

MATH SPEAK - TO BE UNDERSTOOD AND MEMORIZED

- 1) **NUMBER** = a mathematical statement describing the amount of something.
- 2) **UNIT** = a symbol that represents a specific thing. e.g. **km** = kilometre, **\$** = dollars, **mL** = millilitre, **h** = hour
- 3) **QUANTITY** = a statement that describes an amount (*number*) of a specific thing (*unit*).
e.g. 100 km, \$7, 341 mL, 2.5 h
- 4) **RATE** = a *fraction* composed of two *quantities*. e.g. $\frac{100 \text{ km}}{1 \text{ h}}$, $\frac{\$1.69}{100 \text{ g}}$, $\frac{55 \text{ words}}{1 \text{ min}}$, $\frac{2.2 \text{ lbs}}{1 \text{ kg}}$
- 5) **UNIT RATE** = a special *rate* where the *number* of one of the *quantities* is a 1. e.g. $\frac{100 \text{ km}}{1 \text{ h}}$, $\frac{55 \text{ words}}{1 \text{ min}}$, $\frac{1 \text{ kg}}{2.2 \text{ lbs}}$
- 6) **CONVERSION FRACTION** = a *fraction* used to convert one *unit* within a *rate* to another *unit*.
e.g. $\frac{1 \text{ km}}{1000 \text{ m}}$, $\frac{60 \text{ s}}{1 \text{ min}}$, $\frac{1 \text{ kg}}{2.2 \text{ lbs}}$

APPLICATION OF FRACTIONS = RATES**I) INTRODUCING RATES**

A) We often use *fractions* that we don't think of as *fractions*. Consider these two examples.

e.g. When traveling on highway 1 at the legal maximum speed of 100 km/h, the speed at which we are traveling is actually a *fraction* that can be written as $\frac{100 \text{ km}}{1 \text{ h}}$.

e.g. When purchasing grapes from the grocery store we are charged \$1.99/lb is actually a *fraction* that can be written as $\frac{\$1.99}{1 \text{ lb}}$.

- 1) Mathematicians call *fractions* of this type *rates* because they describe how two *quantities* (things) change relative to each other. Consider this price \$1.99/lb of paid for grapes. It is a *rate* describing two *quantities*: the first *quantity* is written as amount of money while the second *quantity* is written as the number of pounds of grapes. The price is \$1.99/lb a *rate* because the amount a person pays (\$) changes as the weight of grapes (lb) purchased changes: more weight of grapes purchased means more money paid; more money paid means more weight of grapes purchased.

II) UNDERSTANDING RATES

A) A *RATE* is a *fraction* composed two different *quantities*: e.g. $\frac{100 \text{ km}}{1 \text{ h}}$, $\frac{\$1.69}{100 \text{ g}}$, $\frac{55 \text{ words}}{1 \text{ min}}$, $\frac{2.2 \text{ lb}}{1 \text{ kg}}$

- 1) A *QUANTITY* is a statement that describes an amount (*number*) of a specific thing (*indicated by a unit*).

e.g. 100 km, \$7, 341 mL, 2.5 h

a) A *UNIT* is a symbol that represents measure of a specific thing.

e.g. km = kilometre, \$ = dollars, mL = millilitre, h = hour

B) Explaining rates

- 1) Consider this *rate* $\frac{100 \text{ km}}{1 \text{ h}}$. It is composed of two *quantities*: the first is **100 km** which describes an amount of distance travelled and the second is **1 h** which describes an amount of elapsed time. The arrangement of these two *quantities* into a *rate* describes how the two *quantities* are related to each other: 1 hour of time travelled equates to 100 km of distance travelled, or each 100 km of distance travelled means 1 hour of time has elapsed.
- 2) Consider this *rate* $\frac{\$1.69}{100 \text{ g}}$ for chocolates. It is composed of two *quantities*: the first is **\$1.69**, which describes an amount the chocolates cost and the second is **100 g**, which describes the amount of weight of the chocolates. The arrangement of these two *quantities* into a *rate* describes how the two *quantities* are related to each other: \$1.69 will purchase 100 g of chocolates, or each 100 g of chocolates costs \$1.69.

- C) A **UNIT RATE** is a special rate where the number of one of the quantities (usually the denominator) is a 1.
- 1) These are **unit rates** because the number of one of the **quantities** is a 1: $\frac{100 \text{ km}}{1 \text{ h}}$, $\frac{55 \text{ words}}{1 \text{ min}}$, $\frac{2.2 \text{ lb}}{1 \text{ kg}}$, $\frac{1 \text{ day}}{24 \text{ h}}$
 - 2) These are not **unit rates** because the number of neither of the **quantities** is a 1: $\frac{\$1.69}{100 \text{ g}}$, $\frac{69 \text{ L}}{650 \text{ km}}$

III) WRITING RATES AND COMPARING RATES

A) **Rates** are written by creating a **fraction** having one **quantity** in the **numerator** and a different **quantity** in the **denominator**. When comparing **rates** it is best to express all of them as **unit rates** containing the same **units**. For example, it is not possible to determine which of two Olympic runners has the fastest **rate** if one **unit rate** is written as metres per second ($\frac{\text{m}}{\text{sec}}$) while the other is written as meters per minute ($\frac{\text{m}}{\text{min}}$). The **unit rates** are best compared when both are written using the same **units**, either metres per second ($\frac{\text{m}}{\text{sec}}$) or metres per minute ($\frac{\text{m}}{\text{min}}$). When comparing **unit rate** having different **units**, you must change, convert, one or more of the **units** to ensure that each **unit rate** has the same **units**. **Conversion fractions** are used to convert one unit to another.

- 1) **SAMPLE PROBLEMS 1:** Study these questions. Be sure you understand and memorize the process used to complete them.
 - 1) Write a **rate** and a **unit rate** for the **Fill-up 1** information given in the table found in the middle of page 456 of your text. Round decimal answers to two decimal places.

Solution: Write a **rate** by writing a **fraction** having the amount of Gas Purchased in the **numerator** and the Total Distance Driven in the **denominator**.

Write a **unit rate** by dividing the number in the **numerator** by the number in the **denominator**.

- 2) Bill is interested in cooking hamburgers for his family. He learns that Rob's Meats sells 1 kg of extra lean ground beef for \$5.99 while Mary's Deli sells bulk packs of extra lean ground beef at 2 kg for \$12.50.
 - a) Write a **rate** for each possibility. Record each as a **unit rate**.
 - b) From which store should Bill buy the meat? Justify your choice.

Solution: a)

b)

- 2) **REQUIRED PRACTICE 1:** {Answers: (a) are on pages 580 & 581; (b) are on page 584 of the text.}
 - a) Pages 458 - 459: Questions 1 & 7(c).
 - b) Page 515: Question 2(c).

INTRODUCING CONVERSION FRACTIONS

I) CONVERSION FRACTIONS DIFINED

A) A **CONVERSION FRACTION** is a fraction used to convert one unit to another. The **conversion fractions** given below are used to convert a specific unit such as minutes to seconds, seconds to minutes, hours to minutes, minutes to hours, metres to kilometres, or kilometres to metres.

- B) Consider the *conversion fractions* found in **SAMPLE PROBLEMS 2** of page 3 of these notes. They are incomplete as they do not contain numbers; they only contain units. This is done on purpose because in order to use the *conversion fractions* effectively, you must focus on only the units. As your experience with math has been focused entirely on numbers, this type of math that focuses entirely on units can be very challenging. **BE SURE YOU UNDERSTAND AND MEMORIZE THE PROCESS DESCRIBED BELOW AS IT IS THE FOUNDATION FOR THE TYPE OF MATH YOU ARE LEARNING AND WILL BE ASSESSED ON IN THIS AND THE NEXT TWO TOPICS.**
- 1) **SAMPLE PROBLEMS 2:** Use *only* these *conversion fractions* to answer the questions below. Be sure you understand and memorize the process used to complete them.

$$\frac{\text{s}}{\text{min}}, \frac{\text{min}}{\text{h}}, \frac{\text{h}}{\text{day}}, \frac{\text{days}}{\text{week}}, \frac{\text{weeks}}{\text{year}}$$

- | | |
|--------------------------------|-------------------------------|
| 1) Convert minutes to seconds. | 2) Convert hours to seconds. |
| 3) Convert hours to days. | 4) Convert hours to weeks. |
| 5) Convert years to weeks. | 6) Convert years to days. |
| 7) Convert days to seconds. | 8) Convert min to weeks. |
| 9) Convert weeks to seconds. | 10) Convert years to seconds. |
- 2) **REQUIRED PRACTICE 2:** Use *only* these *conversion fractions* to answer the following questions. **BE SURE YOU SHOW THE COMPLETE PROCESS INCLUDING THE REQUIRED CONVERSION FRACTIONS.** {Answers are on page 3 of these notes.}

$$\frac{\text{s}}{\text{min}}, \frac{\text{min}}{\text{h}}, \frac{\text{h}}{\text{day}}, \frac{\text{days}}{\text{week}}, \frac{\text{weeks}}{\text{year}}$$

- | | |
|------------------------------|------------------------------|
| 1) Convert minutes to hours. | 2) Convert weeks to hours. |
| 3) Convert years to hours. | 4) Convert days to seconds. |
| 5) Convert weeks to minutes. | 6) Convert seconds to years. |

ANSWERS TO THE REQUIRED PRACTICE

Required Practice 2 from page 3

$$1) \frac{\text{min}}{1} \times \frac{\text{h}}{\text{min}} = \boxed{\text{h}} \quad 2) \frac{\text{weeks}}{1} \times \frac{\text{days}}{\text{weeks}} \times \frac{\text{h}}{\text{day}} = \boxed{\text{h}} \quad 3) \frac{\text{years}}{1} \times \frac{\text{weeks}}{\text{years}} \times \frac{\text{days}}{\text{weeks}} \times \frac{\text{h}}{\text{day}} = \boxed{\text{h}}$$

$$4) \frac{\text{days}}{1} \times \frac{\text{hr}}{\text{days}} \times \frac{\text{min}}{\text{hr}} \times \frac{\text{s}}{\text{min}} = \boxed{\text{s}} \quad 5) \frac{\text{weeks}}{1} \times \frac{\text{days}}{\text{weeks}} \times \frac{\text{hr}}{\text{day}} \times \frac{\text{min}}{\text{hr}} = \boxed{\text{min}}$$

$$6) \frac{\text{s}}{1} \times \frac{\text{min}}{\text{s}} \times \frac{\text{hr}}{\text{min}} \times \frac{\text{days}}{\text{hr}} \times \frac{\text{weeks}}{\text{days}} \times \frac{\text{years}}{\text{weeks}} = \boxed{\text{years}}$$