

Exploring Rates



16. The ratio of the length to the width of the Canadian flag is 2:1.



- a) The flag on the cover of a Canadian atlas is 8 cm wide. How long is it? *16 cm*
- b) The large flag outside a Brampton school is 5 m long. How wide is it? *2.5 m*
- c) One Canadian flag has a perimeter of 2.7 m. What is its length?

speed

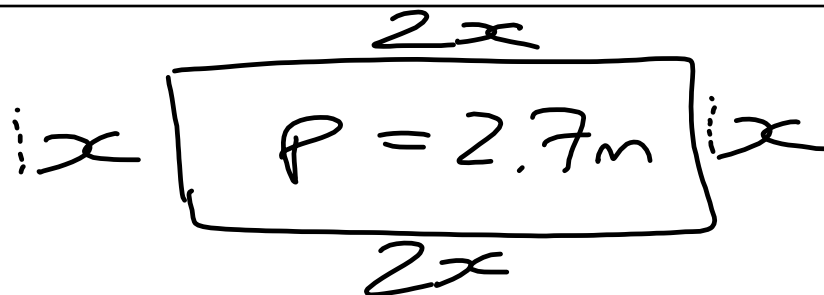
- comparison of distance travelled to time taken
- $\text{speed} = \frac{\text{distance}}{\text{time}}$

rate

- a comparison of two quantities measured in different units
- 120 km in 2 h, \$210 per week, and \$2.49 for 0.5 kg are rates

unit rate

- a rate in which the second term is 1
- 60 km/h, \$4.98/kg, and \$30 per day are rates



Ratio 2:1

$$\frac{6x}{6} = \frac{2.7}{6}$$

$$x = 0.45 \text{ m}$$

At a track-and-field meet, Shaun and Raoul are competing in a 1000-m race. Suppose that, after the first few seconds of acceleration, both runners run at a constant **speed**.

The judges recorded the following information using a stopwatch:

- After 20 s, Shaun passed the 100-m mark.
- After 25 s, Raoul passed the 150-m mark.

How can you determine the winner of the race?

$$\text{Shaun} = \frac{100}{20} \\ = 5 \text{ m/s}$$

$$\frac{\text{Distance}}{\text{Time}} \\ \text{Raoul} = \frac{150}{25} \\ = 6 \text{ m/s}$$

Example 1: Apply Rates to Earnings

Maggie has a babysitting job for which she gets paid an hourly rate.

One evening she earned \$24 for 4 h of babysitting.

- Write a unit rate that describes how much Maggie gets paid.
- How much will Maggie earn if she babysits for 14 h?

$$\text{a) Unit rate} = \frac{24}{4} \\ = \$6/\text{h}$$

$$\text{b) } \frac{x}{14} = \frac{24}{4} \\ x = \frac{24}{4} \times 14 \\ x = \$84$$

$$\frac{\text{Dollars}}{\text{Hours}}$$

Example 2: Convert Rates to Unit Rates

Find the unit rate in each situation.

a) Javier ran 600 m in 2 min.

b) Gina scored 60 points in 80 games.

$$a) \quad \frac{x}{1} = \frac{600}{2}$$

$$x = \frac{600}{2} \times 1$$

$$x = 300 \text{ m/min}$$

$$b) \quad \frac{x}{1} = \frac{60}{80}$$

$$x = \frac{60}{80} \times 1$$

$$x = 0.75 \text{ points/game}$$

Example 3: Apply Rates to Shopping

Jinji went to the grocery store to buy some peanut butter. He found his two favourite brands. Assuming Jinji likes each brand equally, which is the better buy?

$$\text{Nutz} = \frac{5.49}{750}$$

$$= 0.00732 \text{ \$/g}$$

$$\text{Koala} = \frac{\$1.99}{250}$$

$$= 0.00796 \text{ \$/g}$$



\$5.49

Dollars
mass

\$1.99

unit price

- a unit rate that applies to shopping

⇒ Nutz!
is
the
better
buy



2. Last night 40 cm of snow fell in 5 h. Today 3 cm/h is falling.

a) Which sentence uses a rate? Which uses a unit rate?
 b) What is the advantage of converting a rate to a unit rate? Explain.

a) 1ST sentence → RATE
 2ND sentence → UNIT RATE

b) It is easier to compare when using unit rates.

3. Jo and Erin both have part-time jobs. Jo works 10 h per week and earns \$15/h. Erin is paid \$60 for a 5-h shift. She works three shifts per week.

a) Who earns more money per hour?
 b) Who earns more money per week?
 c) Why are the answers to parts a) and b) different?

$\frac{\text{Dollars}}{\text{Time}}$

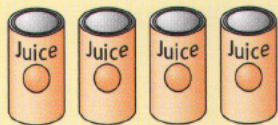
a) Jo = \$15/h
 Erin = $\frac{60}{5} = \$12/h$

b) Jo = $15 \times 10 = \$150/\text{week}$
 Erin = $60 \times 3 = \$180/\text{week}$

c) Part (a) is the unit rate
 Part (b) they work different hours
 [Jo = 10 hours, Erin = 15 hours]

Key Ideas

- A rate is a comparison of quantities measured in different units.
- A rate can be written in fraction form. $\frac{\$3}{4 \text{ cans}}$
- A unit rate is a rate in which the second term, or denominator, is 1. $\frac{\$3}{4 \text{ cans}} = \frac{\$0.75}{1 \text{ can}}$
- Unit prices are unit rates involving prices. Unit prices make it easier to compare the cost of similar items. For example, $0.732\text{¢/g} < 0.796\text{¢/g}$.



\$3 for 4 cans

You can also write this as \$0.75/can.