Learning Brief
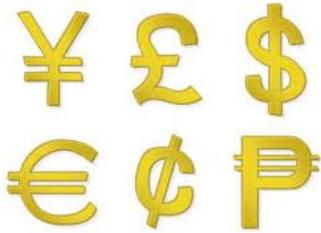Mathematical Applications
Year 11 Semester 1 - MAP1T

Goals

Unit goals

- Understand the concepts and techniques introduced in consumer arithmetic, algebra and matrices, and shape and measurement.
- Apply reasoning skills and solve practical problems.

This week the work is on

- Review of rates
- Converting rates
- Currency exchange
- Best buys
- Mark-ups and discounts
- Profit and loss
- Inflation and GST

Theoretical Components

Resources:
PDF file: Week 3&4 Notes & Exercises
On-line resources: linked in the notes and *Mathspac.*

The following site provides a comprehensive view of the concept of unit pricing
https://www.accc.gov.au/consumers/groceries/grocery-unit-prices

Knowledge Checklist

- Cost price, mark-up, retail price, selling price, discount
- Profit, loss
- Inflation as a measure of the change in the cost of living
- Goods and services tax (GST)
- What is a 'rate'
- Converting rates from one unit to another
- Converting currency
- Using *unit pricing* as an aid when shopping

Order

1. Look at the Investigation.
2. Work through the booklet and online resources to develop the skills necessary to complete the Investigation
3. Complete the Investigation.
4. Complete the quizes on Mathspace
5. Show your completed booklet to Aaron and submit the Investigation for marking.

Practical Components

There are questions to be answered in the booklet *Week 3&4 Notes and Exercises.*

For this week the *Mathspace* lessons are:
Curriculum: World of Math
Topic 1: Percentages
Subtopic: Business applications of percentages

Topic 2: Ratio and Rates

Subtopic: Rates
           Simple Rates Conversions

Investigation

On HawkerMaths.com and attached to this week's

Quiz

revision quiz on Mathspace

MARK-UPS AND DISCOUNTS

When a retailer buys goods from a wholesaler or manufacturer the price paid is known as the *cost price*.
A *mark-up* is usually added to this price in order to cover costs and make money.
The price shown on an item is known as the *retail price* (or *marked price*).
The amount the item is sold for is known as the *selling price*).
The amount added by a seller depends on many factors such as competition, turnover, freshness and storage life.
A *discount* (or *mark-down*) is the amount that is taken of the price of goods so that they sell faster (when they are in abundance, selling slowly, damaged or shop soiled).

EXAMPLE

1. A store applies a 30% mark-up on the item it sells. A particular item has a cost price of $50.
a) How much will be added to the cost price?

Increase = $\dfrac{30}{100}$ × 50 = $15

b) What is the retail price?

50 + 15 = $65

2. What was the cost price of a dishwasher that had a marked price of $1295?
A 40% mark-up means that the retail price is 100 + 40 = 140% of the cost price.

So 140% = $1295 thus 1% = $\dfrac{1295}{140}$.

100% is $\dfrac{1295}{140}$ × 100 = 925. Thus the cost price was $925

Important

The percentage that an item has been marked up by is calculated by using

$$\text{Percentage mark-up} = \frac{mark-up}{cost\ price} \times 100\%$$

If the discount is expressed as a percentage of the original price, it is called a *percentage discount*.

$$\text{Discount = Original price - Sale price}$$

$$\text{Percentage discount} = \frac{discount}{retail\ price} \times 100\%$$

EXAMPLE

A vacuum cleaner is discounted from $180 to $126. Find the percentage discount.

Discount = Original price − Sale price
$$= \$180 - \$126$$
$$= \$54$$

$$\% \text{ discount} = \frac{\text{Discount}}{\text{Original price}} \times 100\%$$

$$\% \text{ discount} = \frac{54}{180} \times 100\%$$

$$= 30\%$$

The vacuum cleaner was discounted by 30%.

QUESTION 1

1. Complete the following table.

	Item	Original price ($)	Discount (%)	Discount ($)	Sale price ($)
a	Microwave oven	300	10%		
b	Furniture set	2030	5%		
c	Mirror	40	30%		
d	Necklace	1560	12.5%		

2. A hardware shop works on a 65% mark-up. What would the shop charge for a chainsaw with a cost price of $280?

3. A takeaway store works on a mark-up of 120%. What was the cost price of a spring roll that sold for $2.20?

4. A department store announced a 15% discount on every purchase for one day only. Elena decided to use the opportunity to buy new clothes for her daughter. She bought a dress normally priced at $29, a 3-piece shorts set (normally $30), pedal pushers (normally $16), an embroidered top (normally $18) and sandals (normally $26). Find:

a) the total cost of the clothes

b) the amount she had to pay after the 15% discount was applied

c) the amount of money Elena was able to save on these purchases by shopping on that day.

5. Healthway is promoting savings in its health and beauty products. For each of the items shown below, find:

a) the original price   b) the percentage discount for any three of these items.

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PROFIT AND LOSS

When an item is sold for more than it cost, the difference is said to be *profit*. It is customary to express profit as a percentage of the cost price:

Profit = Selling price - Cost price

Percentage profit = $\dfrac{profit}{cost\ price}$ × 100%

Loss = Cost price - Selling price

Percentage loss = $\dfrac{loss}{cost\ price}$ × 100%

EXAMPLE

1. Find the percentage profit on an item that was bought for $30 and later sold for $38.

Cost Price (CP), Selling Price (SP)

$CP = \$30;\ SP = \$38$

$Profit = SP - CP$

$Profit = \$38 - \$30$
$\qquad = \$8$

$Percentage\ profit = \dfrac{Profit}{CP} \times 100\%$

$Percentage\ profit = \dfrac{8}{30} \times 100\%$
$\qquad\qquad\qquad = 26.67\%$

2. Steffi runs a market jewelry stall. She spends $450 on supplies to make 36 necklaces. She works on a profit margin of 85%. How much should she sell each necklace for?

Cost per necklace = 450 ÷ 36 = $12.50

A profit of 85% means increase cost price by 85% ie 185% of cost price

185% of $12.50 = $\dfrac{185}{100}$ × 12.5 = 23.125 which we round to $23.13 so she would probably sell each necklace for $23 or perhaps $24.

QUESTION 2

1. A local tradesman works on a profit margin of 140%. Calculate the selling price for a dining set that cost him $2350 to make.

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2. Find the percentage profit (to 2 decimal places) for each of the following items.

Item	CP ($)	SP ($)
Tracksuit	80	139.95
T-shirt	16	22.50

3. The following goods were sold at a garage sale. Find the percentage loss for each of the items, correct to 2 decimal places.

Item	CP ($)	SP ($)
Cutlery	40	8
Two bedside lamps	100	22

4. A shopkeeper buys 20 kg of cooking chocolate for $50 and sells it in 500 g packets at $3 each. Find the profit made and express it as a percentage of the cost price.

5. By selling a collection of coins for $177, Igor makes a profit of 18%. What was the original cost of the collection?

INFLATION AND GST

Inflation is an increase in the price of goods and services. Over time, inflation reduces the purchasing power of a dollar, thereby lowering its value. For example, if the price of petrol rises, drivers must pay more to fill their tanks and they have less money available for other spending (e.g., eating out and buying clothing). The annual inflation rate in Australia is around 3%.

EXAMPLE

Amity receives a pay rise from $53000 to $54800. If the annual inflation rate is 3.4% has her salary kept up with inflation?

Pay increase = 54800 - 53000 = $1800

Percentage increase = $\dfrac{1800}{53000}$ × 100 = 3.396…% = 3.4%

Her salary has 'kept up' with inflation.

GST

GST is short for goods and services tax. That is exactly what it is, a tax on goods and services. It is described as a broad-based consumption tax as it applies to all sorts of goods and services that are consumed by the general public.

GST is levied at a rate of 10%, which means that in order to calculate the GST to be added to goods or services you simply add 10% to the original price.

To calculate the GST included in the price divide the price by 11.

If you have goods to sell worth $100, then 10% of $100 is $10 so the goods will be sold for $110.

In reverse, $110 divided by 11 is $10 thus the GST is $10.

Australian businesses must obtain an Australian Business Number (ABN) from the Australian Taxation Office before they begin trading. Most businesses must also add a Goods and Services Tax (GST) to their prices. Some items, such as basic food and some medical supplies, are exempt from GST. Businesses must pay the GST they have collected to the Federal Government when they lodge their Business Activity Statement (BAS), usually quarterly.

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QUESTION 3

1. A store increases their prices to stay in line with the rate of inflation. If the rate of inflation is 3.8%, calculate the new price of a television now priced at $850.

2. How much GST should be added to each of these prices?

a) $55 pair of jeans

b) $90 pair of shoes

c) $16 rose plant

d) $12 book

3. Each of the following prices is GST-inclusive. Calculate the amount of GST included in each price. Express your answers in cents, correct to 2 decimal places.

a) $9.50 hot BBQ chicken

b) $4.85 pack of toilet paper

c) $11.25 bottle of shampoo

d) $5.80 pack of salted peanuts

4. Shaun buys T-shirts from a wholesaler for $7.50. To calculate the selling price he works on a profit margin of 150% and then adds GST. Calculate the final selling price.

5. At the Great Gals end of year sale customers get a 10% discount on all goods. Will the discounted price be less than or the same as the original price before GST was added?

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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)?

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CONVERTING RATES

One Unit Conversions

Convert 7.9 L/100 km to mL/100 km

1L = 1000mL so 7.9L = 7.9 × 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× 60 = $14.40/h

Convert 80km/h to m/s

80km = 80 × 1000 = 80000m

1h = 1 × 3600 = 3600s

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

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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?

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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.

Money conversions

The value of money changes all the time. The amount of money that can be exchanged for $A1 (one Australian dollar) is the exchange rate. Each day, exchange rates are published in newspapers, on television and on the Internet.

The easiest way to determine currency conversions is to use an online converter. However, if you're planning to buy items in local markets overseas, you are unlikely to be able to use the Internet and will need another way to calculate currency exchange.

The examples below are using the following exchange rates.

$$\$A1 = \$0.875 \text{ Canadian}$$

$$= 9.98 \text{ South African rand}$$

$$= 0.613 \text{ euros}$$

EXAMPLE

1. Convert $500 Australian dollars into euros.

To change Australian dollars into another currency, *multiply* by the $A1 exchange rate.

$A1 = 0.613 euros

$A500 = 0.613 × 500 euros

= 306.5 euros

2. Convert 2890 South African rand into Australian dollars.

To change another currency into Australian dollars, *divide* by the $A1 exchange rate.

9.98 rand = $A1

2890 rand = $A (2890 /9.98)

= $A289.58

1. Convert $3000 Australian dollars into:

a) Canadian dollars   b) South African rand   c) euros.

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

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

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

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. $\frac{\$2.50}{330mL} = \$0.008 \ per \ mL$

Multiply by 100 to get the cost. 0.008×100

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

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 L $\times$ 1000 = 1500 mL

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

Compare the unit price per 100 mL.

$$0.005 \times 100 = \$0.50 \, per \, 100 \, mL \qquad\qquad 0.03 \times 100 = \$.30 \, per \, mL$$

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 SET 4

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

1 kg = 1000 g   1 L = 1000 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

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Week 3&4 Investigation

QUESTION 1

Before the beginning of a winter sale, a shop assistant was asked to reduce the prices of all items in the store by 12.5%. She calculated the new prices and attached new tags to the goods. At the end of the sale she was asked to put the old prices back. Unfortunately, the shop assistant had thrown the old tags away as she did not think she would need them again. She decided to add 12.5% to the sale prices. If the shop assistant proceeds in this manner, will she get back to the original prices?

Explain your answer using Maths!

QUESTION 2

If GST is 10% added to the price of an item, why do we divide the price we pay for the item by 11 to calculate the GST included?

SCORING NOTES

Formatting **if necessary** for all typed/written assessments should be as follows:

Google Doc	11-12 Pt	1.15-1.5 Line Spacing	1 Space between paragraphs	Spelling and Grammar "Soft Limit"	In-Text Citations with footnotes	Title Page/Slide:
Slides	10-12 pt font text 14-24 pt font titles	1.0 1.15 Line Spacing	Bullet Points Preferred	Word Count per slide >100-110 "Soft Limit"	Approved Templates and Themes	- Name - Date - Class - Aim - Assessment title
If there is a **Timeliness** Criterion **-** Student will receive full marks for a submission on time, half marks for a submission within one week of the deadline and no marks for a submission after this without prior arrangement with the teacher. Deadline exceptions can be discussed with your teacher for special considerations.						

"Soft Limits" are not rigidly defined limits and will be assessed on a case-by-case basis. Ask for clarification for specific tasks.

Possible Scoring Groups are out of 2 or 4 Points.

2-Point Criteria

	0 Points	**1 Point**	**2 Points**
2 Point Criteria	Not present or able to be assessed as the required criteria	Item is presented and **does not meet** expectations for quality, rigour, or detail	Item is presented and **does** meet expectations for quality, rigour, or detail

4-Point Criteria

	0 Points	**1 Point**	**2 Points**	**4 Points**
4 Point Criteria	Not present or able to be assessed as the required criteria	Item is presented, but **does not** meet expectations for quality, rigour, or detail	Item is presented and **does** meet expectations for quality, rigour, or detail	Item is presented and **does** meet expectations for quality, rigour, or detail. **Response presented is consistently accurate and demonstrates very high level of proficiency.**

Multiplier

Criteria will be combined with a **Multiplier**. While each criterion will be scored on the 0-1-2-4 scale, the multiplier will attach relevant worth to each criterion. Be aware of these multipliers and dedicate appropriate time to ensure you achieve your best result.

Achievement Standards:

Achievement standards can be found on the BSSS course description.

MARKING RUBRIC

CRITERIA	EXPECTATIONS	POSS	MULT	GIVEN	TOTAL
Practical	Student completes practical work, including exercises and Mathspace task, of the brief to an acceptable standard set by the teacher.	**2**	**3**		**/6**
Investigation Task	Student completes the investigation task of the week 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, Mathspace task and investigation 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?

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