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| **Edges, vertices and faces** | | | |
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| Making cut-out 3D shapes and counting the number of edges, vertices and faces | | | |
| **Subject(s):** Mathematics  **Approx time:** 60 – 100 minutes |  | | **Key words / Topics:**   * Cube * Cylinder * Edges * Faces * Net * Octahedron * Pyramid * Vertices |
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| **Suggested Learning Outcomes** |  | |  |
| * To make 3D shapes such as a cube, pyramid, cylinder and octahedron from 2D nets. * To understand the difference between the edges, vertices and faces of a 3D shape. * To know the number of edges, vertices and faces on a cube, pyramid, cylinder and octahedron. | | | |
| **Introduction** |  | |  |
| This is one of a set of resources developed to support the teaching of the primary national curriculum. They are designed to support the delivery of key topics within maths and science. This resource focusses on making 3D shapes from 2D nets and counting the number of edges, vertices and faces on each shape.  Understanding shapes helps us to understand the spaces and objects all around us. In this activity you will learn about common 3D shapes and their different features. | | | |
| **Purpose of this activity**  In this activity learners will develop their knowledge and understanding of 3D shapes. They will cut out 2D nets for a cube, pyramid, cylinder and octahedron and fold them into their corresponding 3D shapes. They will then count the number of edges, vertices and faces on each shape.  This activity could be used as a main activity to develop knowledge and understanding of the properties of common 3D shapes, or as one of several activities within a wider scheme of learning focussing on the properties of 2D shapes, 3D shapes and everyday objects. | | | |
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| **Activity** |  | | **Teacher notes** |
| **Introduction (2-5 minutes)**  Teacher to explain that learners are going to cut out 2D nets and make them into 3D shapes. Teacher to hand out the 2D nets, scissors and glue sticks.  **Making the 3D shapes (40-60 minutes)**  Teacher to demonstrate how to cut out each net, add glue or double-sided tape to the flaps and fold up each shape one at a time. The shapes should include the following:   * Cube * Pyramid * Cylinder * Octahedron   Learners to make each shape after the teacher demonstration for each one, following the teacher instructions carefully. The teacher presentation could be used to show examples of what each completed 3D shape should look like.  **Identifying the number of edges, vertices and faces on each shape (10-20 minutes)**  Teacher to explain what is meant by edges, vertices and faces, pointing them out on one of the 3D shapes made (e.g. a cube).  Learners to count the number of edges, vertices and faces on each shape that they have made and write their findings onto the worksheet handout.  **Self and peer assessment of responses (5-10 minutes)**  Learners to self and peer assess their worksheet responses. Teacher to show the answers slide in the presentation for reference. |  | | This activity could be done as individuals or in pairs.  **Making the shapes**  The teacher should demonstrate how to fold up each net into a 3D shape. The teacher could show how to make each shape one at a time, with learners following them as they do it. If available, a visualiser or small webcam would help with this.  Sometimes learners forget the flaps and cut out the nets without them, so remind them about the need for these when making each shape. Learners could use double sided tape instead of a glue stick on the flaps, or use sticky tape on the outside of the shapes to hold them together.  **Edges, vertices and faces handout**  This handout can be printed and used as a worksheet for learners to write down the number of edges, vertices and faces on each 3D shape that they have made. The most complex term to understand is typically vertices, which could be explained in simple terms as ‘corners’.  **Answers:**  Show the answers slide on the teacher presentation after learners have filled in their own sheet – learners could also use this slide to self and peer assess their responses. |
| **Differentiation** |  | |  |
| **Basic** |  | | **Extension** |
| Learners could focus on making and identifying the edges, vertices and faces of the cube and pyramid only.  Pre-cut out the nets so they just need to be folded into the 3D shape. |  | | Describe in detail the properties of the cube, pyramid, cylinder and octahedron. Label the edges, vertices and faces on each shape made.  Cut out and make the dodecahedron shape. Write down the number of edges, vertices and faces of this shape. |
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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * Scissors * Glue sticks or double-sided tape * Optional: Visualiser or webcam |  | | icon-ppt edges, vertices and faces presentation  icon-pdf Edges, vertices and faces handout  icon-pdf 3D shape nets |
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| **Additional websites** |  | |  |
| * **Bitesize – Properties of 3D shapes:** Video and notes explaining what is meant by faces, edges and vertices of 3D shapes. <https://www.bbc.co.uk/bitesize/topics/zjv39j6/articles/zgqpk2p> * **Math salamanders - Nets:** A collection of free to download nets for various 3D shapes. <https://www.math-salamanders.com/3d-geometric-shapes.html> * **Primary resources – Properties of 3D shapes:** Sheet showing the number of edges, faces and vertices for a range of 3D shapes, with spaces for learners to enter their own findings. <http://www.primaryresources.co.uk/maths/pdfs/3D_Shape_Properties_VC.pdf> | | | |
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| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Show a range of nets and ask learners to identify the 3D shape that this would be made into. * Quiz recapping the names of various 2D and 3D shapes. | | **Extension** (Options)   * Describe in detail the properties of the cube, pyramid, cylinder and octahedron. * Label the edges, vertices and faces on each shape made. * Cut out and make the dodecahedron shape and write down the number of edges, vertices and faces.   **Plenary**   * Self and peer assessment of worksheet answers. * Recap the names of the 2D nets and 3D shapes made from their pictures. * Recap the main properties of each shape. | |
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| **The Engineering Context** film |
| * Engineers are required to use mathematics knowledge and skills regularly as part of their everyday job. It is therefore essential that they have a good grasp of basic concepts, such as the properties of 3D shapes. |

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| **Curriculum links** | |
| **England: National Curriculum**  Mathematics  KS2 Year 2 Geometry – properties of shapes:   * identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces. | **Northern Ireland Curriculum**  KS1 - Mathematics and Numeracy  Processes in mathematics:   * understand mathematical language and be able to use it to talk about their work   Shape and space:   * count, make constructions, pictures and patterns using 2-D and 3-D shapes * name and describe 2-D and 3-D shapes. |
| **Scotland: Curriculum for Excellence**  Numeracy and Mathematics  Properties of 2D shapes and 3D objects:   * MTH 1-16a | **Wales: National Curriculum**  Mathematics  KS2 - Using geometry skills:   * recognise 3D shapes * identify a net of a cube. |
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| **Assessment opportunities** |
| * Teacher assessment of written responses on the edges, vertices and faces worksheet. * Self and peer assessment of written responses on the edges, vertices and faces worksheet. * Teacher assessment of practical skills shown in making the 3D shapes. |