

Knowledge Organiser: Mathematics

Year 11 Foundation Spring Term 2

Suggested websites: Maths Genie, Save My Exam and Corbett Maths



Comparing Data Sets

You can compare data sets using averages and range, or by drawing suitable diagrams.

Compare Data Sets Using Averages and Range

Say which data set has the higher/lower value and what that means in the context of the data.

EXAMPLE:

Some children take part in a 'guess the weight of the baby hippo' competition. Here is some information about the weights they guess.

Compare the distributions of the weights guessed by the boys and the girls.

Boys:	Girls:
Mean = 40 kg	Mean = 34 kg
Median = 43 kg	Median = 33 kg
Range = 42 kg	Range = 30 kg

1 Compare averages:

The boys' mean and median values are higher than the girls', so the boys generally guessed heavier weights.

2 Compare ranges:

The boys' guesses have a bigger range, so the weights guessed by the boys show more variation.

Big idea: Probability and Statistics

Key skills:

- Construct and interpret stem and leaf diagrams
- Estimate the mean from grouped data
- Construct and interpret tree diagrams
- Draw and interpret scatter graphs
- Draw and interpret Venn diagrams

Stem and Leaf Diagrams put data in Order

An ordered stem and leaf diagram shows a set of data in order of size. This makes it easy to find things like the median and range (see p.116).

EXAMPLE: This stem and leaf diagram shows the ages of some school teachers.

3	3	5
4	0	5 7 8
5	1	4 9
6	1	3

Key: 5|4 = 54 years

a) How old is the oldest teacher?

Use the key to help you read off the diagram. $6|3 = 63$ years old

b) What is the median age?

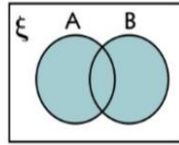
The median is the middle value. There are 11 values, so the median is the 6th value.
Find its position, then read off the value. So median age is $4|8 = 48$ years



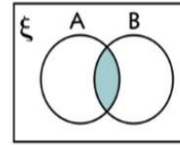
Show Sets on Venn Diagrams



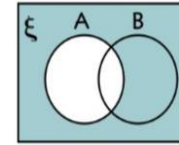
- On a Venn diagram, each set is represented by a circle. The universal set is everything inside the rectangle.
- The diagram can show either the actual elements of each set, or the number of elements in each set.



The union of sets A and B (written the elements set B — it's the circles).



The intersection of sets A and B (written $A \cap B$) contains all the elements in both set A and set B — it's where the circles overlap.

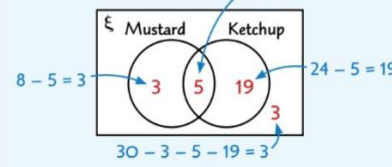


The complement of set A (written 'A') contains all members of the universal set that aren't in set A — it's everything outside circle A.

EXAMPLE:

In a class of 30 pupils, 8 of them like mustard, 24 of them like ketchup and 5 of them like both mustard and ketchup.

- Complete the Venn diagram below showing this information. Start by filling in the overlap.
- How many pupils like mustard or ketchup? This is the number of pupils in the union of the two sets. $3 + 5 + 19 = 27$



- What is the probability that a randomly selected pupil will like mustard and ketchup?

5 out of 30 pupils are in the intersection. $\frac{5}{30} = \frac{1}{6}$

This is $P(M \cap K)$.

Tree Diagrams

Tree diagrams can really help you work out probabilities when you have a combination of events.

Remember These Four Key Tree Diagram Facts



- For branches which meet at a point, the probabilities add up to 1.



2) Multiply along the branches to get the end probabilities.

$$\frac{2}{3} \times \frac{1}{5} = \frac{2}{15}$$

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

$$\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$$

$$\frac{1}{3} \times \frac{4}{5} = \frac{4}{15}$$

$$\text{Total} = 1$$

3) End probabilities add up to 1.

4) Pick the probability you need to answer the question.

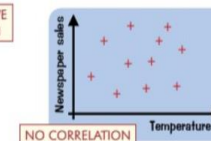
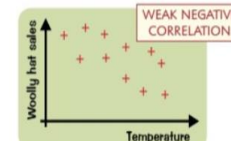
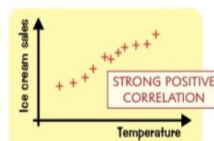
Scatter Graphs

A scatter graph tells you how closely two things are related — the fancy word is CORRELATION.

Scatter Graphs Show Correlation



- If you can draw a line of best fit pretty close to most of your data points, the two things are correlated. If the points are randomly scattered, and you can't draw a line of best fit, then there's no correlation.
- Strong correlation is when your points make a fairly straight line — the two things are closely related. Weak correlation is when your points don't line up so nicely, but you can still draw a line of best fit.
- If the points form a line sloping uphill from left to right, then there is positive correlation. If the line slopes downhill from left to right, then there is negative correlation.



Grouped Frequency Tables

Grouped frequency tables are like ordinary frequency tables, but they group the data into classes.

NO GAPS between classes for CONTINUOUS data. Use inequality symbols to cover all possible values.

Height (h millimetres)	Frequency
$5 < h \leq 10$	12
$10 < h \leq 15$	15

See p.115 for grouped discrete data.

To find MID-INTERVAL VALUES:

- Add together the end values of the class and divide by 2.
- E.g. $(5 + 10) \div 2 = 7.5$

Find Averages from Grouped Frequency Tables

Unlike with ordinary frequency tables, you don't know the actual data values, only the classes they're in. So you have to ESTIMATE THE MEAN, rather than calculate it exactly. Again, you do this by adding columns:

- Add a 3RD COLUMN and enter the MID-INTERVAL VALUE for each class.
- Add a 4TH COLUMN to show 'FREQUENCY \times MID-INTERVAL VALUE' for each class.

You'll be asked to find the MODAL CLASS and the CLASS CONTAINING THE MEDIAN, not exact values. And the RANGE can only be estimated too — using the class boundaries.

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Big idea: Geometry and Measures

Key skills:
 Construct a Triangle
 Different Types of Loci
 Construct Angles

Sides and Angles — use a Ruler and Protractor

EXAMPLE: Construct triangle DEF. DE = 5 cm, DF = 3 cm, and angle EDF = 40°.

- Roughly sketch and label** the triangle.
- Draw the **base line**.
- Draw **angle EDF** (the angle at D) — place the centre of the protractor over D, measure **40°** and put a dot.
- Measure **3 cm** towards the dot and label it F. Join up **D and F**. Now you've drawn the **two sides** and the **angle**. Just join up F and E to **complete** the triangle.

Drawing the Perpendicular From a Point to a Line

- This is similar to the one above but **not quite the same** — make sure you can do **both**.
- You'll be given a line and a point, like this:

Step 1: Initial point. **Step 2:** This is the perpendicular required. **90° angle created.**

Three sides — Use a Ruler and Compasses

EXAMPLE: Construct the triangle ABC where AB = 6 cm, BC = 4 cm, AC = 5 cm.

- First, **sketch and label** a triangle so you know roughly what's needed. It doesn't matter which line you make the base line.
- Draw the **base line**. **Label** the ends A and B.
- For AC, set the **compasses** to **5 cm**, put the point at A and **draw an arc**. For BC, set the compasses to **4 cm**, put the point at B and **draw an arc**.
- Where the **arcs cross** is **point C**. Now you can finish your triangle.

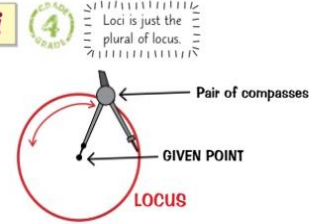
Loci and Construction

A **LOCUS** (another ridiculous maths word) is simply:
A LINE or REGION that shows all the points which fit a given rule.

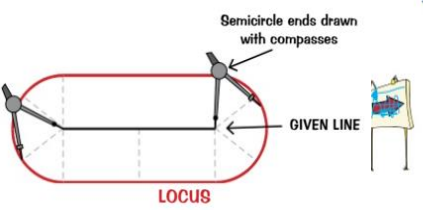
Make sure you learn how to do these **PROPERLY** using a **ruler** and **compasses** as shown on the next few pages.

The Four Different Types of Loci

1) The locus of points which are **'A FIXED DISTANCE from a given POINT'**.
 This locus is simply a **CIRCLE**.

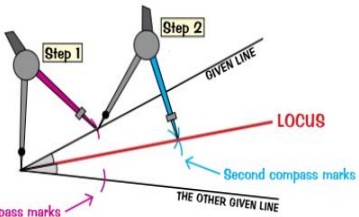


2) The locus of points which are **'A FIXED DISTANCE from a given LINE'**.
 This locus is a **SAUSAGE SHAPE**.
 It has **straight sides** (drawn with a ruler) and **ends** which are **perfect semicircles** (drawn with compasses).



3) The locus of points which are **'EQUIDISTANT from TWO GIVEN LINES'**.

- Keep the compass setting **THE SAME** while you make **all four marks**.
- Make sure you **leave** your compass marks **showing**.
- You get **two equal angles** — i.e. this **LOCUS** is actually an **ANGLE BISECTOR**.

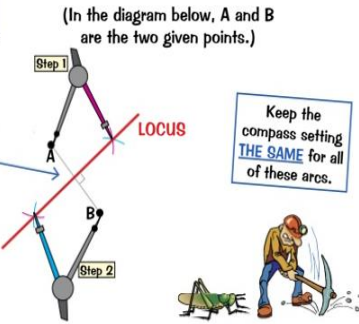


4) The locus of points which are **'EQUIDISTANT from TWO GIVEN POINTS'**.

This **LOCUS** is all points which are the **same distance** from A as they are from B.

This time the locus is actually the **PERPENDICULAR BISECTOR** of the line joining the two points.

The perpendicular bisector of line segment AB is a line at **right angles** to AB, passing through the **midpoint** of AB. This is the method to use if you're asked to draw it.



Constructing Accurate 60° Angles

- They may well ask you to draw an **accurate 60° angle** without a protractor.
- Follow the method** shown in this diagram (make sure you leave the compass settings the **same** for each step).

