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Maths Refresher

Ratios and Unit Conversions

Ratios and Unit Conversions

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Learning intentions ….

- Ratios
  - Description
  - Proportional reasoning
  - Golden Ratio
  - Fibonacci sequence
- Unit Conversions
  - Description
  - Strategy: sort> strategise > solve > check
- Rate
  - Description

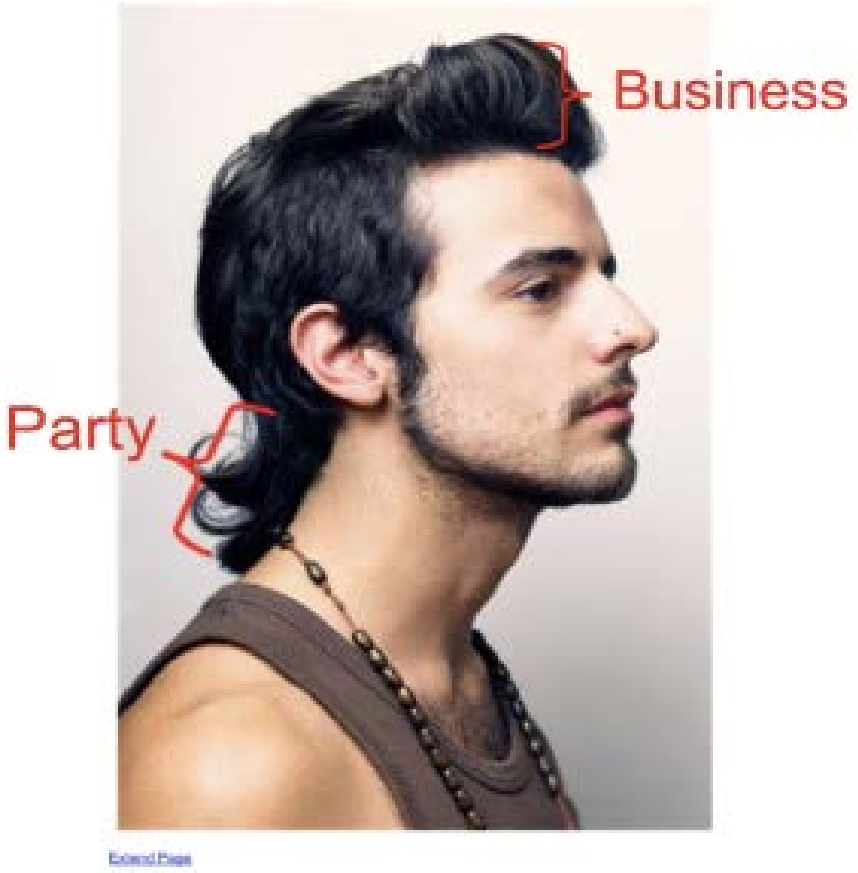
Ratio

The Mullet Ratio

$$R_m = \frac{\text{Party}}{\text{Business}}$$

$$R_m = \frac{17cm}{9cm}$$

$$R_m = 1.\overline{8}$$



Ratio

- Ratio is very closely related to fractions.
- **A ratio is a numerical comparison between two quantities of the same kind**. The ratio itself has no units.
- Ratios use the symbol “ : ”
- 1:3 means 1 part to 3 parts. It is NOT the same as $\frac{1}{3}$!
- The rectangle is 1 part grey to 3 parts white.
- Ratio is 1:3
- The rectangle is 1 part grey and a total of 4 parts. Hence the fraction is $\frac{1}{4}$ and not $\frac{1}{3}$

Proportional reasoning

For example: My 2 stroke mower requires petrol and oil mixed to a ratio of 1:25. This means that I add 1 part oil to 25 parts petrol.

The ratio must stay the same – it must be in the same 'proportions.' So if I add 200mls of oil to my tin:

1:25 = 200:x

$$\frac{1}{25} = \frac{200}{x}$$

We know that to scale up from 1 to 200, we have to multiply the numerator by 200:

$$\frac{1}{25} = \frac{200}{x}$$ x 200

We then have to do the same to the denominator

So, 25 x 200 = 5000

x = 5000

Therefore, I need 5000mls of petrol to 200mls of oil

The total volume of the mixture = 5200mls (= to 5.2 litres).

Proportional reasoning

Mathematically:

1 : 25 is the same as

2 : 50 is the same as

100: 2500 is the same as

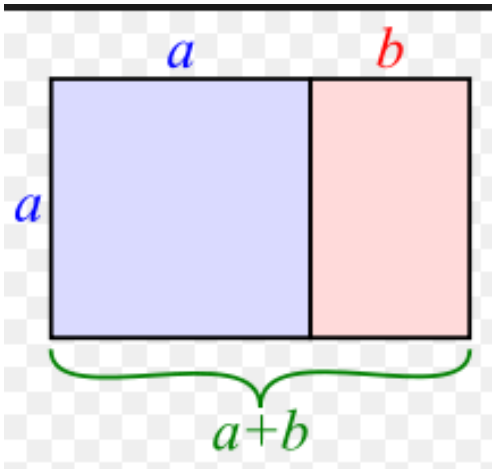
200:5000 and so on.

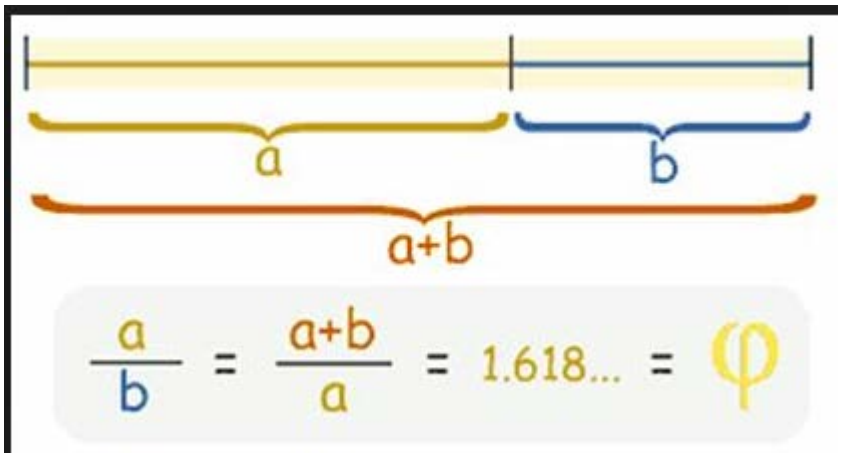
Solve a proportion with unknown variable word problem"
https://www.khanacademy.org/math/cc-seventh-grade-math/cc-7th-ratio-proportion/cc-7th-constructing-proportions/v/find-an-unknown-in-a-proportion-2

Ratio

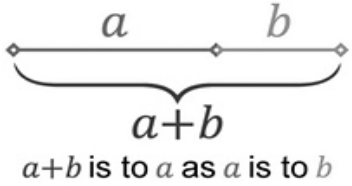
Ratios in the real world:

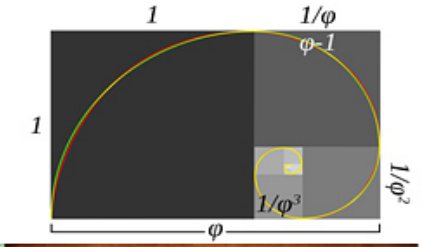
- House plans 1cm:1m = 1:100
- Map scales 1:200 000
- Circles C:D is as π: 1
- 1.618:1





Ratio



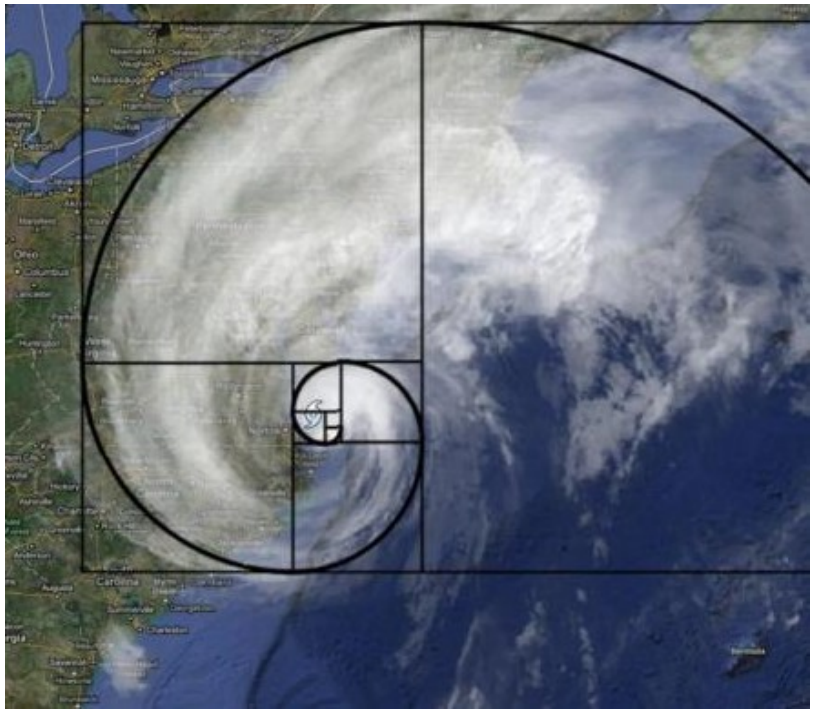


Ratios in the real world

- Golden Ratio

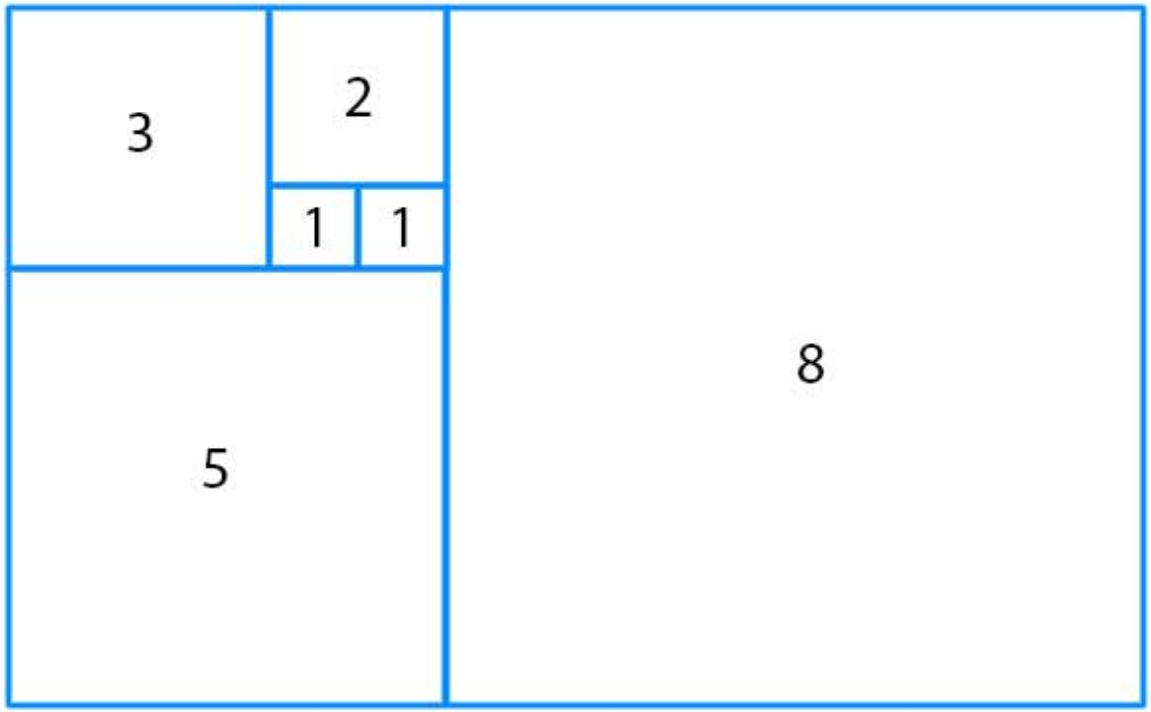
  a:b is as ab:a

φ



Fibonacci sequence

- 1,1,2,3,5,8, 13…..what is the pattern?
- The ratio between two numbers such as 8:13 is similar to the golden ratio



Your turn …

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RATIO

Practise problems:

Write each ratio in its simplest form:

1. \$450 : \$600
2. 25mm : 1.00m
3. 2.5cm : 5.00km
4. 30sec : 1hr
5. 4.5kg : 9.0g
6. 250mL : 2.00L
7. 400m : 80mm
8. 50kg : 1.20t

Ratio Answers

- $450 : $600 = 3:4
- 25mm : 1.00m = 25:1000 = 1:40
- 2.5cm : 5.00km = 2.5:500 000 = 1:200 000
- 30sec : 1hr = 30: (1x60x60) = 30:3600 = 1:120
- 4.5kg : 9.0g = 4500:9 = 500:1
- 250mL : 2.00L = 250:2000 = 1:8
- 400m : 80mm = 4000 000:80 = 5000:1
- 50kg : 1.20t = 50:1200 = 1:24

Unit Conversion

Let's look at conversions symbolically.

- $1m = 100cm = 1000mm$

or

- we could say that $1mm = \frac{1}{10}cm = \frac{1}{1000}m$

Unit Conversion rules:

- Always write the unit of measure associated with every number.
- Always include the units of measure in the calculations.
- Unit conversion requires algebraic thinking which will be covered in the next booklet; however, here you will be introduced to the concept. Let's convert 58mm into metres. $58mm \times \frac{1m}{1000mm} = 0.058m$
- The quantity $\frac{1m}{1000mm}$ is called a **conversion factor or solution map**

Unit conversion

“Unit conversion word problem: drug dosage”
https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-ratios-prop-topic/cc-6th-unit-conversion/v/unit-conversion-example-drug-dosage

International System of Units (SI)

- The symbol SI comes from the initials of the French term: *Systeme International d'Unites* which means international unit system.
- This system consists of seven base units: metre, kilogram, second, ampere, kelvin, candela and mole.

Quantity	Name	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
luminous intensity	candela	cd
amount of substance	mole	mol

Your turn….

- Define the following SI unit prefixes, in words, as a number, and in exponential notation:

a) kilo

b) centi

c) mega

d) deci

Answers

1.	kilo	one thousand	1 000	10^3
2.	centi	one hundredth	0.01	10^{-2}
3.	mega	one million	1 000 000	10^6
4.	deci	one tenth	0.1	10^{-1}

Unit conversion

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Example problem:

- Convert 32centimetres to metres.
- There are 100cm in a metre so our solution map is $\frac{1m}{100cm}$
- The working is as follows:

$$32\cancel{cm} \times \frac{1m}{100\cancel{cm}} = 0.32m$$

Unit conversion

Example problem:

- Convert 2 kilometres (km) into centimetres (cm).
- **Sort**: we know there are 1000 metres in one km, and 100cm in one metre.
- **Strategise**: So our maps could be $\frac{1000m}{1km}$ and $\frac{100cm}{1m}$
- **Solve**: $2km \times \frac{1000m}{1km} \times \frac{100cm}{1m} = x\ cm$
- $2\cancel{km} \times \frac{1000\cancel{m}}{1\cancel{km}} \times \frac{100cm}{1\cancel{m}} = 2 \times 1000 \times 100\ cm\ \therefore 2km = 200{,}000cm$
- **Check**: is there 200,000cm in a kilometre? Yes that seems sensible.

Your turn ….

- Convert the following
- Using this information:

$1\ m^2 = 10\ 000 cm^2 = 1000\ 000 mm^2$

Convert $1.5m^2$ into mm^2

a) 285m into kilometres

b) 96cm into kilometres

Answers

a. $0.285km$

b. $0.00096km$ or $9.6km \times 10^{-4}$

c. $1500000mm^2$ or $1.5mm^2 \times 10^6$

Rates

- **A rate is a numerical comparison between two different kinds of quantities**.
- A rate must have units
  - quantity *per* quantity
  - Km *per* hour
  - Food prices: $ *per* weight
  - Wages: $ *per* hour
- Rates can be displayed on a graph

Rates

Example: Nurses need to calculate IV rates: drops per minute (dpm)

- Some information is required first:
- The total volume to be given (often written on a prescription in mLs).
- The time over which the volume is to be given (often in minutes)
- The drop factor (determined by the administration set). This means how many drops per mL, which are commonly 15, 20 or 60 drops/mL
- $$\frac{total\ volume\ to\ be\ given\ (in\ mLs)}{time\ (in\ minutes)} \times \frac{drop\ factor}{1} = drops\ per\ minute$$

- To generalise: what we are doing is dividing two variables, $\frac{x}{y}$ then we multiply that by the constant, which is the drop factor, to get k (in this case dpm); therefore, $\frac{x}{y} \times \frac{20}{1} = k$

Rates

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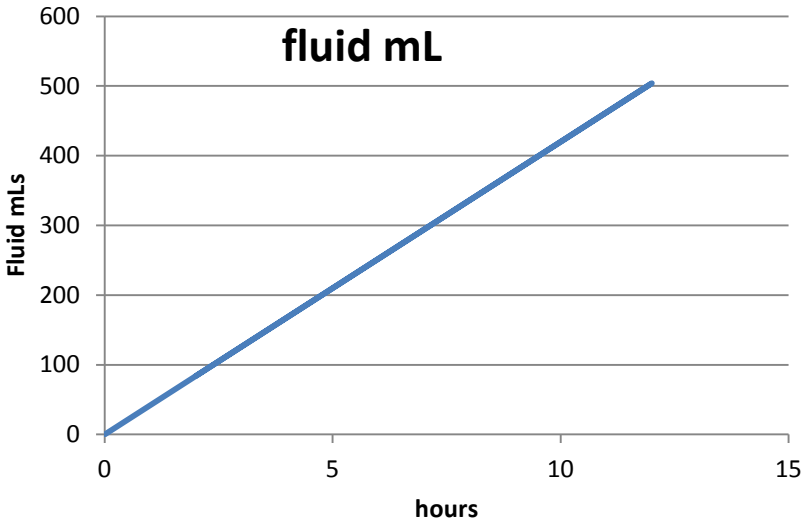
EXAMPLE PROBLEM:

- **What is the IV rate for 1500mLs to be given over 10 hours with a drop factor of 20?**
- $\frac{1500\text{mLs}}{10\text{hrs}} \times \frac{20}{1} = k\ \text{dpm}$
- Because we are looking for drops per minute we convert the hours to minutes $(10 \times 60 = 600\text{mins})$
- $\frac{1500\text{mLs}}{600\text{mins}} \times \frac{20}{1} = 50\text{dpm}$

Link

Challenge yourself and construct a linear graph

- A rate that is constant is related to a linear graph. The line that passes though the origin has a *gradient* which we call the *rise* and *run*, written as *rise: run* and more commonly as $\frac{rise}{run}$
- For this graph $\frac{420}{10}$
- A positive gradient of 42



Your turn…

1. A patient is prescribed 150mg of soluble aspirin. We only have 300mg tablets on hand. How many tablets should be given?

2. A solution contains fluoxetine 20mg/5mL. How many milligrams of fluoxetine are in 40mL of solution?
3. A stock has the strength of 5000units per mL. What volume must be drawn up into an injection to give 6500 units?
4. An intravenous line has been inserted in a patient. Fluid is being delivered at a rate of 42mL/h. How much fluid will the patient receive in
   - 2 hours?
   - 8 hours?
   - 12 hours?

Answers

1. ½ tablet
2. 160 mg
3. 1.3
4. How much fluid will the patient receive in
    a) 2 hours? 84mL
    b) 8 hours? 336mL
    c) 12 hours? 504mL

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Reflect on the learning intentions ….

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Useful references

Ratio: http://www.mathsisfun.com/numbers/ratio.html

Golden ratio: http://math2033.uark.edu/wiki/index.php/Golden_ratio

Direct Proportion: http://www.bbc.co.uk/skillswise/factsheet/ma19rati-l1-f-understanding-direct-proportion

Nursing Calculations:

- http://nursing.flinders.edu.au/students/studyaids/drugcalculations/
- https://www.dlsweb.rmit.edu.au/lsu/content/c_set/nursing/nursingcalculations.html
- https://www.dlsweb.rmit.edu.au/lsu/content/c_set/nursing/nursingcalculations.html