Maths: Year 11F - Topic 1 Overview

Delving into Data: Collecting, representing and interpreting data

This block builds on KS3 work on the collection, representation and use of summary statistics to describe data. Much of the content is familiar, both from previous study within and beyond mathematics (including Geography and Science) and from everyday life. The steps have been chosen to balance consolidation of existing knowledge with extending and deepening, particularly in terms of interpretation of results and evaluating and criticising statistical methods and diagrams. For students following Higher tier, there is additional content relating to continuous data including histograms, cumulative frequency diagrams, box plots and associated measures such as quartiles and the interquartile range. Again, the emphasis with these topics should be on interpretation (particularly in making comparisons) and not just construction.

Key questions

- Why do statisticians take sample rather than interview the whole population?
- How can we ensure the stratified samples is random?
- What's the difference between a midpoint and a endpoint?
- Does it matter what order we present the data ina pie chart?
- What do you notice about the scales of the axis/axes?

Assessment / Topic Reviews:

1. Construct histograms - H
2. Interpret histograms - H
3. Find and interpret averages from a list – R
4. Find and interpret averages from a table – R
5. Construct and interpret time series graphs – R
6. Construct and interpret stem-and-leaf diagrams
7. Construct and interpret cumulative frequency diagrams – H
8. Use cumulative frequency diagrams to find measures – H
9. Construct and interpret box plots - H
10. Compare distributions using charts and measures
11. Compare distributions suing complex charts and measures – H
12. Construct and interpret scatter graphs – R
13. Draw and use a line of best fit – R
14. Understand extrapolation

Specialist key terms for this unit

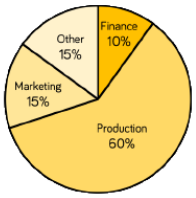
Population, Sample, Representative, Biased, Random, Proportion, Stratified, primary, secondary, source, data, questionnaire, experiment, frequency polygon, midpoint, endpoint, class, interval, table, row, column, total difference, line/bar chart, dual/multiple, composite, angle, sector, radius, subtend, scale, bias, misleading, broken axis, histogram, area, frequency density, class interval, class width, distribution, mean, median, mode, outlier, average, modal class, subtotal, estimate, time series, quarter, trend, steam, leaf, cumulative, polygon, upper/lower quartile, interquartile range, linear, positive/negative correlation, line of best fit, interpolate, extrapolate

Practise makes perfect

https://www.mathsgenie.co.uk/scatter-graphs.php
https://www.mathsgenie.co.uk/bar-charts.php
https://www.mathsgenie.co.uk/pie-charts.php
https://www.mathsgenie.co.uk/mean-tables.php
https://www.mathsgenie.co.uk/frequency-polygons.php
https://www.mathsgenie.co.uk/cumulative.php
https://www.mathsgenie.co.uk/histograms.php

The pie chart shows the percentage of employees of a firm who work for each department.

- What angle represents Production?
- 24 people work in the Marketing department.
  How many work in Production or Other?



Suggested enrichment

Reasoning with data Below resources designed to get you thinking about data handing.

https://nrich.maths.org/reasoning-data-0

Maths: Year 11F- Topic 2 Overview

Trigonometry

In this topic, students will be introduced to trigonometry as a special case of similarity withing right-angled triangles. Emphasis is placed throughout the steps on linking the trig functions to ratios, rather than just functions. This key topic is introduced early in Year 10 to allow regular revisiting e.g. when looking at bearings.
For the Higher tier, calculation with trigonometry is covered now and graphical representation is covered in Year 11.

Key words

Enlarge, Scale factor, Ratio, Corresponding, Constant, Adjacent, Opposite, Hypotenuse, Right-angle, Tangent, Formula, Rearrange, Subject, Subject of a formula, Sine, Cosine, Complement, Angle, Obtuse, Acute, Inverse, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, Area, Square, Square Root, Pythagora's Theorem, Similar, Surds, Exact value, Simplifying, Infinity, Approaching, Increasing, Decreasing, Limit

Key questions

Will the ratio remain constant if the given angle gets bigger/smaller? Why/why not?

Why can the same side on a right-angled triangle be labelled the 'opposite' on some occasions, and the 'adjacent' on others?

How do we know which trigonometric ratio to use?

What is an inverse trigonometry function?

In this problem, is it more efficient to use Pythagoras' Theorem or trigonometry? Which has least steps?

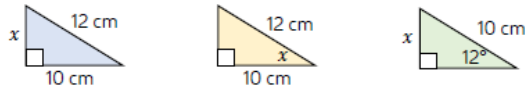
How do we know when to use the sine rule?

How do we know when to use the cosine rule?

How do we know which numbers to substitute into the formula?

Exemplar Questions

Find each value of x.



What's the same and what's different about each question?

Practise makes perfect

https://www.mathsgenie.co.uk/sohcahtoa.html

https://www.mathsgenie.co.uk/pythagoras.html

https://www.mathsgenie.co.uk/3d-pythagoras.html

https://www.mathsgenie.co.uk/sine-rule.html

https://www.mathsgenie.co.uk/cosine-rule.html

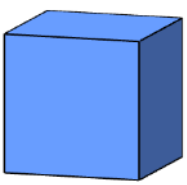
https://www.mathsgenie.co.uk/area-of-any-triangle.html

Assessment / Topic Reviews:

1. Identify and work fluently with the hypotenuse, opposite and adjacent sides.
2. Use sine, cosine and tangent ratios to find missing side lengths
3. Use sine, cosine and tangent ratios to find missing angles
4. Calculate missing sides in right-angled triangles using Pythagoras' Theorem
5. Be able to choose appropriate method to solve right-angled triangle problems
6. Key angles
7. Use trigonometry in 3-D shapes (H)
8. Area of any triangle (H)
9. Use sine rule to find missing lengths and angles (H)
10. Use cosine rule to find missing lengths and angles (H)

Suggested enrichment activities:

1. The distance between centres of two adjacent faces of a cube is 8cm. What is the side length of the cube?
2. I can make an equilateral triangle by cutting off the corner of a cube.
   If the area of the largest equilateral triangle I can create in this way is 140cm², what is the side length of this cube?



Maths: Year 11F- Topic 3 Overview

Geometry: Vectors

Students will have met vectors to describe translations during Key Stage 3. This will be revisited and used as the basis for looking more formally at vectors, discovering the meaning of $-\boldsymbol{a}$ compared to $\boldsymbol{a}$ to make sense of operations such as addition, subtraction, subtraction and multiplication of vectors. This will connect to exploring "journeys" within shapes linking the notation $\overrightarrow{AB}$ with $\boldsymbol{b}-\boldsymbol{a}$ etc. Higher tier students will then use this understanding as the basis for developing geometric proof, making links to their knowledge of properties of shape and parallel lines.

Specialist key terms for this unit:

Column vector, Direction, Scalar, Size, Magnitude, Arrow, Parallel, Multiplier, Equal, Opposite, Addition, Resultant, Subtraction, Multiplying, Vector journey, Express, Parallel, Negative, Equal, Opposite, Multiple, Multiplier, Fractional, Common point, Collinear, Same line, Show, Justify, Prove

Key questions:

What do the numbers in the column vector represent?
How do you know which direction they represent?
What does the arrow show?
What is the significance of the order of the letters when writing $\overrightarrow{AB}$? What does the arrow tell us?
What's the same and what's different about parallel vectors?
How do we know if one vector is a multiple of another?
How do we know if the multiplier is negative?
What's the relationship between $\boldsymbol{b}$ and $-\boldsymbol{b}$?
Which quadrilaterals will have pairs of parallel vectors?
How many pairs of parallel vectors will they have?
Can a square be described by four equal vectors? Why not? What is the same and what's different about the four vectors that describe a square?
What about the vectors that describe a rectangle?
What do you know? What can you find out?
What do the words 'show, justify and prove' mean?

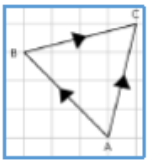
Practise makes perfect

https://www.mathsgenie.co.uk/column-vectors.html

https://www.mathsgenie.co.uk/vectors.html

Exemplar Questions

$\overrightarrow{AB} = \begin{pmatrix}-3\\3\end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix}4\\1\end{pmatrix}$



Complete: $\overrightarrow{AB} + \overrightarrow{BC} = \begin{pmatrix}-3\\3\end{pmatrix} + \begin{pmatrix}4\\1\end{pmatrix} = \begin{pmatrix}1\\?\end{pmatrix}$

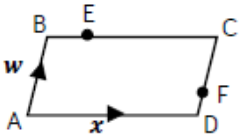
Compare this to the column vector representing $\overrightarrow{AC}$

Eva and Alex are thinking about how they can find $\overrightarrow{AC}$ using $\overrightarrow{AB}$ and $\overrightarrow{BC}$. Who is right? Why?

Eva $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{CA}$ Alex $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$

ABCD is a parallelogram.

BE : EC = 1 : 3 and CF = $\frac{3}{4}$CD.



Express in terms of $\boldsymbol{x}$ and $\boldsymbol{w}$ $\overrightarrow{BD}$ $\overrightarrow{BE}$ $\overrightarrow{AE}$ $\overrightarrow{AF}$

Show that $\overrightarrow{BD}$ is parallel to $\overrightarrow{EF}$

Assessment / Topic Reviews:

1. Understand and represent vectors
2. Use and read vector notation
3. Draw and understand vectors multiplied by a scalar
4. Draw and understand addition of vectors
5. Draw and understand addition and subtraction of vectors
6. Explore vector journeys in shapes – H
7. Explore quadrilaterals using vectors – H
8. Understand parallel vectors - H
9. Explore collinear points using vectors – H
10. Use vectors to construct geometric arguments and proofs - H

Suggested enrichment

Vector walk

Suppose that I am given a large supply of basic vectors $b_1 = \begin{pmatrix}2\\1\end{pmatrix}$ and $b_2 = \begin{pmatrix}0\\1\end{pmatrix}$.

Starting at the origin, I take a 2-dimensional 'vector walk' where each step is either a b_1 vector or a b_2 vector, either forwards or backwards.

Investigate the possible coordinates for the end destinations of my walk.

Can you find any other pairs of basic vectors which yield exactly the same set of destinations?

Can you find any pairs of basic vectors which yield none of these destinations?

Can you find any pairs of basic vectors which allow you to visit all integer coordinates?