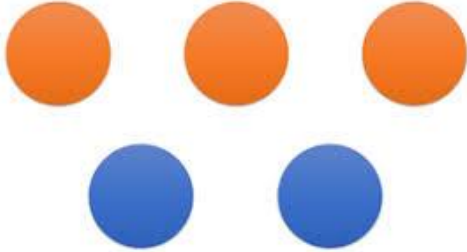


Goals

Goals for this week:

- review identifying common usage of rates such as km/h
- convert between units for rates; for example, km/h to m/s, mL/min to L/h
- complete calculations with rates, including solving problems involving direct proportion in terms of rate
- use rates to make comparisons
- use rates to determine costs; for example, calculating the cost of a tradesman using rates per hour, call-out fees



Theoretical Components

STEP 1

Resources:

PDF file: Week 9 and 10 Notes and Exercises

This week:

We will be learning:

- Identify and compare rates
- Using rates

Check this out:

<https://www.khanacademy.org/math/cc-sixth-grade-math/x0267d782:cc-6th-rates-and-percentages/cc-6th-rates/v/finding-unit-prices>

Practical Components

STEP 2

Read through Week 10 Notes and Exercises for instructions on what to do.

There are 2 Exercises in this booklet. Read any worked examples before you begin.

Remember to regularly check Google Classroom for messages.

Portfolio Task

STEP 3

Complete the task at the end of the brief and submit your weekly work. 😊

Other

Remember to check Google Classroom or hawkermaths.com for each week's learning brief

ESSENTIAL MATHEMATICS 2

WEEK 10 – RATES AND RATIOS

IDENTIFY AND COMPARE RATES

A rate is a ratio between two quantities that are measured in different units. For example, the rate a tap leaks may be 30 mL every 5 minutes. Rates are often expressed as unitary rates where the second quantity in the rate has a measure of 1. The unitary rate for the leaking tap would be 6 mL for every 1 minute, or 6 mL/min.

Common examples of rates include:

- Speeds, eg. 60 km/h, 20 m/s, 400 m every 5 minutes
- Growth rates, eg 20 cm/year, 15 mm/month, 2 kg per week
- Cost of groceries, eg. \$5 per kg, \$1.20 per 100 g, \$10 per box

Handy Conversions

1 metre = 100 centimetres

1 metre = 1000 millimetres

1 kilometre = 1000 metres

1 litre = 1000 millilitres

1 hour = 60 minutes

1 minute = 60 seconds

Converting rates allows us to compare rates given in different units and to also obtain a rate in units suitable for a particular application.

Common applications are comparing unit prices to find the best deal and comparing speeds of different objects.

Example:

Holly runs a 42 kilometre marathon in 3 hours and 30 minutes.

- Find Holly's simplified running rate (speed) in kilometres per hour.
- Convert her speed to metres per second.

Solution:

(a) Find Holly's simplified running rate (speed) in kilometres per hour.

Think: To obtain a rate in km/h, we need to divide the distance in kilometres by the time in hours. (3 hours and 30 minutes = 3.5 hours)

Do:

$$\begin{aligned}\text{Speed} &= \frac{42 \text{ km}}{3.5 \text{ h}} && \text{Divide distance in kilometres by time in hours} \\ &= 12 \text{ km/h} && \text{Simplify the fraction and don't forget units}\end{aligned}$$

(b) Convert her speed to metres per second.

Think: Both the distance unit and time unit are being converted. Let's first change the distance unit. In this case, we are converting distance from kilometres to metres. The number of metres travelled in a given amount of time is 1 000 times greater than the number of kilometres, so we want to multiply the rate by 1 000.

Then we want to convert the new rate in m/h to m/s. There are 60 seconds in a minute, and then 60 minutes in an hour, so the number of metres travelled in a second will be the rate in m/h divided by 60^2 .

Do:

$$\begin{aligned}\text{Speed} &= 12 \text{ km/h} && \text{Write the given rate including units} \\ &= 12 \times 1\,000 \text{ m/h} && \text{Convert the kilometres to metres} \\ &= 12\,000 \text{ m/h} && \text{Simplify the rate} \\ &= \frac{12\,000}{60^2} \text{ m/s} && \text{Convert the rate from per hours to per second} \\ &= 3\frac{1}{3} \text{ m/s} && \text{Simplify the rate}\end{aligned}$$

Exercise 1

1. Convert the following measurements:

a. 20 km to metres

b. $\frac{1}{2}$ Litre to millilitres

c. 40 minutes to seconds

2. Convert the following rates:

a. 50 km/h to m/h

b. 50 km/h to m/s

c. 40 m/s to m/h

d. 40 m/s to km/h

3. An athlete runs 270 metres in 27 seconds. What is his speed in km/h?

4. Use the conversion 1 mile = 1.6093 kilometres to answer the following questions.

a. If Usain Bolt can run 27.8 miles per hour (mph), what is his speed in km/h?

b. The speed limit on a particular road in the US is 70 mph. An Australian visiting the country is more familiar with the speeds using the unit km/h.

i. What is the speed limit in kilometres per hour?

ii. If a car is travelling at 125 km/h, by how many km/h is the car exceeding the speed limit?

5. A supermarket sells two different brands of eggs. Happy Hens and Sunny Side Up. Happy Hens eggs cost \$6.00 for 12 eggs and Sunny Side Up eggs cost \$1.50 for 5 eggs.

a. What is the cost in cents per egg from Happy Hens?

b. What is the cost in cents per egg from Sunny Side Up?

c. Which brand sells eggs at a cheaper price?

USING RATES

We have seen how we can identify and compare rates to decide on the best value for money when comparing similar items or comparing the speed of different objects. As rates arise frequently in everyday life, there are many more practical uses for rates and calculations involving rates.

For example, we can use a pay rate (dollars per hour) to calculate how much money is earned in a week; we can use the speed (km/h) to predict how long it would take to reach a given location; and we can use rates to calculate and compare the cost of different phone plans with differing charge rates for data (\$/GB) and phone calls (\$/min).

Example:

If Steve earns \$157.05 for working 9 hours over the weekend and Tina earns \$144.00 for working 8 hours.

- Who has the better rate of pay?
- How much will Tina earn in a week where she worked 35 hours at the same pay rate?

Solution:

(a) Who has the better rate of pay?

Think: To work this out, we need a common point of comparison, let's work out how much each person earns per hour.

Do:

$$\text{Steve: } \$157.05 \div 9 \text{ hrs} = \$17.45/\text{hr}$$

$$\text{Tina: } \$144.00 \div 8 \text{ hrs} = \$18.00/\text{hr}$$

So now we can say with certainty that Tina's rate of pay is higher.

(b) How much will Tina earn in a week where she worked 35 hours at the same pay rate?

Think: She will receive \$18 for each hour she works. We need to multiply the pay rate by the number of hours.

Do:

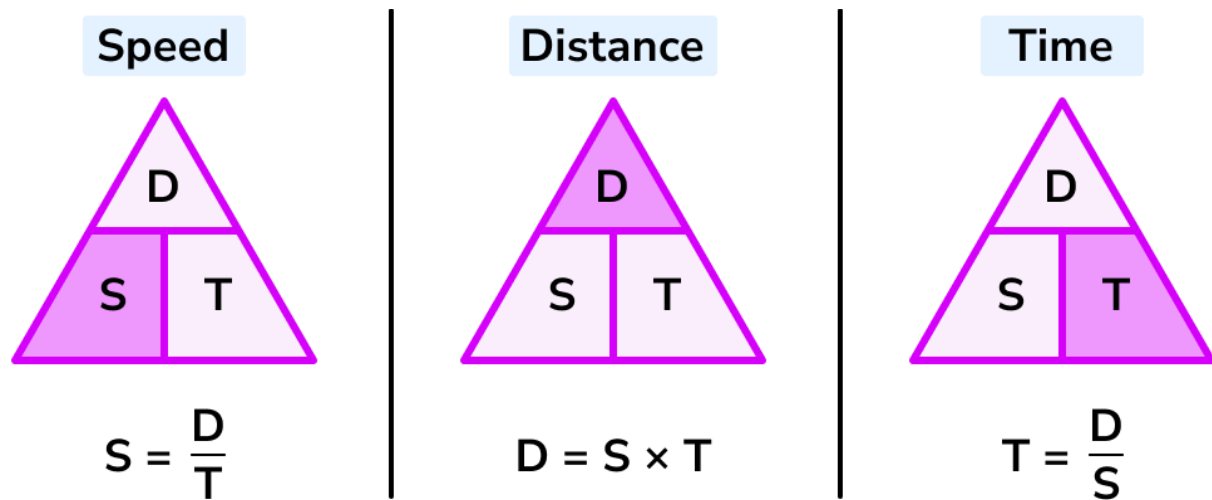
$$\begin{aligned} \text{Weekly pay} &= \$18 \times 35 \\ &= \$630 \end{aligned}$$

3. A fitness club charges a membership fee of \$90 plus \$22 per week. How much would you pay if you went to the fitness club for 11 weeks?

4. Zuber is a taxi services that charges \$1.80 pick-up fee and \$1.25 per kilometre of travel. What is the total charge for a 10km journey?

5. Luke is a locksmith. On weekends, if he is on call, he gets paid \$64.50 per hour plus a flat rate call out fee of \$75. On Saturday he did 3 jobs that took 1.5, 0.25 and 1.25 hours respectively to complete. How much did he earn on Saturday?

6. If three kids can eat three hot dogs in three minutes, how many minutes would it take 100 kids to eat 100 hot dogs?




Write your solutions to the following problems below. Be sure to show working.

1. Tom runs a 100m race in a certain amount of time. If John runs the same race, he takes 2 seconds longer. If John ran at 8m/s, approximately how fast did Tom run?
2. A group of students are making posters to advertise for a bake sale. 12 large signs and 60 small signs are needed. It takes 10 minutes to paint a small sign and 30 minutes to paint a large sign. How many students will be needed to paint all the signs in 2 hours or less?
3. Jerry took a car trip of 320 kilometres. The trip took a total of six hours and forty minutes; for the first four hours, their average speed was 60 kilometres per hour. What was their average speed for the remaining time?

MARKING RUBRIC

CRITERIA	EXPECTATIONS	MARKS
Practical	Student completes practical work of the brief to an acceptable standard set by the teacher.	
<p><i>Completion of practical work is a prerequisite to submitting your portfolio task.</i></p> <p>Your teacher reserves the right not to accept submission of your weekly/fortnightly task if the supporting work is incomplete.</p>		
Portfolio Task	Student response is correct.	<i>/2</i>
	Student response shows clear and logical working out.	<i>/2</i>
	Student response includes appropriate units and correct rounding, where relevant.	<i>/2</i>
	Student response states a conclusion which answers the question. <ul style="list-style-type: none"> • <i>Check:</i> Does your answer make sense in the given context? 	<i>/2</i>
	Submission Guidelines	
Timeliness	Student submits the exercises and assessable task by the set deadline.	<i>/2</i>
	TOTAL	<i>/10</i>

Student Reflection:



On a scale of 1 - 4, I would rate my understanding of this topic:

1	2	3	4
Even with help I don't understand.	I'm starting to understand but need more help.	I'm understanding and able to complete most of the problems on my own.	I fully understand. I could help and teach others.

Written reflection (optional): What was interesting? What did you find easy? What do you need to work on? Any other comments?