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| **Gingerbread Man STEM Challenge** | | |
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| Gingerbread men, buttons and their maths possibilities | | |
| **Subject(s):** Maths  **Approx time:** 45 mins |  | **Key words / Topics:**   * Pattern * Same * Different * Systematic * Possibilities |
| **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 develop reason mathematically by:   + identifying and noticing what is the same and what is different about the biscuits.   + making conjectures such as ‘I think there will be …. number of different biscuits because’   + and developing an argument, justification or proof using mathematical language. Such as ‘I know I have found all the ways because…’ * To solve problems by:   + Breaking it into simpler steps   + To persevere in finding all the solutions | | |
| **Introduction** |  |  |
| The aim of the lesson is to find as many different combinations of different coloured buttons as possible. With a tea party theme, the buttons can be placed on a gingerbread character.   * Provide a plate of gingerbread biscuits and buttons in two different colours. * Each gingerbread man has 2 buttons on his tummy. * How many different gingerbread biscuits can you decorate using 2 buttons? * With 2 colours there are 4 different ways: red/red, blue//blue, red/blue and blue/red. * The lesson continues with the children using 3 different coloured buttons but only 2 allowed on each gingerbread biscuit. (9 solutions) * The lesson concludes with children using 3 different colours and 3 buttons (27 solutions) | | |
| **Purpose of this activity**  This activity is a ‘finding all possibilities’ type of problem. It encourages children to work systematically to ensure they know when all the solutions have been found, as well ensuring they haven’t made any two gingerbread men look exactly the same. A strategy that will be promoted is the idea of fixing one of the variables, in this case one of the buttons, whilst changing, the others in turn. To ensure they become confident talking about their maths ask the children to work in pairs. | | |
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| **Activity** |  | **Teacher notes** |
| **Activity 1 (15 mins)**  Show the children the problem and explain that we have lots of gingerbread biscuits and we want them all to look different.  To do this we have some different coloured buttons. Put out 2 pots of buttons, one red and one blue.  **What is the same and what is different?**  Encourage the children to compare two of their solutions and see if they can find something that is the same and something that is different.  **Activity 2: More colours (15 mins)**  If we add a third coloured button how many gingerbread biscuits can we decorate. They can still only have two buttons on their tummy.  How many solutions can you find?  **Activity 3: More buttons [15 mins]**  The final challenge is to allow each gingerbread button to have three buttons.  How many solutions are there?  How can you make sure you do not have any repeats?  What is the same and what is different about the biscuits? |  | This initial activity allows pupils to explore the problem in a simple form, slides 1-5.  The children could use biscuits and place red or blue buttons on each or you may wish to print off some gingerbread biscuit handouts, see Appendix 1 and the children could place counters/unfix cubes instead of buttons.  Encourage children to work in pairs and provide them with more biscuits than they need, in this case 7 or 8 to ensure they really do need to find the answer and are able to explain how they know they have found all the possible combinations and there are no more.  **Key questions:**  How many different ways can you decorate the biscuits?  How do you know you have found them all?  How do you know you have solved the problem?  Did you find any gingerbread biscuits that were the same? What did you do?  The solution is given on slide 6.  Slide 7 models this activity.  Encourage children to work systematically so they can spot any repeats.  The slide is animated to model keeping one of the variables the same whilst changing the other.  **Key questions?**  If the first two buttons are red, what colour could the third button be?  Could it be any other colour?  How do you know you have found all the solutions?  The handout could be used for this activity with red/blue/white counters or red/blue/white colours.  The solution is provided on slide 8. There are some sentence starters you could use on slide 9.  Slides 10-11 introduce activity 3.  This can be a challenge if children are not working systematically as they will not easily see when they have repeated a biscuit.  The handout could be used for this activity with red/blue/white counters or red/blue/white colours.  The solution is provided on slide 12. |
| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Scale down the number of buttons in use for this activity. |  | * The 3 colours and 3 buttons are much more challenging and may need a greater level of perseverance. |
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| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Gingerbread characters 4x2 grid * Gingerbread characters 4x4 grid * Gingerbread characters 10 x 3 grid * Coloured counters/unfix/multilink * Or Biscuits, and a pot of blue and red buttons for class demonstration |  | icon-ppt Presentation – Gingerbread Man STEM Challenge  icon-doc Templates to print |
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| **Additional websites** | | |
| Related activities (to build a full lesson)   * Three ball line up <https://nrich.maths.org/2858> * Beads and bags <https://nrich.maths.org/7374> | | |
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| **Curriculum links** | |
| **England: National Curriculum**  KS1 & 2 Maths  From the aims of the National Curriculum  The national curriculum for mathematics aims to ensure that all pupils:   * become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. * reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language. * can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.   Year 1 Geometry - Position and direction  Describe position, direction and movement.  Year 2 Geometry – Position and direction  Order and arrange combinations of mathematical objects in patterns and sequences. | **Northern Ireland: Curriculum**   * Curriculum Mathematics and Numeracy Key Stages 1 and 2.   **Processes in mathematics**  **Making and Monitoring Decisions**  Pupils should be enabled to:   * select the materials and mathematics appropriate for a task. * develop different approaches to problem-solving. * begin to organise their own work and work systematically.   **Communicating Mathematically**  Pupils should be enabled to:   * understand mathematical language and be able to use it to talk about their work. * represent work in a clear and organised way.   **Mathematical Reasoning**  Pupils should be enabled to:   * recognise simple patterns and relationships and make predictions. * ask and respond to open-ended questions. * explain their way of working. * know ways to check their own work. |
| **Scotland: Curriculum for Excellence**  Experiences and outcomes   * engage with more abstract mathematical concepts and develop important new kinds of thinking. * Apply skills and understanding creatively and logically to solve problems, within a variety of contexts | **Wales: National Curriculum**  Identify processes and connections   * transfer mathematic skills to play and classroom activities. * identify steps to complete the task or reach a solution. * select appropriate equipment and resources.   **Represent and communicate**   * use every day mathematical language to talk about their own ideas and choices. * present work orally and in pictorial form   **Review**   * use checking strategies to decide if answers are reasonable |
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| **Assessment opportunities** | | |
| * Systematic approaches to problem solving * Using appropriate mathematical language in developing an argument | | |
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