

Name: _____

UNIT 4 LEARNING GUIDE – RATIOS

INSTRUCTIONS:

Using a pencil, complete the following questions as you work through the related lessons. Show ALL of your work as is explained in the lessons. Do your best and always ask questions if there is anything that you don't understand.

4.1 RATIOS

1. Reduce each ratio to its simplest form. *Reminder: To reduce a ratio to its simplest form, divide each part of the ratio by the Greatest Common Factor.*

Ex. 4:10

GCF: 2

2:5

c. 9:3

GCF:

f. 6:9

GCF:

a. 15:5

GCF:

d. 8:24

GCF:

g. 15:25

GCF:

b. 2:4

GCF:

e. 25:100

GCF:

h. 21:14

GCF:

2. Use the image below to answer the following questions. Write each ratio in its simplest form.



- What is the ratio of cats to horses?
- What is the ratio of horses to roosters?
- What is the ratio of roosters to horses?
- What is the ratio of roosters to animals?
- What is the ratio of cats to animals?
- What is the ratio of roosters to cats?

3. Fill in the table.

	Ratio x : y format	Ratio Fraction format	Simplified Fraction
Ex. 7 baseballs to 21 balls	7:21	$\frac{7}{21}$	$\frac{1}{3}$
a. 15 mugs to 35 dishes			
b. 4 dogs to 14 animals			
c. 9 plumbers to 15 employees			
d. 18 swimmers to 42 people			

4.2 EQUIVALENT RATIOS

1. Solve the following problems. Reminder: Keep track of when you are dealing with part-to-part ratios and part-to-whole ratios.

- a. There are 50 teenagers at a swim meet. The ratio of locals to out-of-town participants is 2:3. How many teenagers travelled from out-of-town to the swim meet?
- b. A packet of mixed wildflower seeds contains a total of 75 seeds, some are poppies and some are daisies. The ratio of poppy seeds to daisy seeds is 1:2. How many poppy seeds are there in the packet?
- c. In 1 km^2 of forest there are 2 coyotes. If the ratio coyotes to mice is 1:150. How many mice would you expect in 1 km^2 of forest? How many mice in 4 km^2 of forest?
- d. To make 6 cups of trail mix, you need 2 cups of almonds, 3 cups of raisins, and 1 cup of chocolate chips. How much of each ingredient is needed to make 18 cups of trail mix?

2. Convert each ratio to a unit ratio. Reminder: A unit ratio has a second term of 1.

Ex. 5:2

b. 24:4

d. 4:3

$$5:2 = ? : 1$$

$$2 \div 2 = 1$$

$$5:2 = 2.5$$

$$\mathbf{2.5:1}$$

a. 8:4

c. 10:7

e. 9:2

3. Compare ratios in order to answer the following problems. Reminder: To compare ratios, convert each ratio to a unit ratio.
- a. A librarian wants to compare the ratios of fiction to non-fiction books checked out of the library. In the first week of school, the ratio is 7:5, whereas in the eighth week of school, the ratio is 22:13. During which week are students checking out a higher ratio of fiction to non-fiction books (ie. more fiction books for every non-fiction book)?

 - b. Two brands of fried rice have different ratios of vegetables to rice by weight. *Brand A* has a ratio of 5:8, whereas *Brand B* has a ratio of 2:3. Which brand has the highest ratio of vegetables to rice by weight?

 - c. Jane and Karl are trying out for a hockey team. The coach says that it is important that during practices, the ratio of time that players spend on speed drills versus shooting drills is 2:1. If Jane spends 45 minutes on speed drills and 25 minutes on shooting drills and Karl spends 58 minutes on speed drills and 34 minutes on shooting drills, who came closest to meeting the ratio set out by their coach?

4.3 RATES

1. Circle the correct conversion factor to use for each of these conversions, then complete the conversion.

Ex. 209 feet = 63.53 metres

$$209 \text{ ft.} \times \frac{3.29 \text{ ft.}}{1 \text{ m}} \quad \text{or} \quad \boxed{209 \text{ ft.} \times \frac{1 \text{ m}}{3.29 \text{ ft.}}} \quad \frac{209 \text{ m}}{3.29} = 63.53 \text{ m}$$

- a. **17 metres = _____ feet**

$$17 \text{ m} \times \frac{1 \text{ m}}{3.28 \text{ ft.}} \quad \text{or} \quad 17 \text{ m} \times \frac{3.28 \text{ ft.}}{1 \text{ m}}$$

- b. **1362 grams = _____ pounds (lb.)**

$$1362 \text{ g} \times \frac{1 \text{ lb.}}{454 \text{ g}} \quad \text{or} \quad 1362 \text{ g} \times \frac{454 \text{ g}}{1 \text{ lb.}}$$

- c. **5 years = _____ months**

$$5 \text{ yr} \times \frac{1 \text{ yr}}{12 \text{ mth}} \quad \text{or} \quad 5 \text{ yr} \times \frac{12 \text{ mth}}{1 \text{ yr}}$$

2. Use a conversion factor to solve each problem.

Ex. How many weeks is 84 days?

$$84 \cancel{\text{ days}} \times \frac{1 \text{ week}}{7 \cancel{\text{ days}}} \\ \frac{84}{7} = 12 \text{ weeks}$$

b. How many months is 7 years?

a. How minutes is 5100 seconds?

c. How many minutes is 9.5 hours?

3. a. Determine the mistake that was made in the calculation below when converting 336 hours to weeks.

$$336 \text{ h} \times \frac{1 \text{ d}}{24 \text{ h}} \times \frac{7 \text{ d}}{1 \text{ w}} = 98 \text{ weeks}$$

b. Calculate the correct answer. (336 hours = ? weeks)

4. Convert. *Hint: More than one conversion factor will need to be used.*

Ex. 86 400 seconds to days

$$86400 \cancel{\text{sec}} \times \frac{1 \cancel{\text{m}}}{60 \cancel{\text{sec}}} \times \frac{1 \cancel{\text{h}}}{60 \cancel{\text{m}}} \times \frac{1 \text{d}}{24 \cancel{\text{h}}}$$

$$\frac{86400}{60 \times 60 \times 24} = \frac{86400}{86400} = 1$$

1 day

a. 20 160 minutes to weeks

b. 3 hours to seconds

c. 2 years to minutes

5. Convert each rate. Reminder: The units for rates are stated as x/y . Ex. km/h , $\$/\text{unit}$, etc.

Ex. 90 km per hour to kilometres per minute

$$\frac{90\text{km}}{1\cancel{\text{h}}} \times \frac{1\cancel{\text{h}}}{60\text{min}} = \frac{90\text{km}}{60\text{min}} = 1.5\text{km} / \text{min}$$

c. \$22 for 100 to \$ per unit

a. 15 km per hour to kilometres per minute

d. 1500 seconds per kilometre to seconds per metre

b. \$7 per dozen to \$ per unit

e. 6 minutes per centimetre to seconds per centimetre

6. Convert each rate. Hint: You will need to multiply by several different conversion rates in order to change both units.

a. 30 km per hour to metres per minute

b. 2 metres per second to kilometres per hour

4.4 PERCENTAGES

1. Convert each percentage to a fraction. *Reminder: First, convert each percentage to a fraction over 100, then, simplify the fraction.*

	Percentage	Fraction (Over 100)	Fraction (Simplified)
Ex.	16%	$\frac{16}{100}$	$\frac{4}{25}$
a.	42%		
b.	53%		
c.	75%		
d.	8%		
e.	3%		
f.	80%		

2. Convert each fraction to a percentage. *Reminder: First, convert the fraction to an equivalent fraction over 100, then change it into a percentage.*

	Fraction	Fraction (Over 100)	Percentage
Ex.	$\frac{2}{5}$	$\frac{40}{100}$	40%
a.	$\frac{9}{10}$		
b.	$\frac{1}{4}$		
c.	$\frac{3}{20}$		
d.	$\frac{47}{50}$		

e.	$\frac{1}{5}$		
f.	$\frac{13}{25}$		

3. Fill in the table. Reduce fractions to simplest terms.

	Percent	Decimal	Fraction
Ex.	75%	0.75	$\frac{75}{100} = \frac{3}{4}$
a.		0.09	
b.	65%		
c.			$\frac{1}{2}$
d.			$\frac{7}{20}$
e.	5%		
f.		0.02	

4. Add a symbol ($>$, $<$, $=$) to make each statement true. Reminder: Convert terms into the same form in order to compare them.

Ex. $0.24 > \frac{4}{20}$

$$0.24 = \frac{24}{100}$$

$$\frac{4}{20} = \frac{20}{100}$$

$$\frac{24}{100} > \frac{20}{100}$$

a. $0.46 \underline{\hspace{1cm}} \frac{12}{25}$

b. $\frac{1}{4}$ _____ 23%

d. 7% _____ 0.008

c. $\frac{23}{50}$ _____ 0.49

e. 43.6% _____ $\frac{2}{5}$

4.5 PROBLEM SOLVING

1. Solve for x . Round your answers to the nearest tenth. *Reminder: Isolate the variable. Do the same operation on both sides of the equation in order to keep it balanced.*

Ex. $\frac{60}{100} = \frac{x}{70}$ $(70)\frac{60}{100} = \frac{x}{\cancel{70}}(\cancel{70})$ $\frac{70 \times 60}{100} = x$ $42 = x$

a. $\frac{45}{100} = \frac{x}{24}$

c. $\frac{31}{100} = \frac{x}{175}$

b. $\frac{14}{100} = \frac{x}{52}$

d. $\frac{75}{100} = \frac{x}{90}$

2. Fill in the table to find the percentage of each number using equivalent fractions.

	Question: What is ...	Estimate the answer	Set up equivalent fractions	Multiply to isolate x	Answer
Ex.	40% of 55	20	$\frac{40}{100} = \frac{x}{55}$	$(55)\frac{40}{100} = \frac{x}{\cancel{55}}(\cancel{55})$ $\frac{55 \times 40}{100} = x$	22
a.	40% of 185				
b.	30% of 90				
c.	25% of 750				
d.	3% of 320				

3. Fill in the table to find the percentage of each number using decimals. Round answers to the nearest tenth. Reminder: The word “of” means multiplication.

	Question: What is ...	Estimate the answer	Convert % to decimal	Multiply	Answer
Ex.	41% of 55	20	41% = 0.41	0.41 × 55	22.6
a.	51% of 39				
b.	77% of 560				
c.	5% of 30				
d.	12.5% of 80				

4. Use the formula below to prepare each question for solving. Put an **x** in the place of the unknown value. You do **not** have to solve the question. Hint: You can always place **100** under the first fraction before beginning.

$$\frac{\%}{100} = \frac{\text{is (part)}}{\text{of (whole)}}$$

Ex. What percentage of 30 is 19?

$$\frac{x}{100} = \frac{19}{30}$$

- What percentage of 85 is 50?
- What is 75% of 9?
- Find 22% of 700.
- What percentage of 92 is 87?

e. 49% of what number is 180?

f. 6% of what number is 11?

g. What is 8% of 205?

4. Solve. Answer with a sentence. Round your answers to the nearest tenth. *Reminder: First, remove the numbers from the denominators, then Isolate the variable. Do the same operation on both sides of the equation in order to keep it balanced.*

Ex. 80% of what number is 66?

$$(\cancel{100}x) \frac{80}{\cancel{100}} = \frac{66}{\cancel{x}} (\cancel{100} \cancel{x}) \quad 80x = 66(100) \quad x = \frac{6600}{80} \quad x = 82.5$$

66 is 80% of 82.5

a. 80% of what number 30?

b. 32% of what number is 102?

c. 4% of what number is 3?

d. 97% of what number is 645?

4.6 PERCENTAGE CHANGES

1. Follow the steps to calculate the percentage that each amount increased. Round your answers to the nearest tenth.

Ex. Original amount: 300

New Amount: 350

Step 1: Calculate the amount of increase

New amount less original amount

$$350 - 300 = 50$$

Step 2: Calculate the percentage of increase

$$\frac{\text{Amount of increase}}{\text{Original amount}} \times 100$$

$$\frac{50}{300} \times 100 = 16.7\% \text{ increase}$$

- a. Original amount: 400
New Amount: 500

- d. Original amount: 1.65
New Amount: 1.99

- b. Original amount: 75
New Amount: 100

- e. Original amount: 6400
New Amount: 20 000

- c. Original amount: 34
New Amount: 35

- f. Original amount: 50
New Amount: 100

2. Solve. *Hint: Read the question several times and take time to decide what information you have and what information you need.*

- a. The price of an issue of *National Geographic Magazine* increased from \$6.00 to \$7.50. What was the percentage increase?

- b. In Grade 8, Marcela practiced her cello for 5 hours per week. In Grade 9, she increased her practice time by 20%. How much longer did she practice per week in Grade 9 then in Grade 8?
- c. Landon can jump 45 centimetres in the air on his skateboard. If he increases the height of his jumps by 35%, how high will he be able to jump?
3. Follow the steps to calculate the percentage that each amount decreased. Round your answers to the nearest tenth.
- Ex.** Original amount: 300
New Amount: 250
- Step 1:** Calculate the amount of decrease Original amount less new amount
 $300 - 250 = 50$
- Step 2:** Calculate the percentage of decrease $\frac{\text{Amount of decrease}}{\text{Original amount}} \times 100$
 $\frac{50}{300} \times 100 = 16.7\% \text{ decrease}$
- a. Original amount: 40
New Amount: 30
- d. Original amount: 5.99
New Amount: 4.49
- b. Original amount: 25
New Amount: 20
- e. Original amount: 8575
New Amount: 5000
- c. Original amount: 100
New Amount: 60
- f. Original amount: 1 000 000
New Amount: 836 000

4. Solve. *Hint: Read the question several times and take time to decide what information you have and what information you need.*
- a. A mountain bike is sale on from its original price of \$1500 to a new price of \$1200. What is the percentage decrease in the price?

 - b. A city currently produces 2700 kg of garbage every week. Their goal is to reduce the amount of garbage produced by 15%. How much less garbage will be produced if they meet their goal?

 - c. There are currently 180 school days in a year. If the number of school days is reduced by 5%, how many school days will there be per year?

 - d. In July, Renaldo ran 100 metres in 14.1 seconds. In August, he reduced his time by 10%. How long did it take him to run 100 metres in August?

4.7 COMBINING PERCENTAGES

1. Follow the steps to calculate the price of each item, including taxes. Use 7% PST and 5% GST for all of your calculations (ie. a total of 12%). *Reminder: Taxes are always calculated off of the reduced (or sale) price.*

Ex. A computer with an original cost of \$799.00, on sale for 20% off.

Step 1: Calculate the amount of savings.

$$\text{\$}799.00 \times 0.2 = \text{\$}159.80$$

Step 2: Calculate the new sale price.

$$\text{\$}799.00 - \text{\$}159.80 = \text{\$}639.20$$

Step 3: Calculate the amount of taxes to be paid on the sale price.

$$\text{\$}639.20 \times 0.12 = \text{\$}76.70$$

Step 4: Calculate the total price to be paid (add the sale price and the taxes).

$$\text{\$}639.20 + \text{\$}76.70 = \text{\$}715.90$$

- a. A basketball hoop with an original price of \$250, on sale for 30% off.
 - b. A belt with an original price of \$18.99, on sale for 15% off.
 - c. A book with an original price of \$21.50, on sale for 50% off.
-
2. A guitar has an original price of \$200 and is on sale for 12% off.
 - a. Since the total percentage of taxes also equals 12%, do you think that the final cost of the guitar will be the same as the original price (ie. 12% off for the sale and then 12% added for taxes)?
 - b. Calculate the cost of the guitar (including the sale and taxes.)
 - c. Why is the final price of the guitar not equal to \$200?

3. Sarah's parents buy a car with an original price of \$31 000. The car is on sale for 9% off. How much **less tax** will Sarah's parents have to pay as a result of the sale? The taxes are 5% GST & 7% PST. *Hint: Calculate how much tax would have been paid had there not been a sale and compare this amount to the amount of tax paid on the sale price.*

4. Yolanda is looking to purchase a new set of runners. The original price of the runners at every store is \$100. Calculate all of the scenarios below to find out where she will get the best deal. Before you begin, estimate which deal will be the best for her. Add GST (5%) and PST (7%) to the cost in each scenario.
 - a. **Store A:** A sale of 40% off and then an additional 10% off that sale price.

 - b. **Store B:** A sale of 50% off.

 - c. **Store C:** A sale of 25% off and then an additional 25% off that sale price.

 - d. Where will Yolanda get the best deal?
 - e. Every store gave a total of 50% in savings, but the final price is different at each store. Why?

5. In 2019, the population of Smallville was exactly 4600 people. In 2020, the population is estimated to drop by 10%. However, in 2021, a new employer will be coming to town and the population is estimated to then rise by 25%. What is the population of Smallville estimated to be in 2021?

4.8 UNUSUAL PERCENTAGES

1. Simplify each fraction by removing the decimals. You do not have to simplify the fractions any further. *Reminder: For every place that you move the decimal to the right, add a zero into the denominator. This is the same as multiplying both the numerator and the denominator by 10.*

Ex. $\frac{0.17}{100}$ $\frac{17}{10\ 000}$

c. $\frac{0.5}{100}$

f. $\frac{1.75}{100}$

a. $\frac{0.83}{100}$

d. $\frac{0.1}{100}$

g. $\frac{2.409}{100}$

b. $\frac{0.39}{100}$

e. $\frac{1.3}{100}$

h. $\frac{0.007}{100}$

2. Fill in the table to convert each percentage to a fraction. *Reminder: Percentage means "out of 100." It can be helpful to say this when converting percentages to fractions. Ex. $0.32\% = 0.32$ out of 100.*

	Percentage	Fraction (over 100)	Fraction (remove decimals)	Fraction (Simplified)
Ex.	0.32%	$\frac{0.32}{100}$	$\frac{32}{10\ 000}$	$\frac{2}{625}$
a.	0.45%			
b.	0.98%			
c.	3.16%			
d.	0.005%			

3. Fill in the table to convert each percentage to a fraction.

	Percentage	Fraction (mixed number)	Fraction (Simplified)
Ex.	234%	$2\frac{34}{100}$	$2\frac{17}{50}$
a.	410%		
b.	565%		
c.	284%		
d.	1 846%		

4. Place the values in order on the number line. *Reminder: Convert each value to the same format (decimals) to be able to compare and order them.*

$$\frac{1}{20} \quad 106\% \quad \frac{3}{1000} \quad 0.5 \quad \frac{11}{10} \quad 0.9\% \quad 138\% \quad \frac{3}{4}$$



UNIT 4 – ANSWER KEY

SECTION 4.1

- a. 3:1 b. 1:2 c. 3:1 d. 1:3 e. 1:4 f. 2:3 g. 3:5 h. 3:2
- a. 1:3 b. 3:4 c. 4:3 d. 1:2 e. 1:8 f. 4:1
-

	Ratio x : y format	Ratio Fraction format	Simplified Fraction
Ex. 7 baseballs to 21 balls	7:21	$\frac{7}{21}$	$\frac{1}{3}$
a. 15 mugs to 35 dishes	15:35	$\frac{15}{35}$	$\frac{3}{7}$
b. 4 dogs to 14 animals	4:14	$\frac{4}{14}$	$\frac{2}{7}$
c. 9 plumbers to 15 employees	9:15	$\frac{9}{15}$	$\frac{3}{5}$
d. 18 swimmers to 42 people	18:42	$\frac{18}{42}$	$\frac{3}{7}$

SECTION 4.2

- a. 30 teenagers travelled from out of town b. 25 poppy seeds c. 300 mice in 1 km², 1200 mice in 4 km². d. 6 cups almonds, 9 cups raisins, 3 cups choc. chips
- a. 2:1 b. 6:1 c. 1.43:1 d. 1.33:1 e. 4.5:1
- a. Week 8 b. Brand B c. Jane

SECTION 4.3

- a. $17\text{m} \times \frac{1\text{m}}{3.28\text{ft.}}$ or $17\text{m} \times \frac{3.28\text{ft.}}{1\text{m}}$ b. $1362\text{g} \times \frac{1\text{lb.}}{454\text{g}}$ or $1362\text{g} \times \frac{454\text{g}}{1\text{lb.}}$
 c. $5\text{yr} \times \frac{1\text{yr}}{12\text{mth}}$ or $5\text{yr} \times \frac{12\text{mth}}{1\text{yr}}$
- a. 85 minutes in 5100 seconds b. 84 months in 7 years c. 570 minutes in 9.5 hours.
- b. 2 weeks
- a. 2 weeks b. 10 800 sec. c. 1 051 200 min
- a. 0.25 km/min b. \$0.53/unit c. \$0.22/unit d. 1.5 sec/m e. 360 sec/cm

6. a. 500 m/min b. 7.2 km/h

SECTION 4.4

3.

	Percent	Decimal	Fraction
Ex.	75%	0.75	$\frac{75}{100} = \frac{3}{4}$
a.	9%	0.09	$\frac{9}{100}$
b.	65%	0.65	$\frac{13}{20}$
c.	50%	0.5	$\frac{1}{2}$
d.	35%	0.35	$\frac{7}{20}$
e.	5%	0.05	$\frac{1}{20}$
f.	2%	0.02	$\frac{1}{50}$

4. a. < b. > c. < d. > e. >

SECTION 4.5

- a. 10.8 b. 7.3 c. 54.3 d. 67.5
- a. 34 b. 6 c. 100 d. 0.57
- a. 19.9 b. 431.2 c. 4.5 d. 5.1
- a. 58.8 b. 6.75 c. 154 d. 94.6% e. 367.3 f. 183.3 g. 16.4
- a. $x=37.5$ b. $x=318.8$ c. $x=75$ d. $x=664.9$

SECTION 4.6

- a. 25% b. 33.3% c. 2.9% d. 20.6% e. 212.5% f. 100%
- a. 25% increase b. 1 hour longer c. He will be able to jump 60.75 cm.
- a. 25% b. 20% c. 40% d. 25% e. 41.7% f. 16.4%
- a. 20% decrease in the price b. 405 kg less garbage c. There will be 171 school days.
d. 12.69 seconds

SECTION 4.7

- a. \$196 b. \$18.08 c. \$12.04

2. a. Answers will vary b. \$197.12 c. The final price is not equal to \$200 because taxes are calculated on sale price, not original price, so you would pay less taxes in total on the sale price, resulting in a lower final price.
3. They will pay \$334.80 less in taxes than if they had paid full price for the car.
4. a. \$60.48 b. \$56.00 c. \$63.00 d. Store B e. The final prices are not the same because when a percentage is taken off an already reduced price, the amount taken off for the second percentage will be less than if it had been taken off the original price.
5. 5175

SECTION 4.8

1. a. $\frac{83}{10\,000}$ b. $\frac{39}{10\,000}$ c. $\frac{5}{1000}$ d. $\frac{1}{1000}$ e. $\frac{13}{1000}$ f. $\frac{175}{10\,000}$ g. $\frac{2409}{100\,000}$ h. $\frac{7}{100\,000}$
2. a. $\frac{9}{2000}$ b. $\frac{49}{5000}$ c. $\frac{79}{2500}$ d. $\frac{1}{20\,000}$
3. a. $4\frac{1}{10}$ b. $5\frac{13}{20}$ c. $2\frac{21}{25}$ d. $18\frac{23}{50}$

