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| **Using Pythagoras Theorem** | | |
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| Making a 3:4:5 string triangle to check if an object is upright | | |
| **Subject(s):** Design and Technology, Maths, History  **Approx time:** 40-60 minutes |  | **Key words / Topics:**   * Pythagoras * Proportion * Right angle * Perpendicular * Triangle |
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| 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: ⚠ | | |
| **Suggested learning outcomes** |  |  |
| * To understand basics of Pythagoras Theorem and its use. * To be able measure if something is perpendicular to its base. | | |
| **Introduction** |  |  |
| This is one of a set of resources designed to allow learners to use practical methods to support the delivery of key topics within design and technology, maths, and history. This resource is based on Pythagoras Theorem and using this to determine if an object is perpendicular to its base.  This activity is inspired by the achievements of ancient Greece and how these have affected the modern world. It introduces the concept of Pythagoras Theorem and what it is used for. The main activity involves making a string triangle in the proportion of 3:4:5 and using this to check whether objects are perpendicular to their base. | | |
| **Purpose of this activity**  In this activity learners will discover how to create a visual aid to measure objects using ancient Greek mathematics. They will make a string triangle and then use it to check if the object is perpendicular to its base – an application of Pythagoras.  This activity could be used as a main lesson activity, to introduce Pythagoras Theorem or to teach learners about how the ancient Greeks have affected life in the modern world. | | |
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| **Activity** |  | **Teacher notes** |
| **Introduction (10-15 minutes)**  Teacher to introduce the activity, using maths principles from ancient Greece to measure everyday objects. Teacher to outline Pythagoras Theorem and its use for measuring vertical objects perpendicular to a base.  **Making the string triangle (20-30 minutes)**  Teacher to demonstrate the steps shown below and on the presentation:   * Step 1 – Mark two points on the wood, 5cm apart. Hammer the two nails into the piece of wood leaving them sticking out by about 5cm. * Step 2 – Tie one end of the string to the first nail, then tie a knot to the second nail. Ensure the string is kept tight at all times. * Step 3 – Slip the string off the first nail, using the long end, tie another knot on the free nail as shown * Step 4 – Repeat step 3 until you have 12 knots. Tie the ends together keeping the last gap at 5cm as before. Cut off the excess string.   Learners work in pairs to make their string triangles.  **Using the triangle (10-15 minutes)**  Teacher demonstrates how to tape to a window and measure the perpendicular nature of objects – if hypotenuse is straight, then object is perpendicular.  Students work in pairs to complete worksheet, looking at a variety of objects identified, judging whether they are perpendicular or not. |  | **Pythagoras activity**  Print the activity sheet and distribute to the learners.  Instead of using knots to mark the string, students could effectively mark the string with a board marker at 5cm intervals using a ruler or pre marked template.  At step 1, the activity must be carried out in conformance with the school’s risk assessment for the use of hammers. Finishing nails are recommended as these have a very small head – large head nails will stop the string being removed in step 3. Rulers or templates could be used to mark out the wood. The marking out should be done using a pencil.  At step 2, it may be necessary to demonstrate how to tie the knot. |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Provide learners with a wood board with nails positions already marked out or nails already inserted. * Allow learners to mark the string rather than tie it. |  | * Attach the string to a sheet of clear plastic. Use this to check a variety of other objects. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * 2 nails (finishing type, 60 mm plus long). * Ruler and pencil, for marking out. * Hammer. * Smooth piece of wood. * String/ribbon 70cm long. * Tape. * Sheet of clear plastic (for extension). |  | | icon-ppt Using Pythagoras Theorem presentation  icon-doc Using Pythagoras Theorem activity sheet |
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| **Additional websites** |  | |  |
| * **Basic introduction to Pythagoras with examples and explanations:** <https://www.mathsisfun.com/pythagoras.html> * **How many ways are there to prove Pythagoras Theorem:** <https://www.youtube.com/watch?v=YompsDlEdtc> * **BBC Bitesize explanation of Pythagoras Theorem:** <https://www.bbc.co.uk/bitesize/guides/z3g9q6f/revision/3> * **Pythagoras, the man, the myths, the maths:** <https://www.youtube.com/watch?v=j1N3N4cgHaM> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)  Show a picture of the leaning tower of Pisa. Why is a building leaning an issue? How do we check if something is upright? | | **Extension** (Options)  Attach the string to a sheet of clear plastic. Use this to check a variety of other objects.  **Plenary**  Learners to share their findings on objects they have identified to be perpendicular – can they justify why they are not? | |

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| **The engineering context** film |
| Engineers and astronomers use the Pythagoras Theorem to calculate the paths of spacecrafts, including rockets and satellites. Architects use the Pythagoras Theorem to calculate the heights of buildings and the lengths of walls. |

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| **Curriculum links** | |
| **England: National Curriculum**  Maths KS2   * Recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3).   History KS2   * Ancient Greece – a study of Greek life and achievements and their influence on the western world. | **Northern Ireland Curriculum**  Art and Design KS2   * Respond to the world around them. * Develop and use their imagination. |
| **Scotland: Curriculum for Excellence**  Mathematics   * I have worked with others to explore,  and present our findings on how mathematics impacts the world and the important part it has played  in advances and inventions. * MTH 2-12a. | **Wales: National Curriculum**  History KS2   * Identify the ways in which the past is represented and interpreted. |
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| **Assessment opportunities** | | |
| Informal formative assessment of the finished worksheet | | |
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