

SESSION 6: RATIO, PROPORTION AND RATE**Key Concepts**

In this session we will focus on summarising what you need to know about:

- The definition of a ratio
- The definition of proportions
- Definition and examples of rates

X-planation**1. Ratio Definition**

A ratio is a comparison of two numbers (called terms of the ratio).

Ratios have no units since the quantities being compared are of the same kind or type.

Ratios can be written in different ways:

- In words → a to b
- With a colon → a:b
- As a fraction → $\frac{a}{b}$

Example: Suppose there are 12 boys and 9 girls in a class. The ratio of boys to girls can be written

- In words → 12 to 9
- With a colon → 12:9
- As a fraction $\frac{12}{9}$

Ratios can be written in equivalent form and, therefore, used for comparison.

2. Proportion Definition

When two ratios are equal, for example $a:b = c:d$, the four quantities are said to form a proportion. In other words, proportions are no more than the comparison of ratios – when ratios are equal we say they are in proportion to each other.

Example:

You want to mix cement to patch a crack in the wall and have noticed that the builder mixes 6 pockets of cement with 18 pockets of sand. If you decide to mix 2 cups of cement with 6 cups of sand, you are using the cement and the sand in the same proportion as the builder.

3. Rate Definition

A rate is a special kind of ratio in which the two (or more) quantities being compared have different units. Examples of rates include:

- Comparing the distance travelled by a car to the time taken to travel that distance – this gives the speed of the car in kilometres per hour (km/h)
- Comparing the time spent on a telephone call to the total cost of the call – in Rands per minute (R/min).
- Comparing the value of the Rand currency to the US Dollar currency – this gives the exchange rate of the rand to the dollar in Rand per Dollar (R/\$)

Two important concepts to understand when working with rate are constant rates and unit rates.

- **Constant rate:** When the quantities being compared are in direct proportion, we say that we have a constant rate.
Example: rates at which telephone calls are charged – R2,80 per minute.
- **Unit rate:** A useful method for performing calculations involving rates is to use unit rates; this is the rates in which one of the quantities in the rate is compared with a single unit of the second quantity in the rate.
Example: cost of milk per one litre – R9,75/ℓ

X-ample Questions

Question 1

- a) Vusi is opening a frozen yogurt kiosk at his local cinema. He has bought a chest freezer for the kiosk. The freezer is 150cm wide, 80cm deep and 160cm high.
- i) Use the formula $V = l \times b \times h$ to calculate the capacity of the fridge in litres, if $1000\text{cm}^3 = 1 \text{ litre}$. (3)
 - ii) Vusi buys the frozen yogurt in 25 litre containers. Calculate the approximate number of 25 litre containers that the fridge is able to hold. (3)
 - iii) Will he actually be able to fit this number of containers into his freezer? Explain your answer. (2)
- b) The table below lists the various tub sizes that Vusi will be using for the frozen yogurt.

Tub Size	Tub Size
Small	125ml
Medium	250ml
Large	500ml

Vusi estimates the various tub sizes will sell in the following ratio:

$$\frac{1}{5} \text{ small}; \quad \frac{3}{10} \text{ medium}; \quad \text{and} \quad \frac{1}{2} \text{ large}$$

If Vusi has 1 500 litres of frozen yogurt, use the information given above to calculate how many of each tub size he will sell. (6)

Question 2

- a) Find the value of p if: $480:200 = 36:p$ (2)
- b) There are 11 people in a soccer team. If there are 49 boys in Grade 11 at your school who play soccer,
- What is the maximum number of soccer teams that can be made? (2)
 - The ratio of soccer players to non-soccer players in Grade 11 is 1:3. What is the total number of learners in Grade 11? (2)
- c) A soccer team practises for 4 hours a week. Their coach increases their practice time by 8%. For how much longer will they practise now? (2)
- d) It takes approximately 5 minutes for a water heater to boil 2,5 litres of water. How long will it take the same heater to boil 50 litres of water? Give your answer in hours and minutes. (3)
- e) Sacha has a part-time job, and she saves 9,2% of her monthly salary. If she saves R115.00 each month, what is her salary? (3)
- f) R4 800 is shared in the ratio of 7:3. Determine the difference between the larger and smaller share. (4)
- g) It costs R1 560 for 7 people to attend a *Kings of Leon* concert. 5 more people join the group, bringing the total to 12 people. Calculate the new total price. (3)

X-exercise

- a) Tandeka baked 48 scones at a school bazaar. She used her grandmother's recipe which was not in metric units. Tandeka sold the scones for R1,20 each.

Scones (makes 12) Ingredients
8 oz flour
1½ oz butter
¼ pint milk
1½ tablespoon sugar

- i) Convert 8 oz to grams. (1 oz = 30g) (2)
- ii) Convert ¼ pint to millilitres (1 pint = 560ml) (2)
- iii) Convert 430 °F to degrees centigrade (°C) using the following formula:
- $$\text{Temperature in } ^\circ\text{C} = (\text{Temperature in } ^\circ\text{F} - 32^\circ) \times \frac{5}{9}$$
- iv) Round off the answer to the nearest 10°. (3)
- iv) Calculate how many scones Tandeka must sell in order to recover her costs of R36,00. (2)
- b) If I exchange R36 and I receive \$3,65. What would I get if I exchanged R90? (2)
- c) Concentrated juice must be mixed in the ratio of 1 part juice to 4 parts water. How much concentrate will you need to make 1 litre of mixed juice? (2)
- d) A landline rate for a local telephone call is R0,74 for 89 seconds. How much would a call lasting 00:04:27 cost? (3)
- e) Vusiwe needs to buy milk. She goes to a local supermarket and finds the following packaging options: 2ℓ for R17,99; 500mℓ for R6,50; and 1ℓ for R9,70. Which would be the most economical? (6)