

MATHEMATICAL APPLICATIONS 1

WEEK 4 NOTES & EXERCISES

RATES

A **rate** is a measurement that compares two different quantities. The table shows examples of some rates and their units.

| Rate | Units |
|-----------------------------------|------------------|
| Heartbeat | beats/minute |
| Population growth | persons/year |
| Speed | kilometres/hour |
| Cost of meat/fruit | dollars/kilogram |
| Fuel consumption of motor vehicle | litres/100 km |
| Concentration of pesticide | grams/kilogram |

EXAMPLE

1. A hose delivers 3840 L of water in 1 hour. What is its flow rate in litres/minute?

1 hour equals 60 min thus Flow rate = $\frac{3840}{60} = 64$ L/min

2. The cost of 35 L of petrol is \$25.55. Express this cost as a rate in cents/litre.

\$25.55 \times 100 is 2555 cents thus Cost = $\frac{2555}{35} = 73$ c/L

EXERCISE SET 1

1. What units are used to express these rates?

(i) cost of mobile phone calls

(ii) wage rate

(iii) typing speed

(iv) postage rates for parcels

(v) cost of potatoes

(vi) speed of an athlete

2. Name a rate that uses each unit.

a) persons/square kilometre

b) cents/word

c) litres/100 km

d) kilobytes/second

e) births/1000 people

f) dollars/square metre

3. Campbelltown's population grew by 16 500 over 6 years. What was its growth rate in persons/year?

4. A computer downloaded a 120 kb (kilobytes) of email in 25 seconds. Calculate the download rate in kilobytes per second.

5. Steak costs \$2.47 for 520 g. Calculate:

a) the cost as a rate in dollars/kilogram

b) the cost of 880 g of steak

6. The cost of water is 80 c/kL (where 1 kL = 1000 L). Each day, a household uses an average of 850 L. Calculate:

a) the amount of water used in 91 days (in kilolitres)

b) the cost of water used over the 91 days

7. A breakfast cereal contains 3 mg fat in every 60 g serve.

a) Express this fat content as a rate in milligrams/gram.

b) How much fat would be contained in a 100 g serving?

8. The cost of 7 kg of sausages is \$20.93. How many kilograms of sausages can be bought for \$12 (to the nearest kilogram)?

CONVERTING RATES

One Unit Conversions

Convert 7.9 L/100 km to mL/100 km

1L = 1000mL so 7.9L = $7.9 \times 1000 = 7900$ mL

Thus 7.9L/100km = 7900mL/100km

Two unit conversions

Convert 24 c/min to \$/h

24c = \$0.24 and 1h = 60min

Thus 24c/min = $\$0.24 \times 60 = \$14.40/h$

Convert 80km/h to m/s

80km = $80 \times 1000 = 80000$ m

1h = $1 \times 3600 = 3600$ s

Thus 80km/h = $\frac{8000}{3600} = 22.2$ m/s

EXERCISE SET 2

1. Convert these rates.

a) \$32 500/year to \$/month

b) 5 L/h to L/day

c) 75 km/h to km/min

d) \$685/week to \$/year

e) 78 words/min to words/s

2. Convert these rates.

a) 24 c/min to \$/hour

b) 8 m/s to km/h

c) 15 m/s to km/h

d) 60 km/h to m/s

3. At the 1988 Olympics, American Carl Lewis became the world's fastest man when he sprinted 10 m in 0.83 seconds. What was his speed in kilometres/hour, correct to 1 decimal place?

4. If a car is travelling at a speed of 75 km/h, how many whole metres will it travel in the 5 seconds it takes you to cross the road?

CURRENCY CONVERSIONS

Even though you may be planning to use a credit card when you are overseas, you will need access to local currency to pay bills such as bus and taxi fares and to buy small items of food. If you have an ATM card that has a blue 'cirrus' icon on the back, you can use the card in overseas teller machines to obtain local currency. When you obtain money in this way, the receipt, including the current balance in the account, will be in the currency of the country where you withdrew the money.

Even though you can obtain cash electronically, you still need to know how much you are paying, in Australian dollars, for overseas purchases.

2. Express the following amounts in Australian dollars.

a) \$560 Canadian dollars

b) 1000 euros

c) 2000 rand

3. Suppose that the conversion rate between Australian dollars and Thai baht is $\$A1 = 28.56$ baht. Convert \$250 Australian dollars into baht.

4. When Anika was shopping in a Thai market she wanted to buy some local handicrafts priced at 65 baht. How much is this in Australian dollars?

5. Anika worked out a quick way to convert a price in baht to a price in Australian dollars in her head. Her method is to disregard the last two digits and multiply the remainder by 3.5. For example, to change 213 baht into dollars, forget the 13 and just multiply the 2 by 3.5 to get approximately \$A7.

Use Anika's method to determine an approximate Australian dollar equivalent to 406 baht. How accurate is Anika's method for this approximation?

BEST BUYS

Unit Prices

It is a good idea to compare prices when shopping if you want to get as much value for your money as possible. It is easier to compare prices for items that are identical in quantity than those that come in varying quantities. For example, how would you know which was better value for money – a 150 g chocolate bar for \$2.50 or a 375 g block for \$6.20? One way to determine which item is better value for money is to calculate *unit prices* for the item. We will work in cost per 100 g or cost per 100 mL for this section.

Use these unit pricing tips to help get better value for money:

1. Compare the unit price of different sizes of the same brand's product, as well as products from different brands of the same product. The labels on the shelf that show the price of an item also show the unit price of that item.

2. Look out for special offers which might temporarily have the lowest unit price – but not always.
3. The unit price of large packs is often lower than small or medium size packs. But avoid buying a bigger pack if it's likely to go to waste.
4. If a product is available loose or pre-packaged, check the unit price of both.
5. Compare unit prices in different parts of the supermarket. The same product may be sold in different sections, for example, cheese, meats, seafood, nuts, fruit and vegetables.

EXAMPLE

1. A 220 g item sells for \$5.95. Calculate the unit price for a 100 g quantity.

Divide the cost of the item by the quantity. $\frac{\$5.95}{220} = \$0.027 \text{ per } g$

Multiply by 100 to get the cost per 100 g. 0.027×100

Write the answer as \$ per 100 g. $= \$2.70 \text{ per } 100 \text{ g}$

2. A 300 mL item sells for \$2.50. Calculate the unit price for 100 mL capacity.

Divide the cost of the item by the capacity. $\frac{\$2.50}{300\text{mL}} = \$0.008 \text{ per } \text{mL}$

Multiply by 100 to get the cost. 0.008×100

Write the answer as \$ per 100 mL. $= \$0.83 \text{ per } 100 \text{ mL}$

3. Which is better value for money – a 350 mL carton of milk for \$1.75 or a 1.5 L bottle of milk for \$4.50.

Calculate the unit price for 100 mL for each item. Remember to change litres into millilitres first.

$$1.5 \text{ L} \times 1000 = 1500 \text{ mL}$$

$$\frac{\$1.75}{350 \text{ mL}} = 0.005$$

$$\frac{\$4.50}{1500 \text{ mL}} = 0.003$$

Compare the unit price per 100 mL.

$$0.005 \times 100 = \$0.50 \text{ per } 100 \text{ mL}$$

$$0.03 \times 100 = \$0.30 \text{ per } 100 \text{ mL}$$

State which is better value.

\$0.30 per 100 mL is cheaper than \$0.50 per 100 mL, so the 1.5 L bottle of milk is better value for money.

EXERCISE SET 4

For these questions remember to change kilograms into grams and litres into millilitres.

$$1 \text{ kg} = 1000 \text{ g}$$

$$1 \text{ L} = 1000 \text{ mL}$$

Q1. Calculate the unit price per 100 g or 100 mL for the following items.

a) 180 g tin of Milo for \$4.60

b) 110 g of toothpaste for \$2.65

c) 500 g packet of spaghetti for \$0.89

d) 2 kg bag of potatoes for \$3.98

e) 2 L carton of milk for \$2.98

e) 600 mL of Coke for \$2.50

Q2. Calculate the unit price per 100 g or 100 mL for the following items.

a) 220 g tin of Milo for \$5.50

b) 175 g of toothpaste for \$2.65

c) 1 kg packet of spaghetti for \$1.70

d) 800 g bag of potatoes for \$1.65

Q3. Compare a) b) c) d) from Q1 with a) b) c) d) from Q2 and explain which is better value.

Q4. Compare each bottle of soft drink to work out which item is better value for money per 100 mL.

a) 2 L for \$2.99

b) 1.5 L for \$2.50

c) 1.25 L for \$2.00

d) 600 mL for \$2.80