where a cent is $\frac{1}{100}$ of a dollar. Students should not be computing percentages where they are procedurally finding the percentage of fractions or ratios at this time and need not work with percentages greater than 100, but should recognize:

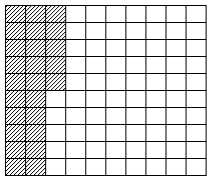
- situations in which percent is commonly used
- diagrams that represent various percentages



25%

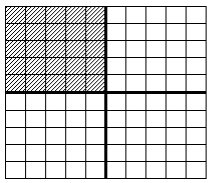
- the relationship between percents, decimals and fractions (e.g., 48% = 0.48 = $\frac{48}{100}$)
- that percent is a ratio or a comparison of the percent value to 100 and can be written as __ : 100 and $\frac{?}{100}$
- that finding a percentage is the same as finding an equivalent ratio out of 100

Demonstrate to students how to use a hundredths grid to represent percents by shading in the desired portion of the grid. E.g., to represent and model 25%, students could use a hundredths grid to shade 25 blocks out of 100. This will help students to understand and see the connection among fractions, decimals, percents and ratios as 25 blocks shaded out of 100 could be seen as $\frac{25}{100}$, or $\frac{1}{4}$, 25:100 or 1:4, 0.25 or 25%.



$\frac{25}{100}$, 25 : 100

25%
0.25



25 % shaded

Discuss with students that you evaluate their progress in many different ways. One form of assessment that they may remember is a test and getting the results in the form of a percentage. The greatest score you can get is 100%; therefore, to give a percent, it must always be 'out of 100'. E.g., if you get 87% on a test, this means you got 87 marks out of a possible 100 marks ($\frac{87}{100}$). As connections are made to fractions, 100% can be seen as a whole where anything less than that whole is a part or percent. To connect decimals to percents, ask students to use a calculator to calculate $\frac{87}{100}$ where they would see an answer of 0.87. Ask students to explore and discover how 0.87 means the same as 87% or $\frac{87}{100}$.

(continued)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Tell students Emma is making a quilt. She has 60 patches. Help Emma create a quilt with the following colors:
  - 25% red
  - 0.10 green
  - 3:10 yellow
  - The rest is blue

  Ask students to draw a picture to show your thinking and explain how you were able to find out how many of each color Emma will need to complete her quilt. (6N6.1)

- Tell students they have been hired by a graphic design company to design a new logo for the company. They tell you the logo can be any shape and have the following criteria:
  - Less than one third of the logo is blue
  - about 60% red
  - the rest yellow.

  Ask students to design the logo and write a description telling the company how you were able to come up with the percentages of each color. You may need to represent each portion (color) of the logo in decimal and fractional form, just in case they may want to make sure you have met the criteria. (6N6.1)

- Ask students to explain which of the following numbers represents the least and which represents the most : $\frac{1}{20}$, 0.25, 0.020. (6N6.1)

- Ask students to choose three percentages. Write these numbers in fractions, decimals and ratios. Order the numbers from least to greatest by placing them on a number line. (6N6.1)

- Ask students if 68% of a hundredths grid is shaded, what ratio of the grid is not shaded? (6N6.1)

- Ask students if a red and blue quilt has 50 squares and 20% are blue, what ratio of the quilt squares is red? (6N6.1)

Resources/Notes

Math Focus 6

Lesson 3: Percents

6N6

TG pp. 23 - 27

Strand: Number

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **6N6 Continued** **Achievement Indicators:**	Focus on mathematical language, using 87 hundredths, or 87 out of 100 to help students see these connections.
6N6.1 Continued	Many problems involving percents will also require students to use their knowledge of equivalent fractions and equivalent ratios. Provide students with an example such as, there were 10 cartons of milk ordered for recess; 7 were chocolate. Therefore $\frac{7}{10}$ milks were chocolate. This also means $\frac{70}{100}$, or 70%, of the milk was chocolate.
6N6.2 Explain that percent is a ratio out of 100.	Provide students with a blank hundredths grid and ask them to use four different colors to shade in the grid. Ask them to, for example, shade 30 blocks red, 20 blocks blue, 45 black and 5 yellow. Ask students to describe each color using a fraction, decimal, percent and a part to whole ratio. This activity will help students connect these four ways of representing a number.
6N6.3 Use concrete materials and pictorial representations to illustrate a given percent.	Ask students to work with various concrete materials to represent percents (e.g., cut sheets of paper and/or lengths of string to show 50%, 10%, 25%, etc.).
6N6.4 Record the percent displayed in a given concrete or pictorial representation.	Hundredths grids are excellent resources to use with students to help develop their understanding of percents. Encourage them to also use other concrete representations to facilitate their understanding. Share with students the book *Piece = Part = Portion: Fractions = Decimals= Percents* by Scott Gifford. The images provided demonstrate concrete examples of percents of objects, as well as equivalences of fractions, decimals and percents. Ask students to predict percentages, give their prediction strategies, and then check their predictions. For example, ask them to estimate the percentage of - red counters when fifty 2-coloured counters are shaken and spilled - each colour of Bingo chips, if a total of 100 blue, red, and green chips are shown on an overhead for 10 seconds - a hundredths grid that is shaded to make a picture
6N6.5 Identify and describe percents from real-life contexts, and record them symbolically	Ask students to bring in a flyer from a local store. Ask them to go through each flyer identifying different percents that are used throughout. Discuss what these percents mean (e.g., Walmart, Zellers, or Canadian Tire, Riffs may have 33.3% off sale).

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask the student to shade hundredths grids to show particular percentages such as 20%, 60%, etc. (6N6.3)

- Ask students to place the following on a number line. Then choose one number and justify their thinking.

  0.40 76% 2/10 95% (6N6.3)

- Ask students to use the Internet or print resources to find out such things as:

  -What percent of the Earth is water?

  -What percent of the rainforests are in danger?

  - What percent of animals are endangered? (6N6.5)

- Ask students to create a collage showing how percents are used in daily life. (6N6.5)

- Ask students to draw a design in a hundredths grid (or partially cover a flat) and describe the percentage of the grid covered.

  Ask further questions such as: How many more squares would you have to cover to fill in the grid? (6N6.4)

- Ask students to use the Internet, a geography book, or other print resource to locate the flags of various countries. You will notice that many flags are created with a number of colors or combinations of those colors. Have the students choose 3 different countries to reflect on the design of their flags. What percentage of a flag is a particular color? What fraction? What would this look like as a ratio to the whole flag? Sort and graph flags that represent halves, thirds, and fourths. (6N6.1)

Journal

- Ask students to draw a picture to show why a decimal can be represented as a percent. (6N6.1, 6N6.3)

- Ask students to choose a fraction and a percent that are not equivalent. Ask them to use pictures, numbers and words to explain which is greater. (6N6.1, 6N6.3)

Resources/Notes

Math Focus 6

Lesson 3 (Cont'd): Percents

6N6

TG pp. 23 - 27

Children's Literature (provided)**:** Gifford, Scott (2005), *Piece = Part = Portion: Fractions = Decimals= Percents*.

Strand: Number

Outcomes

Students will be expected to

6N6 Continued

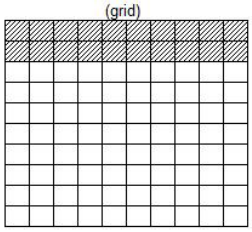
Achievement Indicator:

6N6.6 Express a given percent as a fraction and a decimal.

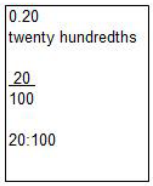
Elaborations—Strategies for Learning and Teaching

Throughout the unit students have been making connections using fraction, decimals, percents and ratios to represent any given number. Working with a hundredths grid is essential to this type of work so students can have a visual representation of the work they are doing. Provide students with a hundredths grid, asking them to shade a percentage of the grid. Once the grid is shaded, ask them to create a corresponding card that illustrates the percent shaded on the grid using a decimal, fraction, ratio and in words.

(grid)



(card)



(These grids and cards will be similar to the materials used in the Decimal Square kit.)

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Student-Teacher Dialogue

- Ask students to compare 20% and 0.02 on a hundredth grid. Which is greater? Explain your answer. (6N6.3)

- Ask students: What percent of a metre stick is 37 cm? How do you know? (6N6.4)

- Ask the students to name percents that indicate:
  - almost all of something
  - very little of something
  - a little less than half of something (ask students to explain their thinking) (6N6.4)

- Ask students to estimate the percentage of red that is shown on the Canadian flag. Justify your thinking. (6N6.4)

Portfolio

- Ask students to create a pencil crayon quilt made of patches of various colours. They can describe the approximate or exact percentages, ratios or fractions of each colour within the patch and then estimate the percent of the total quilt that is each colour. (6N6.2, 6N6.4)

- Tell students to use a hundredths grid and shade in 25% of the grid. Ask what percent is left unshaded? What are other ways of representing the unshaded part? (6N6.3)

Resources/Notes

Math Focus 6

Lesson 4: Percents as Fractions or Decimals

6N6

TG pp. 32 - 35

Math Game: Ratio Match

6N5

TG pp. 36 - 37

Strand: Number

Outcomes

Students will be expected to

6N5 Demonstrate an understanding of ratio, concretely, pictorially and symbolically.

[C, CN, PS, R, V]

Achievement Indicator:

6N5.7 Solve a given problem involving ratio.

Elaborations—Strategies for Learning and Teaching

There are many different applications to the real world where students can use percents and ratios to solve problems. One such example is through the use of scale diagrams; however, students' work and discussion should not be limited to this particular situation.

In using scale diagrams as a means of having students solve problems involving ratios and percents, students can look at maps investigating the particular scale used to represent distances and sizes of countries. For example, based on this scale, they could calculate distances between identified places.

Students may be familiar with model toys, and can readily identify that a model car or motorcycle has a scale of 1:30 to an actual car. Ask them to explore the dimensions of the actual size of the car or motorcycle where they come to realize that the model dimensions are in the numerator and the actual car dimensions are in the denominator. If the model car has a door that is 4 cm in height, students can use their understanding of scales and ratios to determine the height of the actual car door.

It is very important to keep numbers simple when representing or comparing various ratios.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask students to use 20 tiles of four different colors to show pairs of colors that show the following ratios:
  - 4 to 3
  - 2:1
  - $\frac{1}{3}$
- Ask students to create their own scale diagram. Ask them to let every one block of one centimetre-grid paper represent two meters of real, outdoor playground space. To visualize this scale, use string or chalk to mark off a two-meters-by-two-meters space on the floor. Use small cubes or blocks to build a scale model of a playground structure on your paper. Trace and draw on the paper a top-view plan of the structure. How could you represent yourself on your playground? (6N5.6, 6N5.7, 6N6.7)
- Provide students with a problem such as: 758 people were surveyed to determine their favourite laundry detergent. 248 individuals responded that they used Brighto detergent. Working in pairs, ask the students to estimate what ratio would best describe the number of people who use Brighto. Ask students to explain their reasoning. Ask them to make up similar situations for their classmates to solve. (6N5.7)

Resources/Notes

Math Focus 6

Lesson 5: Exploring Scale Diagrams

6N5

TG pp. 38 - 41

Scale diagrams is ONE example of solving a given problem involving percents and ratios. You may wish to explore other ways to ask students to solve problems involving these concepts.

Strand: Number

Outcomes

Students will be expected to

6N6 Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially and symbolically.

[C, CN, PS, R, V]

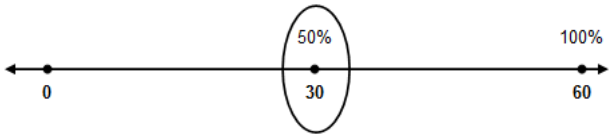
Achievement Indicator:

6N6.7 Solve a given problem involving percents.

Elaborations—Strategies for Learning and Teaching

Students have been working on making connections between percents, decimals, ratios and fractions. Through this work, students understanding of percent will now be extended to calculate and estimate percents to solve problems. They will now be expected to understand how to estimate and find a given percent of a number. E.g., they may be asked to estimate what 50% of 80 is.

Number lines are helpful tools when working with percents. Students can see that when they are asked to get a percentage of a given number, the given number is the whole and is represented at the end of the number line. E.g., Shawn wanted to save 60 dollars for his sister's birthday gift. He thought about it and decided he should have 50% saved by June. How much money would Shawn have saved by June?



Students would then use their knowledge of benchmarks, using $\frac{1}{2}$ as 50%, $\frac{1}{4}$ as 25% and $\frac{3}{4}$ as 75% to help them estimate and calculate the given percentage of the number. E.g.,

Present the following problem:

The school has raised $800.00 to buy new sports equipment. 50% of the money will be spent on volleyball equipment. 30% will be spent on basketball equipment. The remaining money will be used to purchase new scooters. How much money was spent on each item?

Students need to realize that it if they want to use a number line to help represent a problem, they need to see that while the end points of their number line begin at 0 and go to 800, for example, that this number line represents 100% of the total amount of money raised. Therefore, when they establish the benchmarks of one half or 50% it represents $400.00. Through this exploration it is hoped that students will discover that 100% of the money is used and the total for all equipment purchased is $800.00.

Begin instruction with establishing the benchmark of 50% or the half way point. Practice getting 50% of numbers where students can explore how this is really finding the midpoint on their number line between 0 and the number in question. When students are comfortable with this idea, lead them to getting 25% and 75% of given numbers. These two percentages would represent the $\frac{1}{4}$ and $\frac{3}{4}$ mark on their number line.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- In a set of tangrams, a large triangle is 25% of the whole set. Ask students what percentage of the set is the square? Parallelogram? Small triangle? Medium triangle? (6N6.7)

- Tell students Sandra bought a pizza for her slumber party. Jaime and Maria ate 25% of it. Louisa and Abby ate one-third or 33% of what was left. Chantel and Sammie ate 50% of what was left. Manuela ate two slices. Sandra was left with two slices. How many slices were in the pizza? How many slices did each of the girls eat? Draw a picture and show how you went about solving this problem. (6N6.7)

- Tell students that approximately 50% of all people in Canada over 18 years old vote when it is time to elect a new prime minister. If 50% of your class voted, how many people would that equal? How about in your grade? How about in your school? How about in your community? Was this percentage easy or difficult to work with and why? What would happen if the percentage was 75%? Would you use the same strategy or a different strategy to find your answer? (6N6.7)

- Ask students to assign a percentage value to each letter in the word **HEART**. Assign the values so that the sum of the letters equals one hundred percent. All the letters can have the same value or each letter can have a different value. Show 4 different ways you can do this. (6N6.7)

- Changing to newer, more energy-efficient light bulbs can save up to 70 percent on your electric bill. If a person's electric bill was $30 before changing his bulbs, what would the bill be with the newer bulbs? Talk to your family about your electric bill. How much could you save? Or how much are you already saving? Make a list of additional ways your family could both conserve energy and save money. (6N6.7)

Resources/Notes

Math Focus 6

Lesson 6: Solving Percent Problems

6N6

TG pp. 42 – 45

Curious Math: Interesting Percents

6N6

TG pp. 46 - 47

Children's Literature (provided): Merrill, Jean. *The Toothpaste Millionaire*

Some problems presented in this literature use the Imperial system so you will need to modify to reflect the Metric System.

Strand: Number

Outcomes

Students will be expected to

6N6 Continued

Achievement Indicator:

6N6.3 Continued

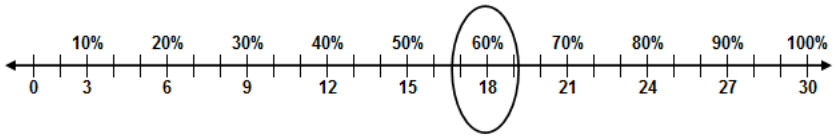
Elaborations—Strategies for Learning and Teaching

Students can then use these benchmarks to help them estimate and calculate any other given percentages.

For some students, it may be difficult to estimate and calculate various percentages of numbers. It may be possible to give these students numbers for which the percent is easier to calculate or think about, such as 10%, 20%, 25%, 50% and 75%.

Using the book "*The Toothpaste Millionaire*", by Jean Merrill, ask students to review page 27 where Mr. Conti caught Rufus passing a note to Kate which read "If there are $2\frac{1}{2}$ billion tubes of toothpaste

Students can use base-ten blocks, counters or a number line to find given percentages. When asked to find 60% of 30, for example, students could count out 30 blocks, or use 3 rods or 30 units. They should see that 60% is the same as $\frac{60}{100}$ or $\frac{6}{10}$. They can use this relationship to discover if they broke the group of 30 into 10 groups, they would have made tenths. Since 60% means 6 tenths, they could show that 60% of 30 would be 6 groups out of 10, where each group consists of 3 counters, so 6 groups of 3 counters would be 18. Therefore, 60% of 30 is 18:



Students should be asked to justify their thinking and provide reasons for answering the question the way they did. This allows students the opportunity to reflect on their answers and decide if it is reasonable. For the above example, students who got an answer of 18 could have thought about the fact that one half of 30 is 15 and 60% is one tenth more than 50%. Therefore 18 would be reasonable, as it is a little more than 15, or 50%.

continued

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Paper and Pencil

- If the Montreal Canadians won 75% of their hockey games this season, and their season consists of 60 games, what is the ratio of their games won? Lost? Justify your answers. (6N6.7)

- There are 50 students in a choir with 32% boys. How many girls are in the choir? Is it possible to use a hundredths grid to solve the problem? (6N6.7)

Resources/Notes

Math Focus 6

Lesson 6 (Cont'd): Solving Percent Problems

6N6

TG pp. 42 – 45

Children's Literature (provided): Merrill, Jean, *The Toothpaste Millionaire*

Please note that this book is written using Imperial system. Please adjust to the metric system.

Strand: Number

Outcomes

Students will be expected to

6N5 Continued

Achievement Indicator:

6N5.7 Continued

6N6 Continued

Achievement Indicator:

6N6.7 Continued

Elaborations—Strategies for Learning and Teaching

Students have been working on understanding the concepts of ratio and percent. They have been solving problems involving these concepts and representing this understanding. The models they have been using, such as hundredths grids, pictures, and pattern blocks, are very useful in helping students communicate their understanding of the problems that are given. Students need to focus on how they communicate their understanding as this is an important skill they need to practice. Students sometimes find it helpful talking out their understanding of a topic as this helps solidify and organize their thinking. Also, analyzing students' communication about a topic becomes a critical assessment tool for teachers.

Students are expected to demonstrate their understanding using pictures, numbers and words, using appropriate mathematical language. Students should be encouraged to use many forms of mathematical communication, including oral, written, physical and symbolic.

Ensuring the use of modelling appropriate responses to various types of questions will allow students to see what is expected and how to use pictures, numbers and words effectively to show their understanding of a concept.

General Outcome: Develop Number Sense

Suggested Assessment Strategies

Performance

- Ask students to explain how they know that the ratio of 1:5 represents 20%.
- Think of and explain two situations which could be described by the ratio 3:4.
- The ratio of boys to girls in Sarah's class is 7:13. Sarah says there are at least 50% girls in her class. Is she correct? Explain.

Resources/Notes

Math Focus 6

Lesson 7: Communicating about Ratios and Percents

6N5

6N6

TG pp. 48 – 51