

Welcome to our first in-person class.

Reminders:

Assignment 1 (Rim Assignment) due tomorrow @ 10 am

- use the submission link
- carefully read accuracy requirements for each problem
- do not include units in your response
- late submissions will not be accepted

Test 2 next week.

Covers: Square, square root, Pythagorean Theorem,
Area, Volume, Chemical and Glue mix calculations
Rim-saw and pulley related calculations

Practice problems on Course Shell

Test will be $1\frac{1}{2}$ hours through online quiz (like test 1)

We will meet in-person, so bring your laptops please.

You are allowed to use your class-notes and a 1-page (1-sided) reference sheet (handwritten), but you will not be allowed to browse online looking for solutions.

Assignment 2 (BOM assignment) becomes available next week.

TODAY:





Ratio & Proportions

Math 1485 Math Fundamentals

1.

Ratio

Ratio: The comparison of two numbers or quantities.

- Ratios compare things like pulley sizes, gears, or even drawings.
- A ratio can compare anything, ash trees to maple trees, softwood to hardwood etc. The items do not need to be related i.e. birds to fish.
- The ratio is expressed in one of three common ways.
 - Using 5 ash trees and 7 maple trees
 - 5 to 7
 - 5:7 (most common method)
 - $\frac{5}{7}$
- The order of the numbers is important, 5:7 is not the same as 7:5.
- Rates are also expressed as a ratio. Km/h, \$/hr, rpm.



2.

Proportions

- Proportion – When comparing 2 ratios, they are considered proportional when they are equal to each other.
- To compare two ratios, first write them as a fraction then cross multiply them.
 - 3:5 compared to 21:35
 - $\frac{3}{5} \times \frac{21}{35}$
 - $3 \cdot 35 = 105$ $5 \cdot 21 = 105$
 - since both values are the same, the two ratios are considered proportional.



Equivalent Ratios

Orange squash is to be mixed with water in a ratio of 1 : 6; this means that for every unit of orange squash, 6 units of water will be used. The table gives some examples:

Amount of Orange Squash (cm ³)	Amount of Water (cm ³)
1	6
20	120
5	30

The ratios 1 : 6 and 20 : 120 and 5 : 30 are all equivalent ratios, but 1 : 6 is the *simplest* form.

Example:

The scale on a map is 1 : 20 000. What actual distance does a length of 8 cm on the map represent?

Solution

$$\begin{aligned}\text{Actual distance} &= 8 \times 20\,000 \\ &= 160\,000 \text{ cm} \\ &= 1600 \text{ m} \\ &= 1.6 \text{ km}\end{aligned}$$

Example: Which two of the following ratios are equivalent?

(a) 2 : 6

(b) 4 : 20

(c) 3 : 15

Example:

A builder mixes 10 shovels of cement with 25 shovels of sand. Write the ratio of cement to sand:

4.

Direct Proportion

- Direct proportion is when a change in one quantity results in the same proportional change in another related quantity.
 - Examples are:
 - Increase the number of apples, increase in weight.
 - Increase in speed, increase in distance.
 - Increase in workers, increase in product manufactured.

5.

Solving Direct Proportions

- When two ratios are equal and in direct proportion, we can solve missing numbers by **comparing them as fractions then cross multiplying.**
- Example

A) 3 cabinet makers can build a total of 7 cabinets in one day. How many cabinets can 5 cabinet makers build in one day?

3:7 to 5:?

3 x 5

7 ?

$$3x? = 7 \times 5$$

$$3? = 35$$

$$? = \underline{35}$$

3

$$? = 11 \frac{2}{3}$$

6.

Direct Proportions example 2

- Example 2
- B) If you can drive 50km in 30 min, How far can you drive in 75min.
- 50:30 to ?:75
- 50 = ?

6.

Direct Proportions example 2

- Example 2

B) If you can drive 50km in 30 min, How far can you drive in 75min.

- $50:30 \text{ to } ?:75$

- $\frac{50}{30} = \frac{?}{75}$

$$30 \quad 75$$

- $30 \times ? = 50 \times 75$

- $30 \times ? = 3750$

- $? = \frac{3750}{30}$

$$30$$

- $? = 125$

- Therefore you can drive 125km in 75 min

Direct proportion can be used to carry out calculations like the one below:

If 10 calculators cost £120,
then 1 calculator costs £12,
and 8 calculators cost £96.

Example:

If 6 copies of a book cost £9, calculate the cost of 8 books.

Try it yourself.

If 10 litres of petrol cost £8.20, calculate the cost of:

- (a) 4 litres (b) 12 litres (c) 30 litres.

7.

Indirect Proportion

- Indirect Proportion : when a increase or decrease of one quantity produces the opposite change in the other quantity.
- Examples:
 - A increase in the number of carpenters on a job site decreases the amount of time to build a house.
 - An increase in speed decreases the amount of time to reach your destination.
- When comparing two ratios in indirect proportion, the two sides are equal when multiplied.
 - i.e. $50 \text{ km/hr} \times 4 \text{ hrs} = 100 \text{ km/hr} \times 2 \text{ hrs}$

8.

Indirect Proportions example

- Lets look at this example.
 - a) If it takes you 2 hours to reach your destination driving 70 km/hr. How long will it take you to reach your destination driving a speed of 105 km/hr?
- The equation is as follows:

$$70 \text{ km/hr} \times 2 \text{ hrs} = 105 \text{ km/hr} \times ?$$

$$140 = 105 \times ?$$

$$? = \frac{140}{105}$$

$$? = 1.33 \text{ hours}$$

9.

Indirect Proportions example 2

One cabinetmaker takes 5 days to install a kitchen, how long will it take 3 cabinetmakers to install the same kitchen?

$$1 \text{ person} \times 5 \text{ days} = 3 \text{ people} \times ?\text{days}$$

$$1 \times 5 = 3 \times ?$$

$$5 = 3?$$

$$? = \underline{5}$$

$$3$$

$$? = 1.66 \text{ days}$$

Therefore 3 cabinet makers would take 1.66 days to install the kitchen.

Inverse Proportion

Inverse proportion is when an *increase in one quantity* causes a *decrease in another*.

The relationship between *speed* and *time* is an example of inverse proportionality: as the speed increases, the journey time decreases, so the time for a journey can be found by dividing the distance by the speed.

Example 1

- (a) Ben rides his bike at a speed of 10 mph. How long does it take him to cycle 40 miles?
- (b) On another day he cycles the same route at a speed of 16 mph. How much time does this journey take?

Solution

$$\begin{aligned} \text{(a)} \quad \text{Time} &= \frac{40}{10} \\ &= 4 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad \text{Time} &= \frac{40}{16} = 2\frac{1}{2} \\ &= 2\frac{1}{2} \text{ hours} \end{aligned}$$

Note: *Faster speed \Rightarrow shorter time*.

Try it yourself.

In a factory, each employee can make 40 chicken pies in one hour. How long will it take:

- (a) 6 people to make 40 pies,
- (b) 3 people to make 240 pies,

If time permits

If 3 people take 10 days to pick the plums from a tree, how many days will it take 10 people to do the same job?

If 6 people take 2 days to pick the apples from a tree, how many days will it take 5 people to do the same job?

If 6 people take 8 days to pick the lemons from a tree, how many days

will it take 3 people to do the same job?

End Reminders

- Rim assignment due tomorrow
- Test 2 next week