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| **UNIT 3: Averages and range, collecting data, representing data** |

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**SPECIFICATION REFERENCES**

G14 use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

S3 **construct and interpret diagrams for grouped discrete data and continuous data i.e. histograms with equal and unequal class intervals …**

S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

* appropriate graphical representation involving discrete, continuous and grouped data …
* appropriate measures of central tendency (median, mode and modal class) and spread (range, including consideration of outliers) …

S5 apply statistics to describe a population

S6 use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing

**PRIOR KNOWLEDGE**

Students should be able to read scales on graphs, draw circles, measure angles and plot coordinates in the first quadrant.

Students should have experience of tally charts.

Students will have used inequality notation.

Students must be able to find midpoint of two numbers.

**KEYWORDS**

Mean, median, mode, range, average, discrete, continuous, qualitative, quantitative, data, scatter graph, line of best fit, correlation, positive, negative, sample, population, stem and leaf, frequency, table, sort, pie chart, estimate

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| **3b. Representing and interpreting data and scatter graphs**  (S2, S3, S4, S5, S6) | **Teaching time**  4-6 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Know which charts to use for different types of data sets;
* Produce and interpret composite bar charts;
* Produce and interpret comparative and dual bar charts;
* Produce and interpret pie charts:
* find the mode and the frequency represented by each sector;
* compare data from pie charts that represent different-sized samples;
* Produce and interpret frequency polygons for grouped data:
* from frequency polygons, read off frequency values, compare distributions, calculate total population, mean, estimate greatest and least possible values (and range);
* Produce frequency diagrams for grouped discrete data:
* read off frequency values, calculate total population, find greatest and least values;
* Produce histograms with equal class intervals:
* estimate the median from a histogram with equal class width or any other information, such as the number of people in a given interval;
* Produce line graphs:
* read off frequency values, calculate total population, find greatest and least values;
* Construct and interpret time–series graphs, comment on trends;
* Compare the mean and range of two distributions, or median or mode as appropriate;
* Recognise simple patterns, characteristics relationships in bar charts, line graphs and frequency polygons;
* Draw and interpret scatter graphs in terms of the relationship between two variables;
* Draw lines of best fit by eye, understanding what these represent;
* Identify outliers and ignore them on scatter graphs;
* Use a line of best fit, or otherwise, to predict values of a variable given values of the other variable;
* Distinguish between positive, negative and zero correlation using lines of best fit, and interpret correlation in terms of the problem;
* Understand that correlation does not imply causality, and appreciate that correlation is a measure of the strength of the association between two variables and that zero correlation does not necessarily imply ‘no relationship’ but merely ‘no linear correlation’;
* Explain an isolated point on a scatter graph;
* Use the line of best fit make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of so doing.

**POSSIBLE SUCCESS CRITERIA**

Use a time–series data graph to make a prediction about a future value.

Explain why same-size sectors on pie charts with different data sets do not represent the same number of items, but do represent the same proportion.

Make comparisons between two data sets.

Be able to justify an estimate they have made using a line of best fit.

Identify outliers and explain why they may occur.

Given two sets of data in a table, model the relationship and make predictions.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Many real-life situations that give rise to two variables provide opportunities for students to extrapolate and interpret the resulting relationship (if any) between the variables.

Choose which type of graph or chart to use for a specific data set and justify its use.

Evaluate statements in relation to data displayed in a graph/chart.

**COMMON MISCONCEPTIONS**

Students often forget the difference between continuous and discrete data.

Lines of best fit are often forgotten, but correct answers still obtained by sight.

**NOTES**

Interquartile range is covered in unit 14.

Misleading graphs are a useful activity for covering AO2 strand 5: Critically evaluate a given way of presenting information.

When doing time–series graphs, use examples from science, geography.

NB Moving averages are not explicitly mentioned in the programme of study but may be worth covering too.

Students need to be constantly reminded of the importance of drawing a line of best fit.

A possible extension includes drawing the line of best fit through the mean point (mean of *x*, mean of *y*).