The Sutton Academy

Knowledge Rich Curriculum Plan

Year 10 Intermediate – Data and Statistics

Lesson	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success:	Feedback
To learn how to use stratified sampling and capture recapture.	• Students will know why it is important to ensure that a sample is representative. They will understand how taking a non-representative sample can lead to bias. • Students will know how to select a stratified sample. • Students will know how to estimate populations using capture recapture. • Students will know how to solve problems involving capture recapture. • Students will know how to write assumptions taken in capture recapture problems.	**Population -** all the inhabitants of a particular place **Sample -** a small part or quantity intended to show what the whole is like **Bias -** inclination or prejudice for or against one person or group, especially in a way considered to be unfair **Strata** - a group that members of a population are divided into **Cultural capital**	• Students need to know how to express one amount as a fraction of another. • Students need to know how to solve equations involving fractions.	**Steps to Success – Stratified Sampling** **Step 1:** Write the frequency for each stratum as a fraction over the total population. **Step 2:** Multiply the fraction for the strata by the sample size to calculate the number of people within the sample that should be from that group. **Step 3:** Round your answers appropriately (for instance if you're talking about people, you must give your answer as a whole number). **Step 4:** If you've worked out how many are needed from all groups then check that your sample size for each group add together to give the total sample size. If it does not, then an adjustment needs to be made. **Steps to Success – Capture Recapture** **Step 1:** Express the number originally captured and marked as a fraction over x (we call the total population x) **Step 2:** Express the second capture as a fraction with the number marked as the numerator and the total number captured as the denominator **Step 3:** Write the two fractions from step 1 and 2 equal to each other. **Step 4:** Work out the multiplier between the two numerators and use this to work backwards to find the denominator of the first fraction	
To learn how to solve problems involving the mean.	• Students will know how to work backwards from the mean to find the sum of the data values. • Students will know how to work backwards from the mean to find the number of data values. • Students will know how to solve simple problems involving finding the mean for a group within a group or for a whole group from two smaller sub-groups.	**Mean –** a mathematical average calculated by adding up all the data and dividing it by the number of pieces of data	• Students need to know how to find the mean from a list of data.	**Steps to Success – Working Backwards with the Mean** **Step 1:** Multiply the mean by the number of groups/items that this represents to work out the total for those groups. **Step 2:** Adjust the total appropriately to account for the new information given. **Step 3:** Divide the new total by the number of groups/items to calculate the new mean. **Step 4:** Check you've answered the question and carry out any other calculations as required.	
To learn how to calculate averages from frequency tables.	• Students will know how to calculate the mean from a frequency table • Students will know how to calculate the median from a frequency table • Students will know how to find the mode from a frequency table • Students will know how to calculate the range from a frequency table	**Frequency** - the count of how many times a specific thing happens **Average –** a number expressing the typical value in a set of data, particularly the mode, median or the mean **Median** – the middle piece of data when the data is ordered from smallest to largest **Mode –** the value that occurs most often in the data. There may be no mode, or the data may be multi-modal **Range –** the difference between the largest and smallest values. This isn't actually an average – but tells us	• Students need to know how to calculate the median, mode mean and range from a list of values.	**Steps to Success - Calculating averages from frequency tables** **Steps to Success – Mean from a table** **Step 1:** Add another column onto the table. **Step 2:** Multiply the number in the group by the frequency for that group. **Step 3:** Add up all of your answers. **Step 4:** Add up all of the frequencies. **Step 5:** Divide the total from step 3 by the sum of the frequency column. **Steps to Success – Median from a table** **Step 1:** Add up the total frequency. **Step 2:** Add 1 to the total and divide the total frequency by 2. **Step 3:** Add up the frequencies one at a time until you go past your answer to step 2. Once you go past it, write down the last group you added on as your answer. **Steps to Success – Mode from a table** **Step 1:** Identify the one with the highest frequency. **Step 2:** Write down that group as your answer. **Steps to Success – Range from a table** **Step 1:** Identify the smallest and biggest data values. **Step 2:** Subtract the smallest value from the biggest.	

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		how spread out the data is			
To learn how to calculate averages from grouped frequency tables.	• Students will know how to calculate the mean for a grouped frequency table • Students will know how to identify the modal class from a grouped frequency table. • Students will know how to find where the median lies in a grouped frequency table.	**Interval –** a set of numbers between two given numbers	• Students need to know how to calculate the mode, median and mean from a non-grouped frequency table.	**Steps to Success - Calculating Averages from grouped Frequency Tables** **Steps to Success – Mean from a grouped table** **Step 1:** Find the midpoints of each class. You need the exact value that is halfway between the numbers of the class. **Step 2:** Multiply your midpoint by the frequency for that group. **Step 3:** Add together all of your resulting products – this finds the total number of the population. **Step 4:** Divide the total by the total from the frequency column – this is your mean. **Steps to Success – Median class** **Step 1:** Add up the total frequency. **Step 2:** Add 1 to the total and divide the total frequency by 2. **Step 3:** Add up the frequencies one at a time until you go past your answer to step 2. Once you go past it, write down the median class. **Steps to Success – Modal class** **Step 1:** Identify the class with the highest frequency. **Step 2:** Write down the class as your answer.	
To learn how to draw and interpret stem and leaf diagrams.	• Students will know that we use stem and leaf diagrams to group all the data into categories whilst still showing each individual result. • Students will know how to draw stem and leaf diagrams. • Students will know how to interpret stem and leaf diagrams. • Students will know how to find the mode, median and range from stem and leaf diagrams. **Opportunity for challenge:** • Students will know how to produce back-to-back stem and leaf diagrams. • Students will know how to compare the median, mode and range for data represented in back-to-back stem and leaf diagrams.	**Stem and Leaf Diagram –** a diagram where each data value is split into a "leaf" (usually the last digit) and a "stem" (the other digits) **Cultural capital**	• Students need to know how to order integers and decimals. • Students need to know how to calculate the mode, median and range from a list of data values.	**Steps to Success – Drawing stem and leaf diagrams** **Step 1:** Order the numbers from smallest to biggest. **Step 2:** Work out what 'stems' you need. The 'stems' are all of the digits that make up the beginning of a number except for the last digit. *E.g. the number 31 has a stem of 3 and a leaf of 1.* **Step 2:** Draw a vertical line and list the stem numbers to the left of the line in order from smallest to largest. **Step 3:** Fill in the leaves by listing them in order after their respective stem. The leaves are the last digit of each number in the data set. If there is more than one of the same numbers then you must list the leaf however many times it appears. **Step 4:** You must then provide a key explaining how to interpret your stem and leaf diagram. **Steps to Success - Interpreting stem and leaf diagrams** **Mode** **Step 1:** Identify the most common number in a single row. **Step 2:** Use the key to write the correct number out. **Median** **Step 1:** Cross the smallest number and largest value in the stem and leaf diagram. **Step 2:** Repeat this until you have either one or two digits left. - If you have one digit left, this is your median. Remember to use the key to find the value. - If you have two digits left, add both together and half it to find the median. Remember to use the key to find the value of this item. **Step 3:** Use the key to write out the correct number.	

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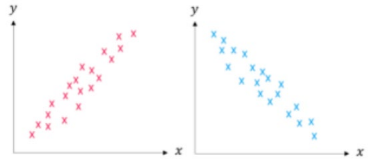
				Range **Step 1:** Identify the smallest and biggest values in your stem and leaf diagram. Use the key to help you right out the correct numbers. **Step 2:** Subtract the smallest value from the biggest value.	
To learn how to draw and interpret pie charts.	• Students will know how to accurately draw a pie chart. • Students will know how to interpret a pie chart. • Students will know how to represent a sector as a fraction of the whole pie chart. • Students will know how to find the frequency of a sector of the pie chart when a total is given. • Students will know how to compare two pie charts. • Students will know how to solve more complex problems involving pie charts.	**Pie Chart –** a circular diagram which is divided into slices to illustrate numerical proportion **Sector –** a pie-shaped part of a circle made of the arc along with its two radii **Cultural capital**	• Students need to know how to draw angles. • Students need to express a number as a fraction of another.	**Steps to Success – Drawing pie charts** **Step 1:** Find the total frequency by adding each frequency together. **Step 2:** Divide 360° by the total frequency. This gives you the value of degrees per single unit. **Step 3:** Multiply the answer by the frequency for each group to determine the angle needed for that group. Check that the angles add up to 360° in total. **Step 4:** Measure the angle and draw in the sector. **Step 5:** Repeat for all groups until the pie chart is complete. **Step 6:** Check all the sectors are the right size and label them appropriately. **Steps to success – Interpreting pie charts** **Step 1:** Find the number of degrees for each sector within your circle. **Step 2:** Find the fraction of the circle you have for your chosen sector; this will be your number of degrees out of 360°. Simplify, if possible. **Step 3:** Multiply the fraction you have found by the total frequency. This will give you the frequency for that sector.	
To learn how to draw and interpret scatter graphs.	• Students will know how to plot points on a scatter graph. • Students will know how to draw the line of best fit on a scatter graph. • • Students will know how to describe the relationship between two variables from a scatter graph. • Students will know how to identify outliers on scatter graphs and give possible reasons why there may be an outlier. • Students will know that correlation is a mutual relationship or connection between two or more things. • Students will know how to distinguish between positive, negative and no correlation using lines of best fit. • Students will know that correlation does not imply causality. • Students will know how interpret correlation in terms of the problem given. • Students will know that correlation is a measure of the strength of the association of the two variables and that zero correlation does not necessarily imply no relationship but simply no linear correlation. • Students will know how to use a line of best fit to make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of doing so. • Students will know how to state how reliable their predictions are, ie. Not reliable if extrapolated.	**Scatter Graph** – a type of mathematical diagram using coordinates to display values for two variables **Outlier –** a person or thing differing from all other members of a particular group **Correlation –** a mutual relationship or connection between two or more things. **Cultural capital**	• Students will need to know how to plot coordinates on a graph	**Key information:** **Correlation** **Positive correlation** - as one variable increases, the other one also increases. **Negative correlation** - as one variable increases, the other decreases.  **Steps to Success - Line of best fit** **Step 1:** Line up your ruler with the general direction of the data. **Step 2:** Move your ruler up to cover approximately half of the data. **Step 3:** Draw in the line of best fit using your ruler. Make sure your line covers the range of the data values. It does not need to touch any axes.	

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To learn how to draw and interpret time series graphs and frequency polygons.	• Students will know how to construct tables for time-series data. • Students will know how to draw line graphs for time-series. • Students will know how to interpret time-series tables and graphs. • Students will know how to draw a frequency polygon.	**Frequency Polygon** – a line graph of class frequency plotted against class midpoint	• Students will need to know how to plot coordinates.	**Steps to Success – Drawing Time Series/Line graphs** The horizontal (x) axis will be the time axis, the vertical axis (y) will be the quantity being recorded/measured. **Step 1:** Plot the data as a series of points. **Step 2:** Use a ruler to join the points together. **Steps to Success – Drawing frequency polygons** **Step 1:** Identify the midpoints of each class. **Step 2:** Plot each frequency against the midpoint. **Step 3:** Join up the points with straight lines, using a ruler.	
To learn how to draw box plots.	• Students will know how to determine the minimum and maximum values from a list of data values. • Students will know how to determine the upper quartile and lower quartile from a list of data including odd and even amounts of data values. • Students will know how to determine the interquartile range for a list of data values. • Students will know how to draw a box plot from a given median, upper quartile, lower quartile, minimum value and maximum value for a data set. • Students will know how to draw a box plot by first working out the median, upper quartile, lower quartile, minimum value and maximum value for a data set. **Opportunity for challenge:** • Students will know how to draw a box plot from information where the interquartile range and either the UQ or LQ or given, or when given the range and either the minimum or maximum value is given.	**Box Plot –** a statistical diagram used for graphically demonstrating the locality, spread and skewness groups of numerical data **Median –** the middle piece of data when the data is ordered from smallest to largest **Lower Quartile –** the median of the lower half of a data set. **Upper Quartile –** the median of the upper half of a data set. **Range –** the difference between the largest value in the data set and the smallest value in the data set **Interquartile Range** – the difference between the upper quartile and the lower quartile **Key words could be used in a matching task.** **Cultural capital**	• Students need to know how to find the median from a list of data values. • Students need to know how to find the range from a list of data values.	**Steps to Success – Drawing Box Plots** **Step 1:** Write down the minimum and maximum values for the data. **Step 2:** Work out the median and write this down. **Step 3:** Work out the upper and lower quartiles for the data and write these down. **Step 4:** Draw an axis with a suitable scale on the graph paper (if they haven't given you one). **Step 5:** Plot the five pieces of information gathered on the axis and join them up to form the box plot.	
To learn how to interpret and compare box plots.	• Students will know how to determine the minimum value, maximum value, upper quartile, lower quartile, median, range and, interquartile range from a drawn box plot. • Students will know that each section of a box plot represents 25% of the data. • Students will know how to compare box plots. They will know that to do this they must compare the medians and either the range or	**Cultural capital**	• Students need to know how to plot a box plot. • Students need to know how to calculate the interquartile range using the	**Steps to Success – Comparing box plots** **Step 1:** If possible, find the median, range and interquartile range of both data sets. **Step 2:** Compare the medians of the two data sets and give it context. Remember to include the values for each median. • E.g. if comparing heights, on average data set one is taller as their median is x, which is bigger than data set two's median of y. Write a conclusion for the median linking what you have found to the context of the question.	

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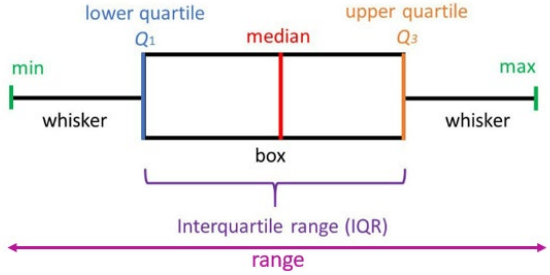
	interquartile range, giving their comparisons in the context of the question. **Opportunity for challenge:** • Students will know how to solve problems involving the spread of data including the use of percentages and/or fractions.		upper and lower quartiles of a list of data values.	**Step 3:** Compare the interquartile range (IQR) or range. • E.g. Data set one's range is higher than data set two's, this means that they have more variation of data, which makes their data less consistent. • E.g. Data set one's IQR is smaller than data set two's, this means that they have less variation within the middle 50% of the data, which makes their data more consistent. Write a conclusion for the range or interquartile range linking what you have found to the context of the question. 	
To learn how to draw and interpret cumulative frequency curves.	• Students will know how to draw a cumulative frequency table given the cumulative frequency table. • Students will know how to calculate cumulative frequency and draw the resulting curve. • Students will know how to estimate values from a cumulative frequency curve. • Students will know how to estimate the median, quartiles and interquartile range from a cumulative frequency curve. **Opportunity for challenge:** • Students will know how to solve problems involving estimated values a cumulative frequency curve. • Students will know how to solve problems involving estimated median, quartiles and interquartile range a cumulative frequency curve.	Cumulative - increasing in quantity by successive additions Cultural capital	• Students need to know how to estimate values from a graph.	**Steps to Success – Drawing cumulative frequency curves** **Step 1:** If necessary, fill in the cumulative frequency table by repeatedly adding on the next frequency and filling in the running total as you work down the table. **Step 2:** Highlight the highest value available in each class. Step 3: Plot each frequency against the highest class values. **Step 3:** Join up the points with a complete smooth curve.	
To learn how to draw histograms.	• Students will know that histograms show frequency density. • Students will know that $frequency\ density = \frac{frequency}{class\ width}$ • Students will know how to draw a histogram for grouped data.	Histogram – a graphical representation of discrete or continuous data where the area of a bar in a histogram is equal to the frequency Frequency Density – the frequency per unit for the data in each class	• Students need to know how to draw a bar chart.	**Steps to Success – Drawing Histograms** **Step 1:** Calculate the frequency density for each group using the formula $$Frequency\ Density = \frac{Frequency}{Class\ Width}$$ **Step 2:** Scale the axes (if they haven't been done for you) and make sure you label the y-axis as the frequency density and the x axis with the same heading as the first column in the frequency table **Step 3:** Draw a bar for each group – the bar should be the same width as the group and the height should show the frequency density	
Exam Preparation 12					