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ERROR AND PERCENTAGE ERROR

An **approximation** is a value given to a number which is close to, but not equal to, its true value.

An **estimation** is a value which has been found by judgement or prediction instead of carrying out a more accurate measurement.

If the actual or exact value is V_E and the approximate value is V_A then the

$$\text{error} = V_A - V_E$$

Error is often expressed as a percentage of the exact value, and in this case we use the *size* of the error, ignoring its sign. We therefore use the **modulus** of the error.

$$\text{Percentage error } E = \frac{|V_A - V_E|}{V_E} \times 100\%$$

You estimate a fence's length to be 70 m whereas its true length is 78.3 m. Find, correct to one decimal place:

- a the error
- b the percentage error.

Alan wants to lay carpet on his 4.2 m by 5.1 m lounge room floor. He estimates the area of the lounge room by rounding each measurement to the nearest metre.

- a Find Alan's estimate of the lounge room area. $4 \times 5 = 20 \text{ m}^2$
- b The carpet costs \$39 per square metre. Find the cost of the carpet using Alan's estimate of the area. \$780
- c Find the actual area of Alan's lounge room. $4.2 \cdot 5.1 = 21.42 \text{ m}^2$
- d Find the percentage error in Alan's estimation. $\frac{1.42}{21.42} \times 100 = 6.62\%$
- e Will Alan have enough carpet to cover his lounge room? How should he have rounded the measurements?

$$\frac{1.42}{21.42} \times 100 = 6.63\%$$

If you visit another country or buy products from overseas, you usually have to use the money or **currency** of that country. We use an **exchange rate** to find out how much your money is worth in the foreign currency, and vice versa.

Exchange rates are constantly changing, and so are published daily in newspapers, displayed in bank windows and airports, and updated on the internet. The rate is usually given as the amount of foreign currency equal to one unit of local currency.

SIMPLE CURRENCY CONVERSION

A bank exchanges 1 British pound (GBP) for 1.65 Australian dollars (AUD). Convert:

a 40 GBP to AUD

b 500 AUD to GBP.

$$\frac{1 \text{ GBP}}{1.65 \text{ AUD}} = \frac{40 \text{ GBP}}{x \text{ AUD}}$$

$$\frac{1 \text{ GBP}}{1.65 \text{ AUD}} = \frac{x \text{ 66 AUD}}{500} \quad \text{£ 303.03 GBP}$$

Sometimes the exchange rates between currencies are presented in a table. In this case we select the row according to the currency we are converting *from*, and the column by the currency we are converting *to*.

Want

currency converting to

have

currency converting from

	Hong Kong (HKD)	China (CNY)	Japan (JPY)
Hong Kong (HKD)	1	0.817	9.885
China (CNY)	1.225	1	12.106
Japan (JPY)	0.101	0.083	1

The table alongside shows the transfer rates between US dollars (USD), Swiss francs (CHF), and British pounds (GBP).

	USD	GBP	CHF
USD	1	0.640	0.91
GBP	1.56	1	1.43
CHF	1.10	0.70	1

a Write down the exchange rate from:

- i CHF to USD
- ii USD to CHF.

1.10 0.91

b Convert:

- i 3000 USD to GBP
- ii 10 000 francs to pounds.

$$\frac{1 \text{ USD}}{0.640 \text{ GBP}} = \frac{3000 \text{ USD}}{X} \quad \left| \frac{1}{.7} = 10 \right.$$

£ 1920

The table alongside shows the conversion rates between Mexican pesos (MXN), Russian rubles (RUB), and South African rand (ZAR).

	MXN	RUB	ZAR
MXN	1	2.230	0.6018
RUB	0.4484	1	0.2699
ZAR	p	q	r

- a Convert 5000 rubles into: i rand ii pesos.

i. 1349.50

ii. 2242

- b How many Russian rubles can be bought for 20 000 Mexican pesos?

4460

- c Calculate the values of: i p ii q iii r

$$\frac{1}{2.23} = \frac{20000}{x}$$

FIXED COMMISSION ON CURRENCY EXCHANGE

When a currency trader (such as a bank) exchanges currency for a customer, a commission is often paid by the customer for this service. The commission could vary from $\frac{1}{2}\%$ to 3%, or could be a constant amount or 'flat fee'.

A banker changes South African rand to other currencies at a fixed commission of 1.5%. Wendy wishes to convert 800 ZAR to Russian rubles where 1 ZAR buys 3.75 RUB.

- a What commission is charged?

- b How much does Wendy receive?

$$800 \times 0.015 = 12 \text{ ZAR}$$

$$\frac{788 \text{ ZAR.}}{x} = \frac{1}{3.75}$$

DIFFERENT BUY AND SELL RATES

Another way currency traders can obtain a commission is to offer different exchange rates which include their commission. They will buy currency from you at a rate lower than the market value, and sell it at a rate higher than the market value. The difference is their commission.

Suppose you live in the United States of America. The following table shows how much one American dollar (USD) is worth in some other currencies.

<i>Country</i>	<i>Currency name</i>	<i>Code</i>	<i>Buys</i>	<i>Sells</i>
Europe	Euro	EUR	0.7502	0.7354
United Kingdom	Pounds	GBP	0.6468	0.6340
Australia	Dollars	AUD	1.0341	1.0136
Canada	Dollars	CAD	1.0516	1.0308
China	Yuan	CNY	6.4263	6.2991
Denmark	Kroner	DKK	5.5828	5.4722
Hong Kong	Dollars	HKD	7.8705	7.7146
Japan	Yen	JPY	77.797	76.256
Mexico	Peso	MXN	14.150	13.870
New Zealand	Dollars	NZD	1.3566	1.3298
Norway	Kroner	NOK	5.8656	5.7494
Saudi Arabia	Riyals	SAR	3.7877	3.7127
Singapore	Dollars	SGD	1.3179	1.2918
South Africa	Rand	ZAR	8.5101	8.3416
Sweden	Kronor	SEK	6.9323	6.7951
Switzerland	Francs	CHF	0.9238	0.9055
Thailand	Baht	THB	31.598	30.972

The 'buy' and 'sell' rates are listed relative to the currency broker (bank or exchange) and are in terms of the foreign currency.

The foreign currency EUR will be bought by the broker at the rate $1 \text{ USD} = 0.7502 \text{ EUR}$, and sold by the broker at the rate $1 \text{ USD} = 0.7354 \text{ EUR}$.

Use the currency conversion table above to perform the following conversions:

- a Convert 400 USD into euros.
- b How much does it cost in US dollars to buy 5000 yen?
- c How many US dollars can you buy for 2000 Swedish kronor?

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a Euros are sold at the rate
 $1 \text{ USD} = 0.7354 \text{ EUR}$
 $\therefore 400 \text{ USD} = 400 \times 0.7354 \text{ EUR}$
 $= 294.16 \text{ EUR}$

b The currency broker sells yen at the rate
 $1 \text{ USD} = 76.256 \text{ JPY}$
 $\therefore \frac{1}{76.256} \text{ USD} = 1 \text{ JPY}$
 $\therefore 5000 \times \frac{1}{76.256} \text{ USD} = 5000 \text{ JPY}$
 $\therefore 5000 \text{ JPY} = 65.57 \text{ USD}$

c The currency broker buys kronor at the rate
 $1 \text{ USD} = 6.9323 \text{ SEK}$
 $\therefore \frac{1}{6.9323} \text{ USD} = 1 \text{ SEK}$
 $\therefore 2000 \times \frac{1}{6.9323} \text{ USD} = 2000 \text{ SEK}$
 $\therefore 2000 \text{ SEK} = 288.50 \text{ USD}$

A currency exchange service exchanges 1 euro for Japanese yen with the buy rate 105.3, and sell rate 101.4. Cedric wishes to exchange 800 euros for yen.

a How many yen will he receive?

b If the yen in **a** were exchanged immediately back to euros, how many euros would they be worth?

c What is the resultant commission on the double transaction?

Exercises:

2 G # 3, 6, 10

2 H # 4, 6

2 I.1 # 2, 5

2 I.2 # 2

2 I.3 # 1, 5

