

Name: _____

Start date: _____

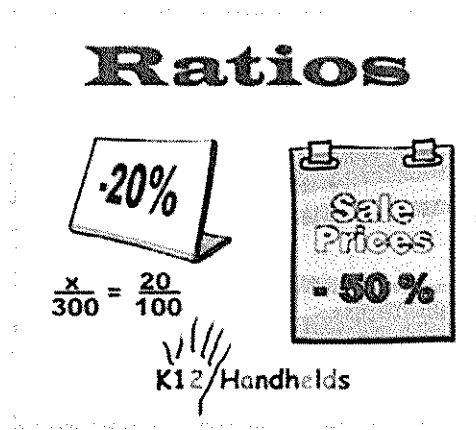
Hand in date: _____

Mark: _____

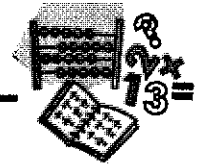
Math 9 K&E

Percent, Ratios,

Proportions, Unit Rates



Calculating Percents



Percent means *out of one hundred*. Percentages, or percents, are used all the time in everyday life. Just check out these signs!

Lowest Interest Rates in Town!

Running Shoes 20% OFF Regular Price!

1.9% Interest on New Cars!

Decimals, fractions and percents are related to each other.

Examples

A)

Decimal	Fraction	Percent	Word Form
0.75	$\frac{75}{100}$	75%	seventy-five hundredths

Picture Form

B)

Picture Form

Decimal	Fraction	Percent	Word Form
0.03	$\frac{3}{100}$	3%	three hundredths

C)

Decimal	Fraction	Percent	Word Form
0.09	$\frac{9}{100}$	9%	nine hundredths

Picture Form

To change a decimal number (to the hundredth place) to a percent, multiply the decimal number by 100.

Examples

A) $0.82 \times 100 = 82\%$

B) $0.07 \times 100 = 7\%$

Remember, multiplying by 100 is the same as moving the decimal two spaces to the right.



The following table shows some examples of how decimal numbers, fractions and percents are related.

Decimal	Fraction	Percent
0.18	$\frac{18}{100}$	18%
0.97	$\frac{97}{100}$	97%
0.08	$\frac{8}{100}$	8%
0.01	$\frac{1}{100}$	1%

Numbers in the tenths position can be turned into percents by creating an equivalent fraction with a denominator of 100.

Examples

A)



This figure has 10 parts. Two parts are shaded.

Fraction: $\frac{2}{10}$

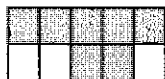
Equivalent Fraction: $\frac{2}{10} = \frac{20}{100}$

Decimal: 0.2

Word Form: two tenths

Percent: 20%

B)



This figure has 10 parts. Seven parts are shaded.

Fraction: $\frac{7}{10}$

Equivalent Fraction: $\frac{7}{10} = \frac{70}{100}$

Decimal: 0.7

Word Form: seven tenths

Percent: 70%

C)

Fraction	Equivalent Fraction	Decimal	Percent
$\frac{6}{10}$	$\frac{60}{100}$	0.6	60%
$\frac{3}{10}$	$\frac{30}{100}$	0.3	30%
$\frac{9}{10}$	$\frac{90}{100}$	0.9	90%

Fractions that have a factor of 100 as a denominator can be changed to percents.

Examples

A) $\frac{12}{25} \times 4 = \frac{48}{100} = 48\%$

B) $\frac{16}{20} = \frac{80}{100} = 80\%$

To convert (change) a fraction to a percent when the denominator is not a factor or multiple of 100, divide the denominator into the numerator.

Examples

Jason got 20 correct answers on a test with 24 questions. The fraction to represent his score is $\frac{20}{24}$. To convert this to a percent, divide the **denominator** into the **numerator**.

$$\begin{array}{r} .833 \\ 24 \overline{)20.00} \\ \underline{-192} \\ 80 \\ \underline{72} \\ 80 \end{array} \quad 0.833 \text{ is } 83\%$$

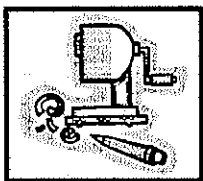
Or use a calculator to convert. Enter the numerator, the division sign, the denominator and the equal sign.

$$\begin{aligned} 20 \div 24 &= 0.833 \\ 0.833 &\text{ is } 83\% \end{aligned}$$

Check out these examples using a calculator.

Correct Answers	Test Total	Fraction	Process
a) 27	40	$\frac{27}{40}$	$27 \div 40 = 0.675 \rightarrow 68\%$
b) 69	75	$\frac{69}{75}$	$69 \div 75 = 0.92 \rightarrow 92\%$
c) 106	130	$\frac{103}{106}$	$106 \div 130 = 0.815 \rightarrow 82\%$

Notice that in (a) and (c) above, the percents are rounded.



Practice: Convert into Percents

Convert the following fractions into percents.

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

e) $\frac{1}{10}$

b) $\frac{1}{4}$

f) $\frac{5}{8}$

c) $\frac{3}{4}$

g) $\frac{7}{8}$

d) $\frac{1}{3}$

Converting Between Decimals and Percents

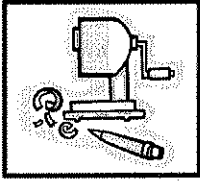
To convert from a **decimal number to a percent**, **multiply** the decimal number by **100**, which is the same as moving the decimal two spaces to the right.

To convert from a **percent to a decimal number**, **divide** the percent by **100**, which is the same as moving the decimal two spaces to the left.

Examples

Decimal	Multiply by 100	Percent
0.67	$\times 100$	67%
0.04	$\times 100$	4%
1.74	$\times 100$	174%

Percent	Divide by 100	Decimal
74%	$\div 100$	0.74
8%	$\div 100$	0.08
136%	$\div 100$	1.36



Practice: Converting Fractions, Decimals and Percents

1. Fill in the blanks in the table below.

Remember that when the numerator and denominator are the same, the fraction equals 1.

For the last two rows, recall how to convert an **improper fraction to a mixed number**.

Fraction	Decimal	Percent
$\frac{3}{10}$		30%
$\frac{65}{100}$	0.65	
	0.8	80%
$\frac{12}{100}$		12%
	0.18	
$\frac{58}{100}$	0.58	
	0.2	20%
$\frac{8}{100}$		8%
$\frac{77}{100}$	0.77	
	0.96	96%
$\frac{100}{100}$	1.0	
$\frac{125}{100}$		125%
	2.35	235%

2. The following table shows the scores that Kenneth received on some of his math assignments. Complete the missing blanks.

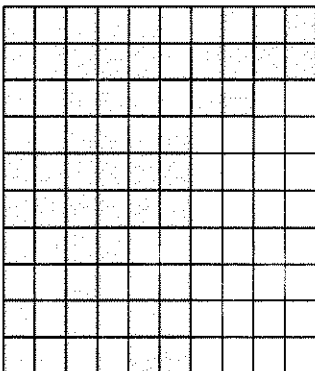
a) Denominators that are multiples or factors of 100

Assignment, Quiz and Review	Score	Decimal	Percent
Adding integers	$\frac{6}{10}$		
Subtracting integers		0.77	
Dividing integers			83%
Multiplying integers		0.5	
Integers review	$\frac{90}{100}$		
Integers quiz			91%
Adding fractions	$\frac{4}{10}$		

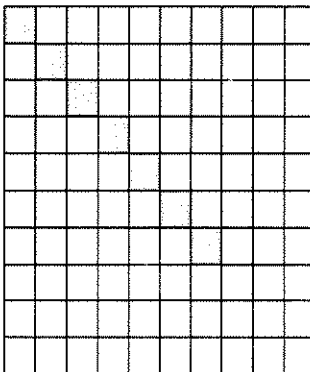
b) Denominators that are not multiples or factors of 100

Assignment, Quiz and Review	Score	Decimal	Percent
Subtracting fractions	$\frac{13}{19}$		
Unlike denominators	$\frac{70}{90}$		
Improper fractions	$\frac{7}{11}$		
Mixed numbers	$\frac{40}{60}$		
Converting quiz	$\frac{82}{120}$		
Multiplying fractions	$\frac{30}{95}$		
Dividing fractions	$\frac{9}{13}$		

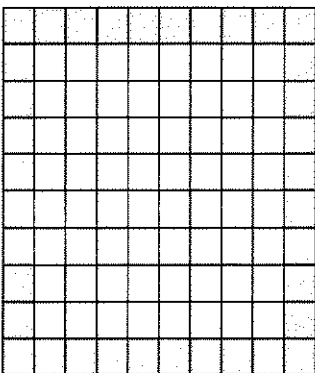
3. Fill in the blanks relating to each figure.



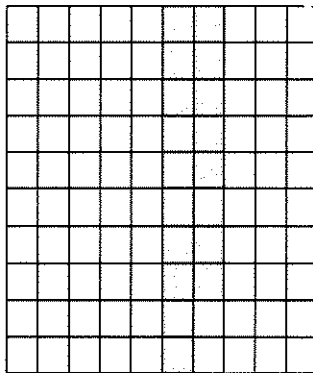
Decimal: _____
Fraction: _____
Percent: _____
Word Form: _____



Decimal: _____
Fraction: _____
Percent: _____
Word Form: _____



Decimal: _____
Fraction: _____
Percent: _____
Word Form: _____

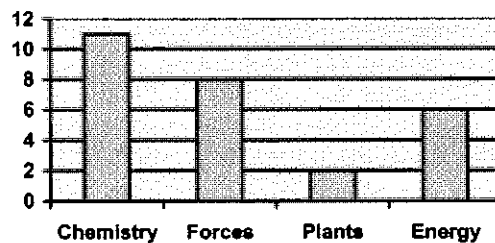


Decimal: _____
Fraction: _____
Percent: _____
Word Form: _____

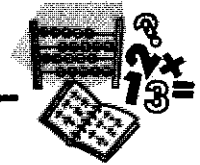
4. Vinny conducted a survey of students in his science class to determine which topic of study was their favourite. He surveyed 27 students and placed the results in a graph.

Calculate the percentage of students who prefer each of the science topics below.

Favourite Science Topics



Estimating and Calculating Percents in Money



Examples

Canada has a 7% General Sales/Service Tax (GST) on most items. Many provinces have an additional Provincial Sales Tax (PST) that is added to the cost of a purchase.

Item	Price	Process	GST	Total Cost
Microwave Oven	\$129.00	\$129.00 $\times \underline{0.07}$	\$9.03	\$129.00 $+ \underline{\$9.03}$ \$138.03
Can of Juice	\$0.69	\$0.69 $\times \underline{0.07}$	\$0.05	\$0.69 $+ \underline{\$0.05}$ \$0.74
Jacket	\$32.98	\$32.98 $\times \underline{0.07}$	\$2.31	\$32.98 $+ \underline{\$2.31}$ \$35.29

You can **estimate** the price of an item including GST by adding 10% of the approximate cost. Remember that 10% in decimal form is 0.10.

Examples

A) $\$15.45 \times 10\% (0.10) = \1.55

$\$15.45 + \$1.55 = \$17.00$

The estimated total will be a little less than \$17.00.



- B) Estimate the GST on a fishing rod that costs \$54.79. Use 10% to estimate. Move the decimal one space to the left \rightarrow \$5.47 and round. The GST is approximately \$5.50. The fishing rod with the GST will cost approximately \$60.00.



- C) Estimate the GST on a pair of running shoes for \$36.49. Use 10% to estimate. Move the decimal one space to the left \rightarrow \$3.64 and round. The GST is approximately \$3.65. The running shoes will cost approximately \$40.00.

If you need to know an exact amount, you can **calculate** the cost of an item including GST by multiplying the amount by 1.07, because **100% plus 7% is the same as 1.07**.

Example

$$\$15.45 \times 1.07 = \$16.53 \text{ (GST incl.)}$$

Remember, you can also use the % key on your calculator to calculate a percent. Type the number **x** 7% to find out the amount of GST, or type the number **+** 7% to find out the total including GST.

Example

$$\begin{aligned} \$129.00 \times 7\% &= \$9.03 \\ \$129.00 + 7\% &= \$138.03 \text{ (GST incl.)} \end{aligned}$$

Reviewing Money and Decimals

- The decimal number 0.02 is the same as 2 pennies out of 100 and can be represented as 2%.
- The decimal number 0.89 is the same as 89 pennies out of 100 and can be represented as 89%.
- The decimal number 1.15 is the same as 115 pennies and can be represented as 115%.

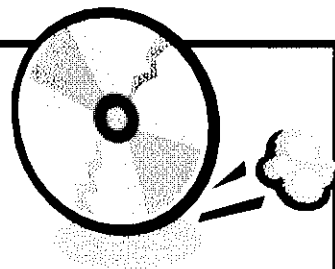
Examples

A)

CONGRATULATIONS!

This certificate earns you 15% off the regular price of a CD of your choice at the grand opening of our new location.

Hurry in today as selection may be limited.



The CD Liska wants costs \$18.99. She is planning to use her 15% off certificate. She has exactly \$16.25 in her wallet. With the 15% discount, will Liska have enough money to buy the CD? Let's find out ...

Step 1	Write down the original price of the item.	\$18.99
Step 2	Convert the percent into a decimal number.	15% 0.15
Step 3	Multiply the original price by the decimal number and place the decimal in the appropriate position.	$\$18.99 \times 0.15 =$ \$2.8485
Step 4	Round this number to the nearest hundredth.	Round to \$2.85
Step 5	Write down the original price and subtract.	$\$18.99 - \2.85
Step 6	The answer is the new sale price with the 15% discount.	\$16.14

The CD will cost \$16.14. Liska has enough money.

B) Derik and his family went to a restaurant for dinner and when the bill arrived, they wanted to add a 15% tip. If the bill was \$65.83, how much would they tip?



$$\begin{array}{r}
 \$65.83 \\
 \times 0.15 \\
 \hline
 \$9.87
 \end{array}$$

The tip would be \$9.87.

C) Sometimes items are discounted by a percent, for example 20% off the regular price. To figure out the sale price, you must:

1. Figure out how much 20% of the regular price is.
2. Subtract that amount from the regular price to get the sale price.

Regular Price: \$14.00

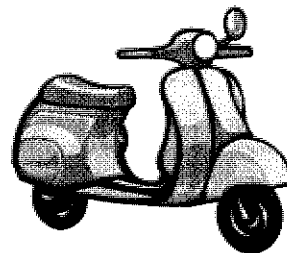
Discount: 20%

$$20\% \text{ of } \$14.00 = \$2.80 \quad (\$14.00 \times 0.20 \text{ or } \$14.00 \times 20\% \text{ using the calculator})$$

$$\$14.00 - \$2.80 = \$11.20 \text{ sale price}$$

- D) Joanne sold her scooter for 20% less than what she paid for it. She paid \$625.00. How much did Joanne get when she sold her scooter?

Find 20% of \$625.00
 $0.20 \times 625.00 = \$125.00$
Subtract $\$625.00 - \$125.00 = \$500.00$
Joanne received \$500.00 for her scooter.



- E) Paul paid an extra 4% to have his new car painted his favourite colour. The price of the car was \$20 650.00.

- a) How much did Paul pay for the special paint job?

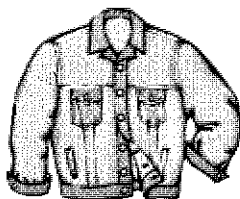
Find 4% of \$20 650.00
 $0.04 \times 20\ 650 = \$826.00$
Paul paid \$826.00 for the paint job.

- b) How much did Paul pay in total for his new car?

$\$20\ 650.00 + \$826.00 = \$21\ 476.00$

Paul paid \$21 476.00 for the car.

- F) Ashlyn noticed that the jacket she has been longing for is on sale. The regular price of the jacket is \$35.00. Now it is $\frac{1}{2}$ off! Ashlyn has \$18.00 in her wallet. Does she have enough money?



Solution: Find $\frac{1}{2}$ of \$35.00

$$\frac{1}{2} \times \frac{\$35.00}{1} = \frac{\$35.00}{2} = \$35.00 \div 2 = \$17.50$$

Luckily, Ashlyn has enough money to purchase the jacket.

Remember that when dealing with money, always round to 2 decimal places—to the nearest hundredth.

G) Find: $\frac{3}{4}$ of \$14.95

$$\frac{3}{4} \times \frac{\$14.95}{1} = \frac{\$44.85}{4} = \$11.2125 \quad (\text{round to the nearest hundredth}) = \$11.21$$

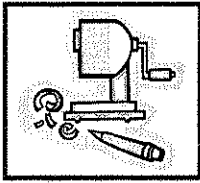
Find: $\frac{1}{4}$ of \$18.99

$$\frac{1}{4} \times \frac{\$18.99}{1} = \frac{\$18.99}{4} = \$4.7475 \quad (\text{round to the nearest hundredth}) = \$4.75$$

Think About ...

Every item for sale in a store has a “mark-up,” which means its price has been marked up from what it cost the store. The mark-up in a lot of stores is 100% or 200%, so when they sell items at a discount later, they don’t lose money.

For example, a T-shirt costs the store \$5.00, but they sell it for \$15.00 (200% mark-up). If they later sell it at a discount of 20% (\$12.00), they’re still making a profit of \$7.00.



Practice: Calculating Percents of Money

1. Use the decimal numbers below and demonstrate the relationship between pennies and percent. The first one has been done for you.

- a) $0.46 \implies$ 46 pennies is 46 out of a dollar, $\frac{46}{100}$ or 46%.
- b) 0.09
- c) 2.25
- d) 0.71

2. With a partner, make a list of 5 to 10 items you commonly buy or wish to buy. Use newspapers or other sources of information to list the prices. Calculate the price including the GST.



3. It was a busy shopping day! Carlo purchased all of the items below. Determine the sale price that Carlo paid with the discount.

a)



Regular price: \$3.49
Discount: 10%
Sale Price:

b)



Regular price: \$199.54
Discount: 15%
Sale Price:

c)



Regular price: \$18.99
Discount: 20%
Sale Price:

d)



Regular price: \$17.68
Discount: 25%
Sale Price:

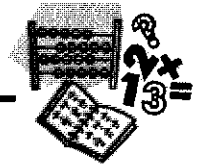
4. Leah made more money than she expected on her paycheque. She decided to take \$20.00 of this extra money and buy some gifts. The regular price of a vase was \$10.99, but Leah got it for $\frac{1}{4}$ off. She received $\frac{1}{3}$ off the regular price of \$12.49 for a set of golf balls. How much does Leah have left after buying the gifts?

5. Dakota works in retail at a popular clothing store. He receives instructions from his manager to discount the prices of certain items of clothing.

Use pencil and paper, calculator or another method to fill in the blanks in the chart below. The first one has been done for you.

Item of Clothing	Original Price	Discount	Amount of Discount (\$)	Sale Price
Blue Jeans	\$24.95	20%	\$4.99	\$19.96
Jean Jackets	\$36.49	15%		
Skirts	\$18.23	17%		
Designer T-shirts	\$9.08	22%		
Ladies' Suit Jackets	\$39.52	18%		
Necklaces	\$9.55	12%		
Hair Ties	\$1.29	15%		
Box of Sox	\$6.90	8%		

Calculating Ratios



Ratio is a way of comparing numbers.

Ratios can be expressed in several ways:

67:100

67/100

Sixty-seven to one hundred

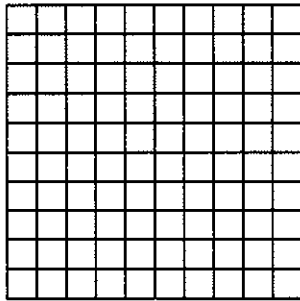
67 to 100

The order of ratios is the same as the order of items being compared in the problem.

Examples

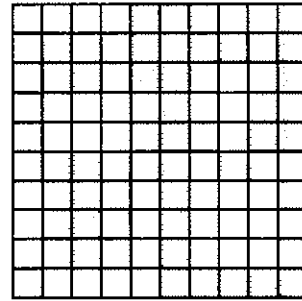
A) The ratio of shaded squares to the total number of squares for each figure is shown below.

1.



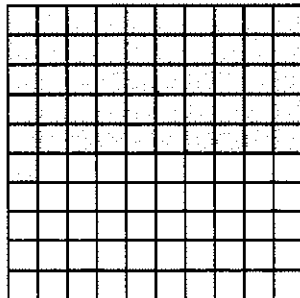
17 shaded squares:100 squares in all

2.



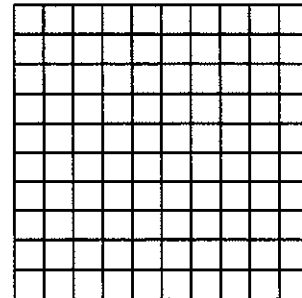
67 shaded squares:100 squares in all
67:100

3.



51:100

4.



8:100

B) If 38% of all customers (total 100%) at a restaurant request a glass of water with meals:

- what percent of customers request water? 38%
- what percent of customers do not request water? 62%
- what is the ratio of customers requesting water to those not requesting water?
38:62

C) Miguel's teacher asked the students how many had completed their science assignment early. Eighteen of the 29 students had finished the assignment.

- Write the ratio representing students who completed early and the total number of students. 18:29
- Write the ratio representing students who completed early and those who did not. 18:11
- Write the ratio representing students who did not complete early and the total number of students. 11:29

Think About ...

Ratios are often used to compare the statistics of two sports teams.
Can you think of any examples when ratios are used?

Using Ratios to Solve Problems

Ratios can be used to solve for unknowns.

Examples

- A) The ratio of girls to boys practising basketball in the gym is 3:4. If there are 16 boys practicing, how many girls are practicing? The ratios are:

girls:boys

3:4

n :16

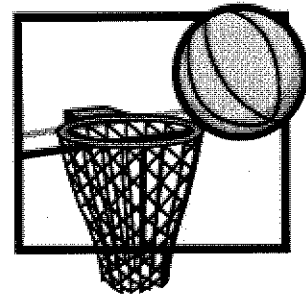
Set up the ratios as equivalent fractions and solve for n .

$$\text{Step 1: } \frac{3}{4} = \frac{n}{16}$$

$$\text{Step 2: } \frac{3 \times ?}{4 \times ?} = \frac{n}{16} \quad (\text{What } \times 4 \text{ equals } 16?)$$

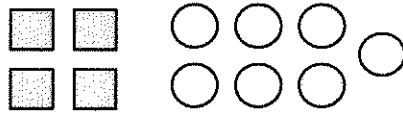
$$\text{Step 3: } \frac{3 \times 4}{4 \times 4} = \frac{n}{16}$$

$$\text{Step 4: } n = 3 \times 4 = 12$$



Conclusion: When the ratio of girls to boys is 3:4 and there are 16 boys, there are 12 girls practising.

B)



The ratio of squares to circles above is 4:7. If the number of squares increases to 20, how many circles will there be?

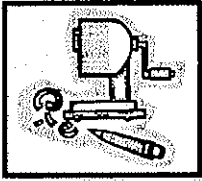
squares to circles
4:7
20: n

Set up the equivalent fraction statement and solve for n .

$$\frac{4 \times 5}{7 \times 5} = \frac{20}{n} \text{ (What } \times 4 \text{ equals } 20\text{?)}$$

$$n = 35$$

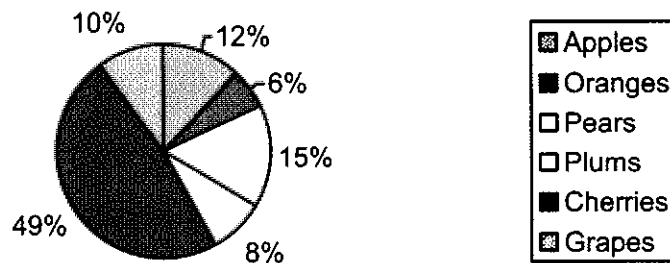
Conclusion: If the ratio of squares to circles is 4:7 and the number of squares increases to 20, the number of circles will be 35.



Practice: Working with Ratios

1. The school cafeteria conducted a survey of students to determine their favourite fruit. The results are in the circle graph below.

Favourite Fruit of Students



Answer the questions below in complete sentences:

- What is the ratio of plums to apples as the favourite fruit of students?
- What is the ratio of pears to grapes as the favourite fruit of students?
- What is the ratio of cherries to apples and oranges as the favourite fruit of students?
- What is the ratio of oranges and cherries to grapes and plums as the favourite fruit of students?
- What is the ratio of cherries to all others as the favourite fruit of students?
- With a partner, survey students in your class, grade or school about interesting topics or opinions. For example:
 - movies
 - subjects
 - sports
 - vehicles.

Then make a graph and prepare a set of questions to challenge other classmates or your teacher.

2. Marybeth is doing a research project on the topic of tropical rainforests. Her online search separates her books into three categories.

Nonfiction Books

- *Rains of the Amazon*
- *Plants of the Rainforest*
- *Rainforest Animals*
- *Climate: The Rainforests*
- *Heaven on Earth: The Rainforests*
- *Endangered Species of the Rainforests*

Fiction Books

- *Gone With the Rain*
- *Out of Control in the Forests*

Biographies

- *Jane Goodall*
- *The Life & Times of David Suzuki*
- *Protectors of the Rainforests*

Fill in the missing ratios in the table below. The first one has been done for you.

Compare	Ratio (using :)	Ratio (using /)	Ratio (using words)	Ordered Pairs
Fiction to biographies	2:3	2/3	Two to three	(2,3)
Biographies to nonfiction				
Fiction to nonfiction				
Nonfiction to biographies				
Biographies to fiction				

3. Select a partner. Each of you write a list of 3–5 words and exchange lists. Look at the letters in each word and state the ratio of consonants to vowels in each word.



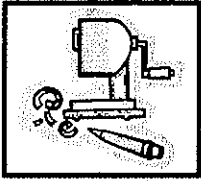
Select specific letters and identify the ratio of these letters. For example: compare the number of *es* in each word to the number of *rs*.

4. With a partner, count the number of male and female students in your class. Make ratios comparing males to females, females to total and males to total.

5. Complete a variety of activities comparing quantities in ratio form. E.g.,
 Number of classrooms in a section of the school to the total number of rooms.
 Number of cars to trucks/other vehicles in the school parking lot.
 Number of math classes to number of English language arts classes.

6. Braden is responsible for stocking shelves for a large grocery store. The manager wants both name brand and generic brand products on the shelves. Look at the chart below and determine how many of each product Braden must place on the shelves.

Product	Ratio Generic to Name Brand	Number of Generic Products on Shelf	Number of Name Brand Products on Shelf
Peas	2:3	6	
Mushrooms	4:7		21
Creamed Corn	1:2		8
Asparagus	3:5	18	
Green Beans	1:4	4	
Yellow Wax Beans	2:3		6
Mixed Vegetables	1:2	4	
Beets	3:4		12
Water Chestnuts	5:2	15	
Kernel Corn	3:4	15	
Carrots	3:2		8



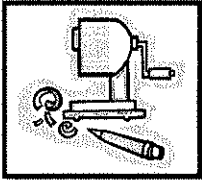
Practice: Constructing Ratio Problems

1. A family orders salads in Dwayne's diner. Two want spicy salad dressing and 4 order house dressing.
 - What is the ratio of family members to those ordering house dressing?
 - What is the ratio of spicy to house salad dressing?
2. Katrina sorted her winter clothes. She counted 8 sweaters, 5 jackets, 6 turtlenecks, 3 skirts, 2 pairs of blue jeans and 4 vests. What is the ratio of Katrina's tops to bottoms?
3. A little league baseball team entered the ice-cream parlor where Sheila works. Eight of the players order strawberry ice-cream cones and 11 players order chocolate ice-cream cones.
 - What is the ratio of strawberry to chocolate ice-cream cones?
 - What is the ratio of chocolate to the total number of cones?



4. Refer to an atlas, map or other information source and select approximately 15 cities and towns near your area. Create ratios using:
 - a) towns to cities
 - b) cities to towns
 - c) locations with populations greater than 20 000 to locations with populations less than 20 000
 - d) locations less than 100 kilometres from you to locations greater than 100 kilometres from you.



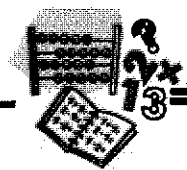


Practice: Solving Ratio Problems

Solve for the unknown values in the following ratio problems.

1. In Mr. Yellowknee's class, students have a choice of methods to represent their project information. The ratio of students selecting a poster display to a computer presentation is 3 to 5. If 12 students select a poster display, how many students select a computer presentation?
2. Mrs. Gladeau uses a composter to make fertilizer for her lawn and garden. She uses a ratio of 5 to 1 to make the compost. That is, for every 5 parts of organic waste she puts in the composter, she also adds 1 part water. If she has 15 containers of waste, how much water will she add?
3. Three litres of juice serves 14 people. How many litres are needed if 42 people want juice?
4. A set of 24 tickets at the fairgrounds costs \$8.00. How much money will Alain need to purchase 45 tickets?

Calculating Proportions



Ratios that are equivalent can be expressed as a proportion to solve proportion problems.

Examples



- A) Pearl likes bird watching. Every Saturday she looks for different species of birds. For several Saturdays, she noticed a ratio of 2 robins for every 3 sparrows. If, on another Saturday, she saw 18 robins, how many sparrows did she see?

Robins:Sparrows

$$2 : 3$$

$$18 : n$$

$$\frac{2}{3} = \frac{18}{n}$$

Solve for n by calculating equivalent fractions.

$$\frac{2 \times 9}{3 \times 9} = \frac{18}{27} \quad n = 27$$

Using the ratio of 2:3, if Pearl saw 18 robins, she would have seen 27 sparrows.

- B) The next week, she saw 4 hummingbirds for every 7 bluebirds. If, on another Saturday, she saw 28 bluebirds, how many hummingbirds did she see?

Hummingbirds:Bluebirds

$$4 : 7$$

$$n : 28$$

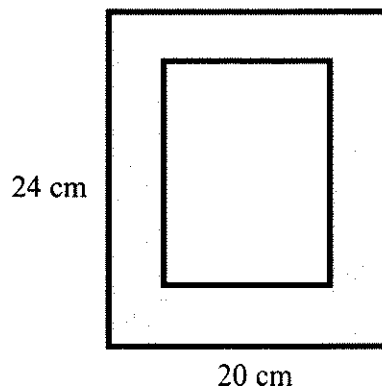
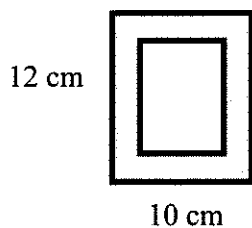
$$\frac{4}{7} = \frac{n}{28}$$

Solve for n by calculating equivalent fractions.

$$\frac{4 \times 4}{7 \times 4} = \frac{16}{28} \quad n = 16$$

Using the ratio of 4:7, if Pearl saw 28 bluebirds one Saturday, she would have seen 16 hummingbirds.

c)



The picture frames demonstrate proportion.

The small frame has dimensions of 10 cm × 12 cm. In ratio form, 10:12. The larger frame has dimensions of 20 cm × 24 cm. In ratio form, 20:24.

The picture frames are proportionate to each other. Their measurements are equivalent fractions.

$$\frac{10}{12} \times 2 = \frac{20}{24}$$

The larger frame is double the size of the smaller frame.

Reducing each fraction to its lowest form will prove equivalent ratios.

$$\frac{10}{12} \text{ in lowest form is } \frac{5}{6}$$

$$\frac{20}{24} \text{ in lowest form is } \frac{5}{6}$$

Proportion is used in a variety of ways, such as when building homes, roads and models of shopping malls or cars. Artists often use proportion to create sculptures.

Examples

- A) Small Set Model Company wants to develop model kits of well-known cars, trucks and airplanes. A specific car they want to use has a length of 300 cm and a height of 150 cm. The ratio of height to length is 150:300

The company wants the model to be approximately 30 cm in length. To make the model proportionate to the real car, Small Set identifies an equivalent fraction.

$$\frac{150 \div 10}{300 \div 10} = \frac{15}{30}$$

The height of the model will be 15 cm and the length will be 30 cm.

- B)** Sylvie-Ann has coins in the ratio of 1 loonie to 3 nickels. If Sylvie-Ann has \$0.60 in nickels, calculate the proportion of dollar coins.

Divide 60 by 5 to determine the number of nickels she has.

$$60 \div 5 = 12$$

Set up a ratio of loonies to nickels.

1:3

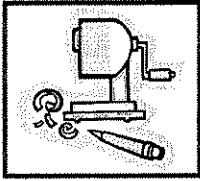
Set up an equation.

$$\frac{1}{3} = \frac{n}{12}$$

Solve for n .

$$\frac{1 \times 4}{3 \times 4} = \frac{4}{12} \quad n = 4$$

Sylvie-Ann has 4 one-dollar coins.



Practice: Creating Proportions

1. Find the lowest form of the proportions for the ratios below. Compare your answers to those of a classmate.

a) $\frac{4}{12}$

b) $\frac{10}{15}$

c) $\frac{3}{15}$

d) $\frac{4}{16}$

2. Use your knowledge of proportions to complete the following.

$$\frac{4}{5} = \frac{8}{\quad}$$

$$\frac{9}{12} = \frac{3}{\quad}$$

$$\frac{15}{20} = \frac{3}{\quad}$$

$$\frac{4}{\quad} = \frac{16}{24}$$

$$\frac{7}{21} = \frac{\quad}{3}$$

$$\frac{16}{32} = \frac{\quad}{4}$$

$$\frac{7}{9} = \frac{28}{\quad}$$

$$\frac{3}{\quad} = \frac{27}{21}$$

$$\frac{2}{6} = \frac{\quad}{18}$$

$$\frac{6}{14} = \frac{3}{\quad}$$

$$\frac{16}{20} = \frac{8}{\quad}$$

$$\frac{7}{\quad} = \frac{25}{35}$$

$$\frac{7}{42} = \frac{\quad}{6}$$

$$\frac{24}{56} = \frac{\quad}{7}$$

$$\frac{9}{12} = \frac{\quad}{4}$$

$$\frac{8}{\quad} = \frac{45}{72}$$

$$\frac{5}{9} = \frac{10}{\quad} = \frac{\quad}{27}$$

$$\frac{15}{\quad} = \frac{3}{5} = \frac{\quad}{30}$$

$$\frac{\quad}{50} = \frac{36}{\quad} = \frac{4}{5}$$

$$\frac{5}{6} = \frac{45}{\quad} = \frac{\quad}{18}$$

$$\frac{5}{6} = \frac{\quad}{12} = \frac{50}{\quad}$$

$$\frac{8}{\quad} = \frac{1}{4} = \frac{\quad}{16}$$

$$\frac{18}{\quad} = \frac{\quad}{28} = \frac{3}{7}$$

$$\frac{2}{3} = \frac{\quad}{27} = \frac{8}{\quad}$$

$$\frac{8}{10} = \frac{\quad}{5} = \frac{24}{\quad}$$

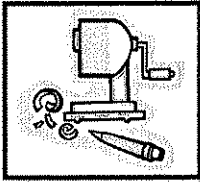
$$\frac{9}{\quad} = \frac{3}{6} = \frac{\quad}{36}$$

$$\frac{\quad}{3} = \frac{24}{\quad} = \frac{6}{9}$$

$$\frac{8}{12} = \frac{\quad}{24} = \frac{2}{\quad}$$

3. Cheng has been hired by Red Deer city council to paint portraits and landscapes from photographs. The paintings will be larger than the photographs and Cheng must calculate ratios to make sure the paintings are proportional to the photographs. Help Cheng by calculating the ratios in the chart.

Photograph	Size of item in photograph (in cm)	Size of portrait (in cm)
Columbia Ice Fields	4:6	_____ : 18
Grain elevator	1:3	7 : _____
Former Premier Don Getty	6:5	36: _____
Wayne Gretzky	2:7	_____ : 14
Red Deer homestead	3:8	9 : _____
Jamie Sale	5:9	_____ : 63
City park	10:6	_____ : 12

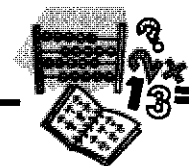


Practice: Proportion Problems

Solve for the unknown in the problems.

1. Mrs. Luong makes great chow mein. She uses a proportion of 3 parts vegetables to 5 parts sprouts. If Mrs. Luong uses 15 parts sprouts, what proportion of vegetables will she use?
2. Mr. Singh and his daughter build chests out of cedar and spruce wood. They discover that for each chest, a ratio of 14 cedar to 27 spruce slats works best for strength and attractiveness. What proportion of wood do they need if they build three cedar chests using 42 cedar slats?
3. Tanya estimates that she reads 2 books and Brad reads 5 books every month. Show the proportion of books Brad will read if Tanya reads 12 books.

Unit Rates



3 bags for
\$11.99

60
km/h

The above illustrate **rates**. A rate is a comparison of quantities with different units.

Unit rate is a comparison that has one in its second term, such as 60 heartbeats/(per) one second and 3.52 minutes/(per) one lap.

Examples

Unit Rate	Ratio
\$14.99 per CD	\$14.99:1 CD
\$12.35/watch	\$12.35:1 watch
\$2.37/hamburger	\$2.37:1 hamburger
60 km per hr	60 km:1 hour

Unit Prices

Unit price information can be used to calculate the cost **per** item.

Step 1: Divide the price by the number of items included in the price.

Step 2: Round the answer to the nearest hundredth.



The advantage of calculating and comparing unit pricing is to allow the consumer to determine the best buy.

Examples



SALE!

4 bags of potato chips for \$4.36

A)

Is this a good deal? It depends on how much each individual bag costs.

$$\$4.36/4 \text{ bags of chips} \longrightarrow \frac{\$4.36}{4}$$

$$\text{Divide } \$4.36 \text{ by } 4 \longrightarrow \$4.36 \div 4 = \mathbf{\$1.09/\text{bag}}$$

Each bag of chips costs \$1.09.

B)



SALE!

12 cans of soup for \$4.56

$$\$4.56/12 \text{ cans of soup} \longrightarrow \frac{\$4.56}{12}$$

$$\text{Divide } \$4.56 \text{ by } 12 \longrightarrow \$4.56 \div 12 = \mathbf{\$0.38/\text{can}}$$

Each can of soup costs \$0.38.

Think About ...

Many grocery stores show the price of items in different ways so that the customer can see what is the best deal (e.g., 4 for \$1.00, 25 cents each, 25 cents per laundry load). Find examples of the different ways your local grocery store prices its products.

Examples

Unit pricing can be used to find out which size of product is the better value for the money. Calculating unit prices allows comparisons to be made.

A)



Which is the better buy?

Three large pizzas for \$22.89 or 2 large pizzas for \$16.95?

Part 1: Find the cost of 1 pizza if three pizzas are purchased.

$$\text{Step 1: } \frac{3 \text{ pizzas}}{\$22.89} = \frac{1 \text{ pizza}}{?}$$

$$\text{Step 2: Divide } \$22.89 \text{ by } 3 \\ \$22.89 \div 3 = \$7.63 \text{ per pizza}$$

Part 2: Find the cost of 1 pizza if two pizzas are purchased.

$$\text{Step 1: } \frac{2 \text{ pizzas}}{\$16.95} = \frac{1 \text{ pizza}}{?}$$

$$\text{Step 2: Divide } \$16.95 \text{ by } 2 \\ \$16.95 \div 2 = \$8.48 \text{ per pizza}$$

Conclusion: The better buy is 3 large pizzas for \$22.89.

B)

Which is the better buy?
Two 200 mL tubes of toothpaste for \$3.20 or one 350 mL tube of toothpaste for \$2.95?

Calculate the price of 100 mL of toothpaste by setting up an equation and dividing.

Part 1: If two 200 mL tubes cost \$3.20, how much will 100 mL cost?

Step 1: Let n = cost of 100 mL

$$\text{Step 2: } \frac{\$3.20}{400 \text{ mL}} = \frac{?}{100 \text{ mL}}$$

$$\text{Step 3: } n = \frac{100 \text{ mL} \times 3.20}{400 \text{ mL}}$$

Step 4: $n = 0.80$

Part 2: If 350 mL costs \$2.95, how much will 100 mL cost?

Step 1: Let n = cost of 100 mL

$$\text{Step 2: } \frac{\$2.95}{350 \text{ mL}} = \frac{?}{100 \text{ mL}}$$

$$\text{Step 3: } n = \frac{100 \text{ mL} \times 2.95}{350 \text{ mL}}$$

Step 4: $n = 0.84$

Conclusion: One tube costs \$0.84/100mL. Two tubes costs \$0.80/100mL. The better buy is two tubes for \$3.20.

- C) Which bag of chips is the best value for the money?
Calculate the cost per gram.



A medium-sized bag of potato chips costs \$4.00/250 grams.



A jumbo-sized bag of potato chips costs \$7.05/475 grams.

$$\begin{array}{r} \text{Medium-sized bag} \\ \$4.00 \\ \hline 250 \text{ gram} \end{array} = \frac{\$0.016}{1 \text{ gram}}$$

$$\begin{array}{r} \text{Jumbo-sized bag} \\ \$7.05 \\ \hline 475 \text{ gram} \end{array} = \frac{\$0.0148}{1 \text{ gram}}$$

Conclusion: The jumbo-sized bag is the better value for the money because the cost per gram is less than the medium-sized bag.

- D) Jonah is buying soft drinks for his class party. He could not decide which was the better buy: 12 cans (355 mL/can) for \$4.95, or a 2-litre bottle for \$1.79. Help Jonah out, which is the better buy?

$$\begin{array}{l} 12 \text{ cans} \times 355 \text{ mL/can} = 4260 \text{ mL for } \$4.95 \\ 2 \text{ L} = 2000 \text{ mL for } \$1.79 \end{array}$$

$$\frac{\$4.95}{4260 \text{ mL}} = \frac{\$0.00116}{1 \text{ mL}}$$

$$\frac{\$1.79}{2000 \text{ mL}} = \frac{0.00089}{1 \text{ mL}}$$



Conclusion: The 2 L bottle for \$1.79 is the better buy.

Ratios, proportions and unit rates can also be used to make predictions.

Example

Saul has been keeping track of his gas use. He knows that he can drive 415 km on one tank of gas. He is planning a vacation to the southern United States, a distance of approximately 2075 km.



How many tanks of gas will Saul need?

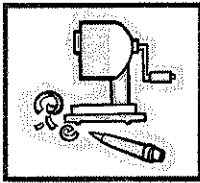
Divide 2075 by 415 to identify 5 as the multiple of 415 and 2075.

Multiply 1 tank by 5.

$$\frac{415 \text{ km} \times 5}{1 \text{ tank} \times 5} = \frac{2075}{? \text{ tanks}}$$

$$\frac{415 \text{ km}}{1 \text{ tank}} = \frac{2075}{5 \text{ tanks}}$$

Saul will need 5 tanks of gasoline to drive 2075 km.



Practice: Working with Rates

- Express the following in unit rate form. E.g., 7 days each week = 7 days/week.
 - 1 kg of coffee costs \$4.88.
 - You earn \$7.35 for each hour you work.
 - On some highways, the speed limit is 100 km in one hour.
- To earn extra money before summer vacation, Miguel decided to do odd jobs and he posted signs advertising his services. The table below indicates how much money Miguel made per hour for some of the odd jobs that he completed. Complete the chart. The first one has been done for you.

Wages Earned (in total)	Hours Worked	Money Made Per Hour
\$27.75	3	\$9.25
\$30.00	5	
	8	\$8.92
\$44.45	7	
\$72.45	9	
	5	\$5.25
\$38.28	6	
	7	\$8.35

Use information from your past or present experiences to make unit rate calculations, such as how much you make per hour at your part-time job.

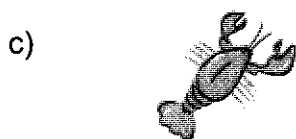
3. Calculate the price for one of the items in each of the following.



4 chocolate bars for \$2.68



3 bananas for \$1.26



8 lobsters for \$74.16



3 kg green pepper for \$5.34

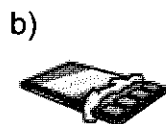
4. Calculate the unit price and determine which is the better buy for each of the products below.



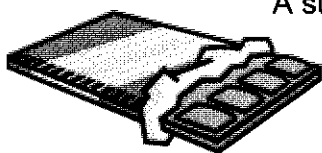
A small can of soup costs \$1.18/250 mL.



A large can of soup costs \$3.69/750 mL.

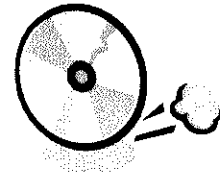


A regular-sized chocolate bar costs \$0.79/62 grams.



A super-sized chocolate bar costs \$1.75/140 grams.

- c) Marc's favourite music store is having a CD sale and has two different sale promotions—4 CDs for \$55.96 or 5 CDs for \$68.80.



Which is the better sale price?
What is the difference in price for individual CDs?

5. In 1909, a group of Ukrainian pioneers took 98 days to travel 7350 km from Halifax to Alberta.

Estimate and calculate the number of km travelled per day.

6. Heather's favourite salon hairspray is on sale at \$21.90/3 cans. How much would 5 cans of hairspray cost?

7. There is nothing like fresh fruit to keep a person healthy.

Plums	\$3.49/3 kg	Cherries	\$5.67/4 kg
Pears	\$3.54/2 kg	Honeydew	\$6.81/6 kg
		Melon	

Use unit pricing or other methods to determine the better fruit buy per kilogram.

8. Calculate the unit price and cost of the number of products indicated below. The first one has been done for you.

Price	Unit price	Number of products to calculate for	Total price
2 CDs for \$21.80	\$10.90	6	\$65.40
3 packages of gum for \$2.22		5	
4 T-shirts for \$35.44		2	
5 pairs of earrings for \$12.70		4	
2 paperback novels for \$14.96		5	
4 pizzas for \$37.04		3	

9. Examine newspapers, magazines and other sources of information. Locate and compare costs of items from the same or a variety of stores.

