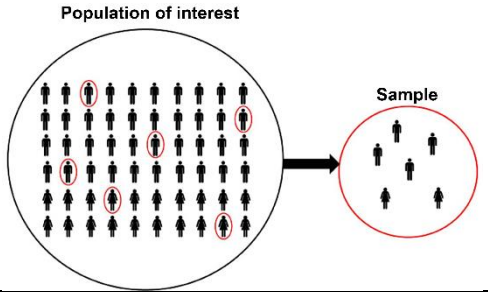
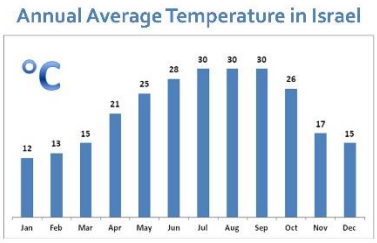
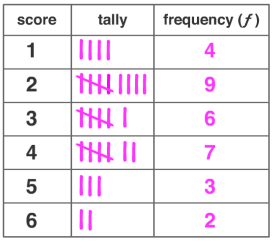
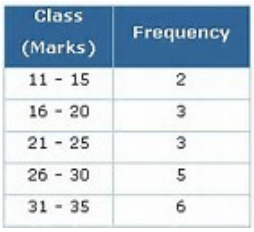
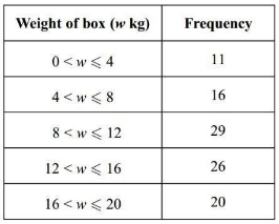
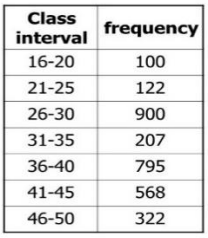
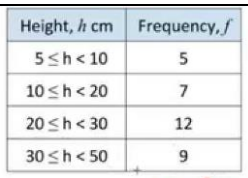
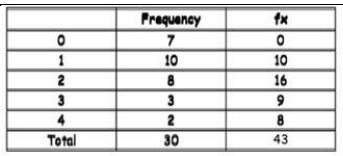
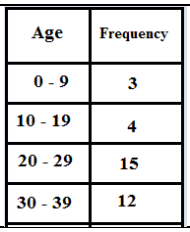
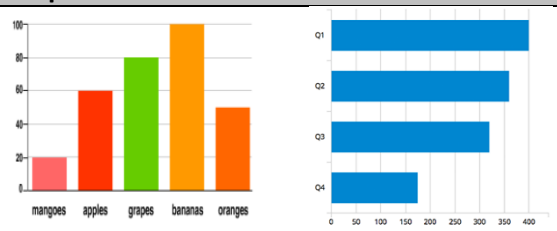
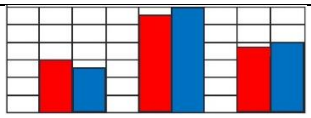
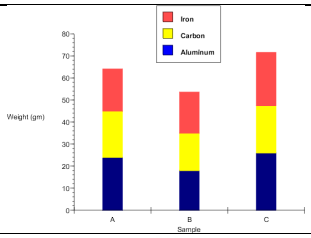
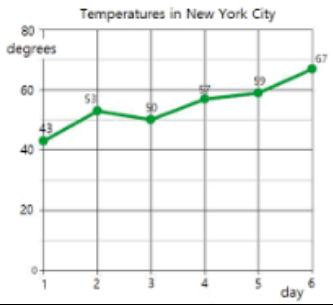
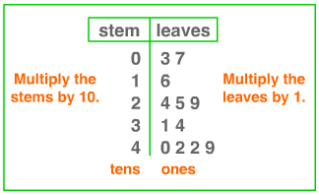
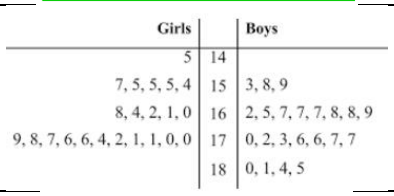
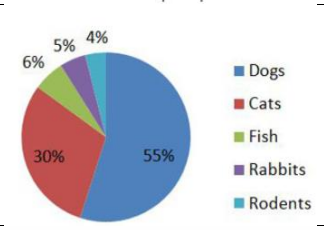
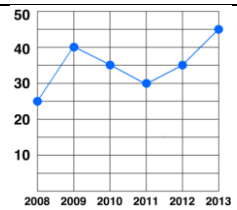
# Y11 Maths Knowledge Organiser – Half Term 3

| Statistics - Key vocabulary | | | Examples |
|---|---|---|---|
| 1 | **Qualitative data** | Non-numerical data (also known as categorical data) | Hair colour, type of pet |
| 2 | **Quantitative data** | Numerical data – data which is counted or measured | Age, length, frequency |
| 3 | **Primary data** | Data which you collect yourself | Survey, questionnaire, data collection sheet |
| 4 | **Secondary data** | Data which someone else has collected | Database, newspaper, internet |
| 5 | **Discrete data** | Quantitative data that can be counted. It has a finite number of possible values | Shoe size, number of people |
| 6 | **Continuous data** | Quantitative data which can be measured. It has an infinite number of possible values within a selected range | Length, weight, time |
| 7 | **Bivariate data** | Data which contains 2 variables | Often represented by a scatter graph |
| 8 | **Population** | The whole group from which data may be collected |   |
| 9 | **Census** | Data collected from the whole population | |
| 10 | **Sample** | Data collected from a subset (section) of the whole population. | |
| 11 | **Bias** | When a sample or probability is not fair – every member does not have an equal chance of being selected | |
| 12 | **Random sample** | Each member of the population has an equal chance of being selected. | Number each person. Use a random number generator to select the sample. |
| 13 | **Strata** | The name given to groups that a population has been divided into. | Year groups in a school, gender, age |
| 14 | **Stratified Sample** | The population is divided into different groups (strata) and each group is sampled in proportion. | The population contains twice as many males as females, so the sample must be in the same proportion |
| 15 | **Hypothesis** | An idea or theory, which can be tested. | 'Large dogs are better at catching tennis balls than small dogs'. We can test this hypothesis by having hundreds of different sized dogs try to catch tennis balls. |
| **Averages - Key concept/skill** | | | **Examples** |
| 16 | **Average** | The central or typical value in a data set → mode, median or mean. |   |
| 17 | **Mode** | The most common/frequent value from a set of data. | Mode of 3, 3, 6, **7**, **7**, **7**, 8, 9, 10 = 7 |
| 18 | **Median** | The middle value when the data is in order. | Median of 9, 5, 15, 6, 8 → 5, 6, **8**, 9, 15 = 8 |
| 19 | **Mean** | Add up all the numbers and divide the total by how many numbers there are. | Mean of 7, 8, 9: $\frac{7+8+9}{3} = \frac{24}{3} = 8$ |
| 20 | **Range** | A measure of the spread of the data, $= largest\ value - smallest\ value.$ | Range of **14**, 16, 16, 17, **19** = 19 – 14 = 5 |

| | | | |
|---|---|---|---|
| **21** | **Quartiles** | Divide a data set into quarters. After finding the median, find the median of the lower and upper halves of the data | 2, 2, 3, 3, 3, 4, 5, 5, 6, 6, 7<br>Upper quartile = 6<br>Lower quartile = 3 |
| **22** | **Inter-Quartile Range** | A measure of spread of the middle 50% of the data,<br>IQR = Upper Quartile – Lower Quartile | 2, 2, 3, 3, 3, 4, 5, 5, 6, 6, 7<br>IQR = 6 – 3 = 3 |
| **23** | **Frequency Table** | A table showing how often (frequent) something occurs. Can include tally charts. |  |
| **24** | **Grouped data** | Data that has been organised into categories. | Discrete<br>  <br>Continuous<br>  |
| **25** | **Class interval** | One of the groups into which data has been divided. |  |
| **26** | **Upper class boundary** | The highest possible value in each class. | For the class interval 20 < h ≤ 30, 30 is the upper class boundary |
| **27** | **Modal class** | The class (group) which has the highest frequency. |  <br>The modal class = $20 \leq h < 30$ as it is the group with the highest frequency |
| **28** | **Mean from a frequency table** | $\frac{Total\ of\ (Value\ \times\ Frequency)}{Total\ Frequency}$ |  <br>43÷ 30 = 1.43333 |
| **29** | **Mean from a grouped frequency table (Estimated Mean)** | $\frac{Total\ of\ (Midpoint\ \times\ Frequency)}{Total\ Frequency}$ |  <br>Total $fx$ = 768.5<br>Total $f$ = 8+7+5+8+4+1= 33<br>Mean = 768.5 ÷ 33 = 23.3 |
| **30** | **Median from a frequency table** | Find the middle value when the data is represented in a frequency table. |  <br>The total frequency is 34 so the middle value is between 17th and 18th $(\frac{(n+1)}{2})$ = Age 20-29. |

| Representing Data | | | Examples |
|---|---|---|---|
| **31** | **Bar chart / graph** | A way of displaying data, using horizontal or vertical bars which are the same width and have gaps between them. |   |
| **32** | **Dual / comparable bar chart** | A type of graph which has at least two bars in each category to show a comparison. |  |
| **33** | **Composite bar chart** | A type of graph with more than one set of information shown on the same bar. |   |
| **34** | **Line graph** | Uses lines to join points on a graph to represent a data set. |   |
| **35** | **Stem & leaf diagram** | A diagram where numbers are split and displayed partly in the stem and partly in the leaf. |   |
| **36** | **Back-to-back stem & leaf diagram** | A form of stem and leaf diagrams sharing the same stem used to compare the distribution of two data sets. |   |
| **37** | **Pie Chart** | Method of displaying proportional information by dividing a circle up into different-sized sectors. |   |
| **38** | **Pictogram** | A pictorial way of presenting data, in which a symbol is used to show a specific quantity of items. |   |
| **39** | **Time-series graph** | Data that is collected over a period of time. When plotted in a graph the time is represented on the horizontal x-axis. |   |

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| **40** | **Two-way table** | A table that organises data from 2 categories. | |

| | Soda | Water | No Drink | Total |
|---|---|---|---|---|
| Hot Dog | **50** | 62 | 46 | **158** |
| Pizza | **120** | 58 | **4** | **182** |
| No Food | 30 | 20 | **10** | 60 |
| Total | **200** | **140** | 60 | **400** |

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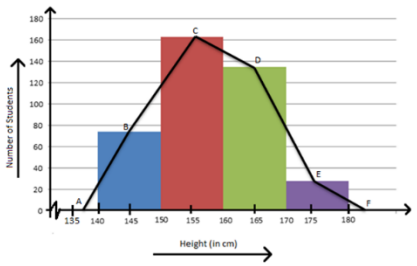
| **41** | **Frequency Polygon** | A straight line graph plotting frequencies, using the mid-point of each group. |  |



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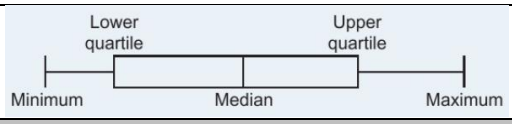
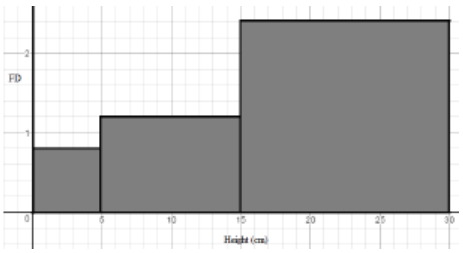
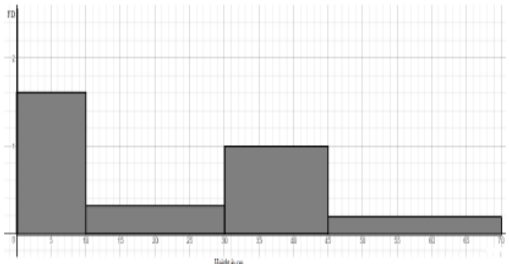
| **42** | **Box plot / Box & whisker diagram** | Diagram showing 5 values from a data set: minimum, LQ, median, UQ and maximum. |  |



| **Histograms & Cumulative Frequency – Higher Tier** | | | **Examples** |
|---|---|---|---|
| **43** | **Histogram** | A chart where the **area** (not the height) of the bar represents the **frequency.**<br><br>The **bars** can be **unequal in width**<br><br>Histograms show **frequency density** on the **y axis**, not frequency | |
| **44** | **Frequency density** | $Frequency\ Density = \frac{Frequency}{Class\ Width}$ | |
| **45** | **Interpreting Histograms** | The **area** of the bar is proportional to the **frequency** of each class interval.<br><br>$\boldsymbol{Frequency = Freq\ Density \times Class\ Width}$ | A histogram shows information about the heights of a number of plants. 4 plants were less than 5cm tall. Find the number of plants more than 5cm tall.<br><br>  <br><br>Above 5cm:<br>1.2 x 10 + 2.4 x 15 = 12 + 36 = 48 |
| **46** | **Cumulative frequency** | A running total of frequencies. | |

| Height(cm) | Frequency |
|---|---|
| $0 < h \leq 10$ | 8 |
| $10 < h \leq 30$ | 6 |
| $30 < h \leq 45$ | 15 |
| $45 < h \leq 70$ | 5 |

| Frequency Density ($FD$) |
|---|
| $8 \div 5 = 1.6$ |
| $6 \div 20 = 0.3$ |
| $15 \div 15 = 1$ |
| $5 \div 25 = 0.2$ |



| Age | Frequency | Cumulative Frequency |
|---|---|---|
| $0 < a \leq 10$ | 15 | 15 |
| $10 < a \leq 40$ | 35 | $15 + 35 = 50$ |
| $40 < a \leq 50$ | 10 | $50 + 10 = 60$ |

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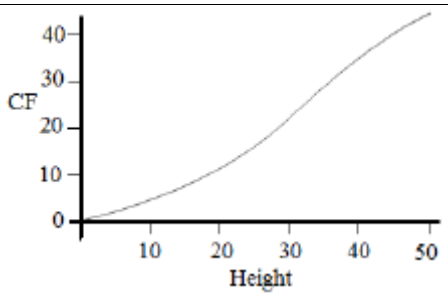
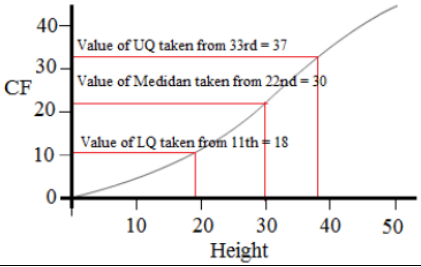
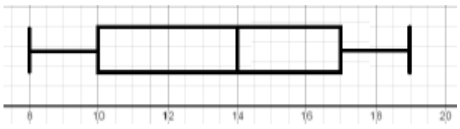
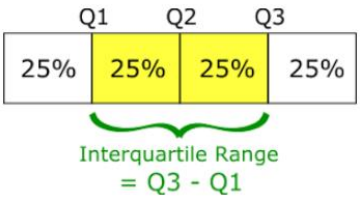
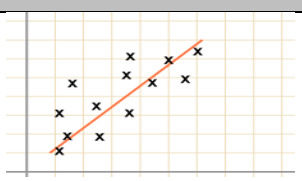
| **47** | **Cumulative frequency graph** | Cumulative frequency is plotted against the upper class boundary for each group. Join the points with a smooth curve |  |
| **48** | **Median and quartiles from a cumulative frequency graph** | Use the total frequency to work out which values (cumulative frequencies) will represent the median, upper quartile and lower quartile.<br>Read these values from the graph |  |
| **49** | **Box plot / Box & whisker diagram** | The minimum, lower quartile, median, upper quartile and maximum are shown on a box plot.<br><br>A box plot can be drawn independently or from a cumulative frequency diagram. | Students sit a maths test. The highest score is 19, the lowest score is 8, the median is 14, the lower quartile is 10 and the upper quartile is 17. Draw a box plot to represent this information.<br>  |
| **50** | **Inter-quartile range (IQR)** | $Inter\text{-}quartile\ range = Upper\ Quartile - Lower\ Quartile$<br><br>$IQR = UQ - LQ$ |  |
| **51** | **Comparing Box Plots** | Write two sentences.<br>1. Compare the **averages** using the **medians** for two sets of data.<br>2. Compare the **spread** of the data using the **range or IQR** for two sets of data.<br><br>The <u>smaller</u> the range/IQR, the <u>more consistent</u> the data.<br><br>You must compare box plots **in the context of the problem**. | 'On average, students in class A were more successful on the test than class B because their median score was higher.'<br><br>'Students in class B were more consistent than class A in their test scores as their IQR was smaller.' |
| **Scatter Graphs** | | | **Examples** |
| **52** | **Scatter graph** | A diagram whose purpose is to establish the relationship between two variables. |  |
| **53** | **Line of best fit** | A straight line drawn through a scatter graph to show a correlation. | |

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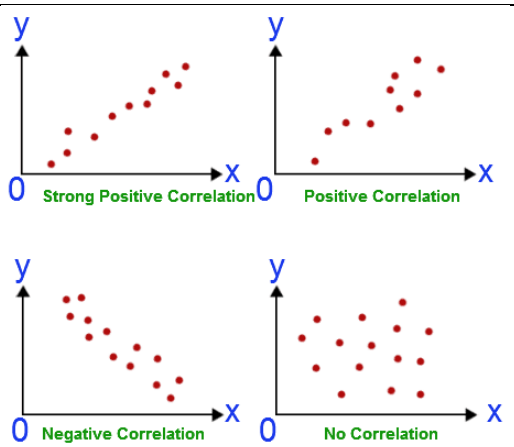
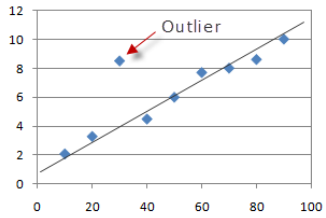
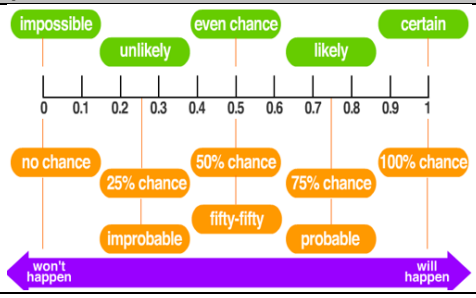
| **54** | **Correlation** | The relationship between two variables shown on a scatter graph. |  |
| **55** | **Positive correlation** | An upward trend in the line of best fit. As one variable increases, the other also increases | |
| **56** | **Negative correlation** | A downward trend in the line of best fit. As one variable increases, the other decreases | |
| **57** | **No correlation** | No linear relationship between the two variables shown on a scatter graph. | |
| **58** | **Strong correlation** | A close relationship between the two variables shown on a scatter graph. | |
| **59** | **Weak correlation** | A general relationship between two variables shown on a scatter graph. | |
| **60** | **Outlier** | A value that lies outside most of the other values in a set of data. |  |
| **Probability – Key Concepts & Skills** | | | **Examples** |
| **61** | **Probability** | The chance that an event will happen. |  |
| **62** | **Probability scale** | Is expressed as a fraction or decimal between 0 (impossible) and 1 (certain). (Can also be a percentage). | |
| **63** | **Total Probability** | Probabilities always add up to 1. | P(head)=0.5 and P(tail)=0.5<br>$\therefore P(head + tail) = 1$ |
| **64** | **Theoretical Probability** | $\frac{Number\ of\ successful\ Outcomes}{Total\ Number\ of\ Possible\ Outcomes}$ | Probability of rolling a 4 on a fair 6-sided die = $\frac{1}{6}$. |
| **65** | **Relative frequency** | $\frac{Number\ of\ Successful\ Trials}{Total\ Number\ of\ Trials}$ | A coin is flipped 50 times and lands on tails 29 times. The relative frequency of getting tails = $\frac{29}{50}$. |
| **66** | **Exhaustive** | Events are exhaustive if they include all possible outcomes | When rolling a six-sided die, the outcomes 1, 2, 3, 4, 5 and 6 are exhaustive, because they cover all the possible outcomes. |
| **67** | **Mutually exclusive** | Events that cannot happen at the same time, i.e. P(A and B) = 0 | Turning left and right; Heads and Tails on a coin |
| **68** | **Independent events** | The outcome of one event does not affect the outcome of another | Replacing a counter in a bag after picking it. |
| **69** | **Dependent events** | The outcome of one event affects the outcome of another | Not replacing a counter in a bag after picking it, <u>without replacement</u>. |
| **70** | **AND rule** | 2 events BOTH happen. Multiply the probabilities. | P(A and B) = P(A) X P(B) |
| **71** | **OR rule** | Either one event OR another happens. Add the probabilities. | P(A or B) = P(A) + P(B) |
| **72** | **Probability of event not happening** | P(event') = 1 – Probability of event happening | P(A') = P(1 – A) |

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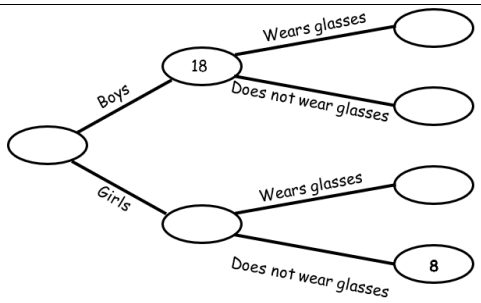
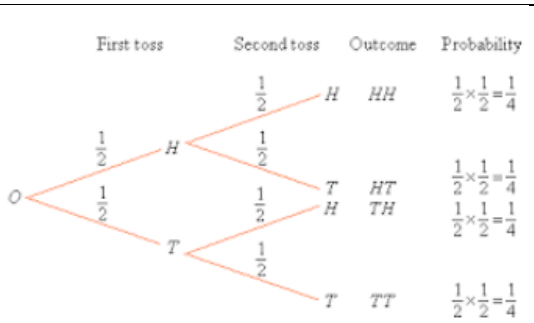
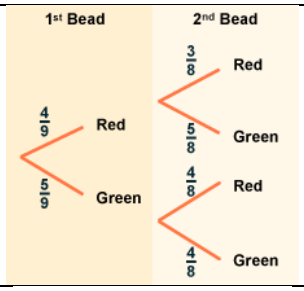
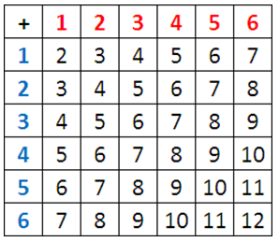
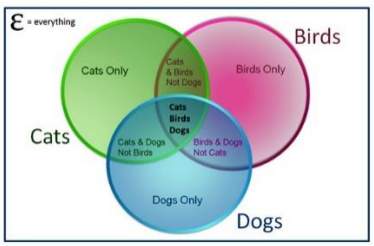
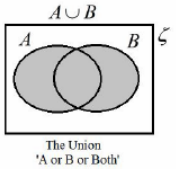
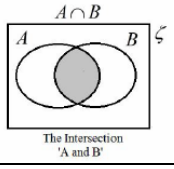
| **73** | **Frequency Tree diagram** | Used to represent the possible outcomes and frequencies of 2 or more events |  |
| **74** | **Probability tree diagram** | A diagram to show all the possible outcomes of 2 or more events. It is used to calculate the associated probabilities. |  |
| **75** | **Conditional probability** | The probability of an event A happening, given that event B has already happened. |  |
| **76** | **Sample space** | Shows all of the possible outcomes for one or more events |  |
| **77** | **Venn Diagram** | Diagram used to represent the relationship between 2 or 3 sets of data (overlapping circles inside a rectangle). |  |
| **78** | **$\varepsilon$** | The universal set – all the data | |
| **79** | **A U B** | Union of A and B (all the data contained in set A or B or both). |  <br>The Union<br>'A or B or Both' |
| **80** | **A ∩ $B$** | Intersection of A and B (only the data that overlaps set A and B). |  <br>The Intersection<br>'A and B' |
| **81** | **A'** | Data which is not in set A | A = people with blue eyes<br>A' = peoplewho do not have blue eyes |