

Unit 1: Numeracy (H225 74/75)

Ratio and Proportion

Identifying Ratio: A ratio shows how much of one item there is compared to another. If you are making orange squash, for example, and you mix one part diluting orange to four parts water, then the ratio of diluting orange to water will be 1 to 4



Ratios are usually written in the form $a:b$ ('a to b') so for this type of orange squash we would write -

$$\text{Orange} : \text{Water} = 1 : 4$$




The order in which a ratio is stated is important, changing the order of the numbers in a ratio changes the proportions. The squash would not taste very nice if we put the diluting orange and water in the opposite measures i.e. $4 : 1$!!



Simplifying Ratios: Similar to fractions, ratios can be simplified if they have a hcf (highest common factor) of more than one. In other words, if both numbers appear in the same multiplication table then the values can be divided by this number to make them smaller or simpler:

e.g. $8 : 6 = (8 \div 2) : (6 \div 2) = 4 : 3$ since the hcf of 8 and 6 is 2

$3 : 9 = (3 \div 3) : (9 \div 3) = 1 : 3$ since 3 and 9 are in the 3-times table

Bronze 	Silver 	Gold 
Simplify:	Simplify:	Simplify:
1) 2 : 8	1) 32 : 40	1) 4 : 10 : 18
2) 3 : 15	2) 45 : 36	2) 3 : 6 : 9
3) 4 : 10	3) 222 : 4	3) 10 : 15 : 25
4) 8 : 4	4) 33 : 36	4) 28 : 35 : 49
5) 20 : 30	5) 2 : 1242	5) 30 : 15 : 60
6) 28 : 21	6) 17 : 34	6) 22 : 33 : 110
7) 100 : 60	7) 48 : 102	7) 13 : 65 : 26
8) 15 : 40	8) 2 : 4 : 10	8) 40 : 30 : 45 : 70

Ratio Calculations: Ratios can be used in a variety of real-life problems where we are required to scale up the amounts.

Example: ① A particular shade of green paint is made by mixing yellow paint and blue paint in the ratio 2 : 3. If we already have 14 litres of yellow paint then how many litres of blue paint will be required?



Similar to generating a family of equivalent fractions, we can create a table of equivalent ratios until we reach 14 for yellow:

Yellow	Blue
2	3
4	6
6	9
8	12
10	15
12	18
14	21

Continuing the pattern until we reach 14 litres for yellow allows us to identify that 21 litres of Blue will be required.

This method will only work if the answer is part of the equivalent ratio family. The method that works for any of these types of questions requires us to identify the multiplier that will take the simplified ratio to the target value.

In the above example, the multiplier is 7 since $2 \times 7 = 14$:

Yellow	Blue
2	3
$\times 7$	$\times 7$
= 14	= 21



Example: ② Concrete is made by mixing cement, sand and aggregate in the ratio 4 : 3 : 2. How much sand and aggregate will be needed for 15kg of cement?

For this example, we need the multiplier that will take 4 to 15.

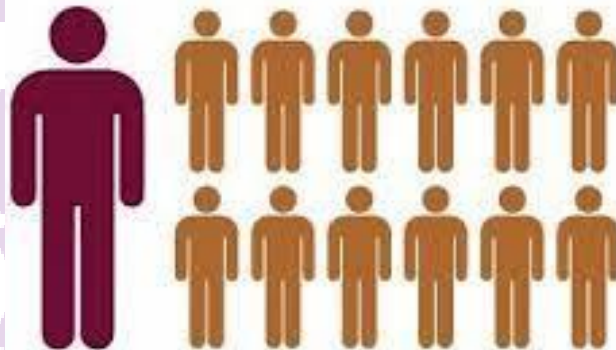
We calculate this using $15 \div 4 = 3.75$:



Cement	Sand	Aggregate
4	3	2
$\times 3.75$	$\times 3.75$	$\times 3.75$
15	11.25	7.5

11.25kg of sand and 7.5kg of aggregate will be required.

STUDENT TEACHER RATIO



Did you know that a school trip requires a minimum student teacher ratio of 1 : 12.

- How many teachers would be required to accompany 60 students?
- How many teachers would be required to accompany 61 students?

Sharing in a Given Ratio:

e.g. Share 14000 in the ratio 2 : 5

If we represent this question as two people who form a lottery syndicate. One of them buys 2 lottery tickets, the second person 5 lottery tickets and they win £14000, what would be a fair split of the money?

- If we think of their syndicate as a company where person one has 2 shares and person two has 5 shares, we can establish that the company has 7 shares in total $2 + 5 = 7$
- Taking the winnings of £14000 as the value of the company, we can establish that each share has a value of £2000 - $14000 \div 7 = 2000$
- Since person one has 2 shares, they would get £4000 (2×2000) and since person two has 5 shares then they would get £10000 (5×2000)

We use this method to solve similar and more challenging questions of this type:

- 1) Add the ratios
- 2) Divide the total by this answer
- 3) Multiply this answer by each ratio to find the ANSWERS (plural!)

Share \$48 in the ratio 3:1:2

1) Find the **total number of parts**

$$3 + 1 + 2 = 6$$

2) Divide the **amount** by the **total number of parts**

$$\$48 \div 6 = \$8 = 1 \text{ part}$$

Can you finish this off?

Direct Proportion: This is when two quantities are related to each other. When one quantity increases, the other increase also e.g. if 6 eggs cost £0.72, how much will 10 eggs cost?

Set up a table with the quantities as headings: -

Write down the information given:

Find the unit value:-

Complete the calculation:-

Number of Eggs	Cost
6	£0.72
1	$£0.72 \div 6 = £0.12$
10	$£0.12 \times 10 = £1.20$

We say that the number of eggs is directly proportional to the cost of the eggs. In other words, the more eggs you buy, the more it will cost.

Foreign Exchange: Most countries have their own currency. In Britain we have pounds (£) and pence (p), USA has dollars (\$) and cents (c) while EU countries have euros (€) and cents (c). When we visit these countries, we are required to convert our British money into the currency of this country. This is known as 'foreign exchange' and is an application of direct proportion.



The shops which offer foreign exchange display a board called the exchange rate for each of the currencies they offer, this is the unit value i.e. how much £1 is worth:

Currencies	We Buy
Euro Over £500	1.20
Euro	1.19
USA Over £500	1.60
USA	1.58
Australia	1.65
Canada	1.78
New Zealand	2.17
South Africa	14.07
Czech Republic	34.85
Bulgaria	26.90
Turkey	2.75
Egypt	10.84

- To convert from pounds into a foreign currency, we multiply by the exchange rate.
- To convert back into pounds from a foreign currency, we divide by the exchange rate.

Example: ① Convert £350 into Canadian dollars.

$$£350 \times 1.78 = 623 \text{ C\$}$$

Example: ② Convert 660 Australian dollars into pounds.

$$660 \text{ A\$} \div 1.65 = £400$$

Indirect Proportion: This is when two quantities are related to each other. When one quantity increases, the other decreases e.g. it takes 6 people to build a wall in 4 days, how long will it take 8 people to build the same wall?

Set up a table with the quantities as headings:

Write down the information given:

Find the unit value:

Complete the calculation:

Number of People	Time
6	4
1	$6 \times 4 = 24 \text{ days}$
8	$24 \div 8 = 3 \text{ days}$

We say that the number of people is indirectly proportional to the time taken. In other words, the more people you put on the job, the less time it will take.