Week 7/8
Term 1
2022

HAWKER COLLEGE
Engage | Inspire | Achieve

EM1
Calculations, percentages and rates; Measurement

Goals

Goals for this fortnight:

Rates

- identify common usage of rates; for example, km/h as a rate to describe speed, beats/minute as a rate to describe pulse (EMA14)
- convert units of rates occurring in practical situations to solve problems (EMA15)
- use rates to make comparisons; for example, using unit prices to compare best buys, comparing heart rates after exercise (EMA16)

Units of energy

- use units of energy to describe consumption of electricity, such as kilowatt hours (EMA30)
- use units of energy used for foods, including calories (EMA31)
- use units of energy to describe the amount of energy in activity, such as kilojoules (EMA32)
- convert from one unit of energy to another (EMA33)

Theoretical Components

Resources:
PDF file: Week 7/8 Notes and Exercises
YouTube Videos: Linked in the PDF File

Knowledge Checklist

- Common rates
- The rate at which we use energy - kilojoules
- Converting km/h to mph and vice-versa
- Unit pricing

Order

1. Read through the notes and examples
2. Work through the exercises
3. Complete the Portfolio Task
4. Complete the reflection at the end of the booklet
5. Come and see your teacher and make sure you are up to date.

Practical Components

There are 4 Exercises in this booklet. Read any notes and worked examples before you begin.

There are some revision questions at the end of the notes for you to complete as well.

Remember to regularly check Google Classroom for messages.

The following site provides a comprehensive view of the concept of unit pricing

https://www.accc.gov.au/consumers/groceries/grocery-unit-prices

Portfolio Task

Complete the task at the end of the brief and submit your work for checking. ☺

QFO

Quiz/Forum/Other

There is a **25% test** during **Week 9**. It will be held in the Gym and it is “open book” so you may use your folders. Be sure to get your briefs up-to-date and bring a calculator and writing equipment to the test.

ESSENTIAL MATHEMATICS 1

WEEK 7/8 NOTES AND EXERCISES

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

USING RATES

EXERCISE 1

Q1. Express the following as rates

a) A pipe costs $100 for 20 metres ($/m)

b) A waiter earns $90 for a 6 hour shift ($/hour)

c) 42kg of seed is spread over 7m² of garden (kg/m²)

d) A tanker pumps 1000 litres of water in 5 minutes (L/min)

e) A vehicle travels 450km in 6hours (km/h)

f) ActewAGL charges 37.4330 cents per kilowatt hour of electricity use (c/kWh)

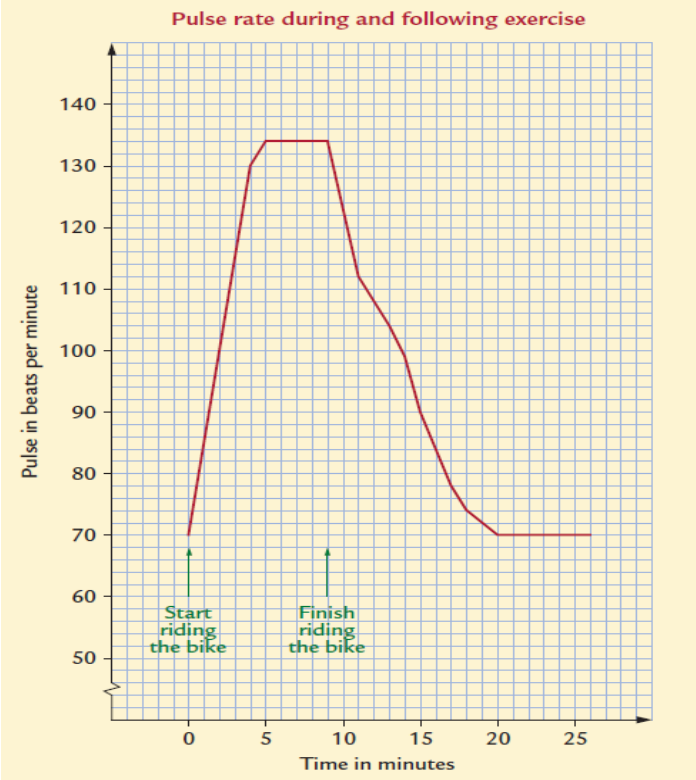
Q2. Martin earns $1840 per fortnight.

a) How much does Martin earn per week?

b) Calculate the amount that Martin earns anually.

Q3. Brian takes 5 minutes and 48 seconds to complete a three lap event. What is the average time he takes to complete each lap? (answer in seconds)

Q4. As part of his annual check up, Michael's doctor completed this graph.



a) At what rate is Michael's pulse when he starts riding the bike?

b) How long does it take for Michael's pulse to reach 134 beats/min?

c) What is Michael's pulse rate when he finished riding the bike?

UNITS OF ENERGY - KILOJOULES

If you use more energy than you eat, then you will lose body weight. Similarly, if you eat more energy than your body uses, this energy will be stored as fat.

The number of kilojoules (a measurement of energy) your body requires each day depends on your age, gender and lifestyle.

Age (years)	Lifestyle	Men (kJ/day)	Women (kJ/day)
18–35	Inactive	10 500	8000
	Active	12 500	9000
	Very active	14 800	10 500
36–70	Inactive	10 000	8000
	Active	11 800	8800
	Very active	14 300	10 400
	Pregnant women		10 100
	Breast-feeding		11 800

EXERCISE 2

Q1. Estelle is 18 years old. During the week she works in an office and is inactive, but on the weekends, she is very active: jogging, swimming, and cycling.

a) How many kilojoules does Estelle use per day during the week?

b) How many more kilojoules does Estelle use per day on the weekend than on weekdays? (show working)

c) How many kilojoules does Estelle use per week? (show working)

.

.

Q2. How many kilojoules does a very active 40 year old male require per week?

Q3. According to the above table, how many more kilojoules per day does Joanne need, now that she is pregnant, than her twin sister Assya, who is an active 20 year old woman? (show working)

Q4. This table shows the average length of time it takes a typical 18 year old to burn 1000 kj.

Activity	Time required to use 1000 kJ
Sleeping	4 hours
Eating	3 hours
Working in class, studying, watching TV	$2\frac{1}{2}$ hours
Walking	1 hour
Bike riding	50 minutes
Swimming	30 minutes

a) How many kilojoules are used in swimming for 30 minutes?

b) How long does it take to burn 500 kj while sleeping? (show working)

c) Suzie, aged 18 years, leads a very active life. This is how she usually spends her day:

8 hours	sleeping
5 hours	working in class
3 hours	swimming training
$2\frac{1}{2}$ hours	studying
$2\frac{1}{2}$ hours	watching TV
$1\frac{1}{2}$ hours	walking
$1\frac{1}{2}$ hours	eating

(i) According to the table above, how many kilojoules does Suzie use each day? (show working)

(ii) If Suzie restricts her daily kilojoule intake to the amount shown in the table on page 3, would she have a sufficient amount of kilojoules to meet her energy requirements? Explain.

Q5. This table shows another way of calculating kilojoule requirements.

Activity	Energy used (kJ/min)
Sleeping	4
Cleaning	15
Ironing	17
Bricklaying	17
Playing tennis	31
Gardening	23
Circuit training	53
Walking	23

Calories and kilojoules

A calorie is another unit that measures energy. It is usually used to measure the energy content of foods and beverages.

Calories are bigger than kilojoules.
1 calorie = 4.18 kilojoules

*To convert kilojoules to calories, divide by 4.18

*To convert calories to kilojoules, multiply by 4.18

a) How long would it take you to use 230 kj walking?

b) Jodie uses 1240 kj playing tennis. For how long does she play tennis?

c) How many kilojoules would you use doing these activities? How many calories would need to be consumed?

	Kilojoules	Calories
i) Cleaning for one hour		
ii) Bricklaying for 30 minutes		
iii) Circuit training for 2 hours		

CONVERSION TABLES

Converting quantities such as metres per second to kilometres per hour, temperatures from degrees Fahrenhiet to degrees Celsius, are easy with a conversion table.

Conversion from km/h to m/s

km/h	m/s	km/h	m/s	km/h	m/s	km/h	m/s
1	0·28	12	3·3	55	15·3	105	29·2
2	0·56	14	3·9	60	16·7	110	30·6
3	0·83	15	4·2	65	18·1	115	31·9
4	1·11	20	5·6	70	19·4	120	33·3
5	1·39	25	6·9	75	20·8	125	34·7
6	1·67	30	8·3	80	22·2	130	36·1
7	1·94	35	9·7	85	23·6	135	37·5
8	2·22	40	11·1	90	25·0	140	38·9
9	2·50	45	12·5	95	26·4	145	40·3
10	2·78	50	13·9	100	27·8	150	41·6

Example

Use the conversion table above to change 45 km/h to m/s

Solution

The third column from the left lists speeds from 12 km/h to 50 km/h. The foruth column, next to 45 in the third column, is 12.5. A speed of 45 km/h is the same as 12.5 m/s.

Example

Use the conversion formula

m/s = km/h X 0.278

to convert a speed of 32km/h to m/s

Solution

32 km/h = 32 X 0.278 m/s

= 8.896m/s or 8.9m/s, correct to 1 decimal place.

32 km/h is the same as 8.9 m/s.

EXERCISE 3

Q1. Use the conversion table above to express the following speeds in metres per second.

a) 20 km/h b) 9 km/h c) 65 km/h

Q2. Use the conversion table above to approximate the following speeds in kilometres per hour.

a) 8 m/s b) 32 m/s c) 35 m/s

Q3. Which is faster?

a) 40km/h or 12m/s b) 20m/s or 75km/h

Q4. Kangaroos can bound at a top speed of 48 km/h. Approximately how many metres can they bound in a second?

Q5. A Peregrine falcon's top flying speed is 200 miles per hour. Use the formula

m/s = miles/h x 1.609 x 0.278

to convert this speed into m/s (show working).

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.

Examples

a) 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. $\frac{\$5.95}{220} = \$0.027\ per\ g$

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

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

b) 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 L × 1000 = 1500 mL

$$\frac{\$1.75}{350\ mL} = 0.005 \qquad \frac{\$4.50}{1500\ mL} = 0.003$$

Compare the unit price per 100 mL.

$$0.005 \times 100 = \$0.50\ per\ 100\ mL \qquad 0.03 \times 100 = \$0.30\ per\ mL$$

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 4

For this question remember to change kilograms into grams: 1 kg = 1000 g

Q1. Calculate the unit price per 100 g for the following items. Explain which is better value.

		Which is better value?
180 g tin of Milo for $4.60	220 g tin of Milo for $5.50	
110 g of toothpaste for $2.65	175 g of toothpaste for $2.65	
500 g packet of spaghetti for $0.89	1 kg packet of spaghetti for $1.70	
2 kg bag of potatoes for $3.98	800 g bag of potatoes for $1.65	

REVISION WEEK 8

Revision Exercise 1

Q1. Which of these statements are true and which are false?

a) $8 + 2 \times 3 = 14$

b) $12 - 4 \times 3 = 16$

c) $5 \times 2^2 = 100$

d) $(42 - 36) \times 2 = 12$

e) $24 \div 6 \times 2 = 2$

f) $\frac{10+8}{7-5} = 9$

Q2. What is the value of following expressions?

a) $3 \times (5 + 4)$

b) $8 \times 2 - 3 \times 5$

c) $(12 - 9) \times (7 - 2)$

d) $(18 + 3) \div 2 \times 3$

e) $\frac{16+9}{5}$

f) $\frac{5+3 \times 10}{5}$

Revision Exercise 2

Q1. Express 43% as a fraction in simplest form.

Q2. Express 90% as a fraction in simplest form.

Q3. Write the fraction $\frac{7}{10}$ as a percentage.

Q4. Express the fraction $\frac{15}{71}$ as a percentage, correct to two decimal places.

Q5. Consider the fraction $\frac{114}{400}$.

a. first, convert to a fraction with a denominator of 100.

b. now, convert to a percentage.

Q6. Express 4.5% as a fraction in simplest form.

Q7. David is paying for a meal with lots of friends. They received great service, so he is giving a 20% tip. The meal cost $182.30, how much will David leaves as a tip? Show working.

Q8. Tobias works at a restaurant that automatically charges 25% service to groups of 8 or more people. He has just served a group of 8 people. Before sales tax, their meal came to $238.51. How much of a tip is Tobias going to get from this bill? Round your answer to the nearest cent.

WEEK 7/8 PORTFOLIO TASK

Task 1

At the 2020 Olympic games, the qualifying standards for the women's 100 metres race was 11.15s. How does this compare with the speed of a bus travelling at 40km/h through a school zone?

Task 2

Imagine that you raced in the 200m with Usain Bolt. By what length would he beat you? (Note: In the 2009 IAAF World championship, Usain Bolt ran the 100m in 9.58s.)

MARKING RUBRIC

CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work of the brief to an acceptable standard set by the teacher.	**2**	**3**		**/6**
Portfolio Task	Student completes the portfolio task of the brief to an acceptable standard set by the teacher.	**2**	**2**		**/4**
Communication and Reasoning	Student responses are accurate and appropriate in presentation of mathematical ideas in different contexts, with clear and logical working out shown.	**4**	**-**		**/4**
Knowledge and Application	Student submitted work selects and applies appropriate mathematical modelling and problem solving techniques to solve practical problems, and demonstrates proficiency in the use of mathematical facts, techniques and formulae.	**4**	**-**		**/4**
	Submission Guidelines				
Timeliness	Student submits the exercises and portfolio task by the set deadline. See scoring guidelines for specific details.	**2**	**-**		**/2**
		FINAL			**/20**

Student Reflection:
How did you go with this week's work?

What was interesting?

What did you find easy?

What do you need to work on?

Checklist: Are you up to date with your briefs this semester?

Brief: topic/work covered	**Rules and formulae; worked examples / Reminders**
Week 1: Why maths? **Score: /20**	
Week 2: Calculations – order of operations **Score: /20**	
Week 3: Estimation **Score: /20**	
Week 4: Further estimation **Score: /20**	
Week 5/6: Percentages **Score: /20**	
Week 7/8: Rates and revision **Score:** tba**/20**	

More practice

Rounding:
https://www.transum.org/software/SW/Starter_of_the_day/Students/RoundingDP.asp?Level=2

Percentages:
https://www.transum.org/Maths/Exercise/Express_As_A_Percentage.asp
https://www.transum.org/software/SW/Starter_of_the_day/Students/Percentages.asp
https://www.transum.org/software/SW/Starter_of_the_day/Students/PercentageChange.asp