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| **Daylight hours maths activity** | | |
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| Looking at the way the length of the day changes over the year and predicting the longest and shortest days | | |
| **Stay safe** | | |
| Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:    • ensuring that any equipment used for this activity is in good working condition  • behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others    Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ | | |
| **Subject(s):** Mathematics, Science  **Approx time:** 50 - 80 minutes |  | **Key words / Topics:**   * day * graphs * hours * interpreting data * night * sunrise * sunset |
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| **Suggested learning outcomes** | | |
| * To understand how to plot a graph from data. * To be able to interpret data. * To be able to determine the longest and shortest days of the calendar year | | |
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| **Introduction** | | |
| This is one of a series of resources designed to allow learners to use the theme of the festive season to develop their knowledge and skills in Mathematics and Engineering. This resource focuses on working out the date of the longest and shortest day of the year.  The length of the day, with regards to the amount of sunlight, varies with what time of year it is. Can you work out the longest and shortest days of the year? | | |
| **Purpose of this activity** | | |
| In this activity learners will use a data sheet to plot a graph, then interpret the data to work out the date of the longest and shortest days of the year in the United Kingdom.  This activity could be used as a main lesson activity to teach about the different times of the day and the use of the use of the 24-hour clock. It could also be used as part of a wider scheme of learning focussing on keeping time or how the solar system works. | | |
| **Activity** |  | **Teacher notes** |
| **Introduction (10-20 minutes)**  Teacher to use the introductory slides in the teacher presentation to discuss the background knowledge required for the task with learners.  **Plotting the data (30-40 minutes)**   * **Step 1** – Interpreting the datasheet (5-10 mins)   The learners are given the datasheet and discuss what the numbers mean. What is sunrise? What is sunset?  **Step 2** - Laying out the axes (10-15 mins)  The learners lay out the X and Y axes on the worksheet.   * **Step 3** – Plotting the data (10 mins)   The data is plotted on the worksheet.  **Analysing and checking the results (10-20 minutes)**   * **Step 4** – Analysing the data   Learners to analyse their data by following the instructions on slide 10 of the teacher presentation.   * **Step 5** - Checking the result   Reveal the correct answers and discuss how close the results came out. What affects the accuracy? Would more points help? |  | This activity could be carried out individually or in pairs.  A globe may be useful as a discussion aid here.  Step 1 – Data sheets could be shown on the screen but would be best printed so learners can tick off their data points as they go.  Step 2 – If it isn’t possible to use the given worksheet then 1 cm A4 landscape graph paper will work, but extra time will be needed to draw the axes  Step 3 – The hours will need to be plotted every 5 mm. The graph could be filled in on the whiteboard as the learners work. It can help for the learners to tick off the data as they work though to avoid double entry. Each point should be plotted carefully, possibly with a check at each point (depending on the ability and prior learning of the group).  Step 4 – It is possible that some learners will already know when the shortest and longest days are. They can be asked to see if their knowledge is backed up by their calculations. The rest can have a go at guessing before the answer is revealed.  The teacher could show a completed graph to show the way the day length smoothly rises and falls over the year. The actual shortest and longest days are not part of the data so these will need interpolation to make the graph smooth. |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Pre-label the X and Y axes on the graph sheet. * Provide a partially completed graph with the first couple of data points pre-plotted as a starting point. |  | * Learners could complete further mathematical analysis to find the equinoxes. * Research the history of measuring time. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Datasheet * Worksheet * Pencils * Rubbers |  | | icon-ppt Teacher presentation – A light day |
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| **Additional websites** |  | |  |
| * **Sunset times – UK:** The source of the data for sunrise and sunset in the United Kingdom. [http://www.sunsettimes.co.uk](http://www.sunsettimes.co.uk/) * **Royal Observatory – GMT:** A range of useful videos and activities to support the topic. <https://www.rmg.co.uk/royal-observatory> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Discuss the reasons why days are longer in summer than in the winter. What are the differences between the northern and southern hemispheres? | | **Extension** (Options)   * Learners could complete further mathematical analysis to find the equinoxes. * Research the history of measuring time.   **Plenary**   * Discuss the key terms used in the lesson. Why plot the data in a graph? What affects the accuracy? Would more points help? | |
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| **The Engineering Context** film |
| * Engineers must be able to interpret data to understand how things work. For example, drawing a graph of how much material in a product is lost over time due to corrosion, so that they can determine when the product must be replaced. |

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| **Curriculum links** | |
| **England: National Curriculum**  KS3 Science - Space physics   * Our sun as a star, other stars in our galaxy, other galaxies * The seasons and the Earth’s tilt, day length at different times of year, in different hemispheres   KS3 Mathematics - Laying out graphs  **Scotland: Curriculum for Excellence**  Science   * SCN 2-06a   Mathematics   * MTH 2-21a * MTH 3-21a | **Northern Ireland Curriculum**  Science - Earth and Universe   * The solar system and universe.   Mathematics - knowledge and understanding   * Handling data   **Wales: National Curriculum**  Science   * KS3 Range: 6, 7   Mathematics   * KS3 Using data skills |
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| **Assessment opportunities** | | |
| * Informal teacher assessment of data analysis skills through observation of learners. * Formal teacher assessment of completed graphs. | | |
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