**Number:** Operations – Addition 4

**9. A Game of Coins**

In this task, students are asked to construct number sentences to reach a target number. They will use their understanding of addition to solve the problem. Students may add with or without renaming, depending on how they find their solution. They will need to use mental strategies of addition to help them find the number combinations needed to reach their target number.

**Focus Skills:**

* *Applying and problem-solving*:Select and apply appropriate strategies for completing a task or solving a problem.
* *Reasoning*: Recognise and create mathematical patterns and relationships.
* *Implementing*: Devise and use mental strategies and procedures for carrying out mathematical tasks.

**Teaching Points:**

* Some students may benefit from having a 100-square to help them with their addition. Concrete materials may also be helpful, e.g. base-ten equipment or interlocking cubes. Using these resources will help students to see patterns and help devise mental strategies for solving problems.
* Encourage students to share their thinking and reasoning behind their number choices. Some students may recognise that beginning with higher valued numbers is a good starting point to get closer to the target number.
* Students are tasked with finding a specific target number in Part A and Part B. A trial and improvement strategy is needed to find a suitable combination. Some students may see how they can use subtraction, as the inverse of addition, to help solve this problem. Encourage them to check their answers by adding the numbers altogether, to ensure it reaches the target numbers. Encourage students to explain their thinking.
* When finding solutions, students may notice for example, that adding the units of all three numbers is a helpful way to make 10, or that 74 is a common number that the blue and yellow coins total.
* Encourage students to explain their approach to this problem – *Do you have a system?*; *Would a system be useful for testing the different number combinations?*
* For students who are struggling, encourage them to find totals that are close to, rather than exactly, 90 (Part A) and 81 (Part B).

**Anticipated Student Responses:**

|  |  |
| --- | --- |
| **Part A** | **Part B** |
| Some example coin combinations which total 90:   |  |  |  | | --- | --- | --- | | **Red** | **Blue** | **Yellow** | | 39 | 11 | 40 | | 30 | 35 | 25 | | 39 | 42 | 9 | | 16 | 11 | 63 | | 16 | 71 | 3 | | 16 | 34 | 40 | | 30 | 42 | 18 | | Coin combinations which total 81:   |  |  |  | | --- | --- | --- | | **Red** | **Blue** | **Yellow** | | 30 | 11 | 40 | | 21 | 35 | 25 | | 30 | 42 | 9 | | 21 | 42 | 18 | |
| **Extension** | |
| Students will choose their own target number. Encourage them to reason how they know they have gotten the closest to their target number. | |

**Algebra:** Extending and Using Patterns 2

**16. Number Patterns**

In this task, students are exploring number patterns on a 100-square. They are encouraged to discuss their findings by examining the number pattern created.

**Focus Skills:**

* *Applying and problem-solving*: Select and apply appropriate strategies for completing a task or solving a problem.
* *Reasoning*: Recognise and create mathematical patterns and relationships.
* *Implementing*: Execute procedures efficiently.

**Teaching Points:**

* Before starting this task, encourage students to examine the 100-square and discuss what they notice about the numbers. Some observations may include:
  + The units stay the same as you move down vertically.
  + The units increase as you move from left to right, horizontally.
  + The units decrease as you move from right to left, horizontally.
  + The opposite is true for the tens. The tens stay the same as you move horizontally, from the left or the right.
  + The tens increase as you move down, vertically.
  + The tens decrease as you move up, vertically.
* For some students, Part A may be straightforward. However, it provides a challenge by encouraging them to make connections and explain their results by making generalisations. They must dig deeper to recognise how numbers are connected to each other and, most importantly, encourage them to explain what they see.
* In Maths Talk aspect of the lesson, students may reason how 5 is related to 10, as 5 is half of 10. For example, when counting in tens, regardless of what number you start on, you land on every second number you counted in fives. Students may also recognise, if they started counting from 3, for example, that it is not possible to land on any numbers other than numbers that have a 3 or 8 in the units place when counting in fives, and only a number with 3 in the units place when counting in tens*.*
* For further extension in Part A, encourage students to test the number patterns they found for fives and tens by starting at a different number and counting in twos, threes or fours. Ask – *Do you always land on the same unit digits?*; *Which counting pattern includes the greatest number of numbers? Why?*
* For Parts B, C and D encourage students to use the 100-squares on page 72 to help them prove whether these statements are true or false. For Part B, suggest that they record each of their counts in a different way, and provide a key for reference, e.g. count in fives = blue, count in threes = /, count in fives and take away 2 = yellow.
* In Parts B, C and D the statements ‘always true’, ‘sometimes true’ or ‘never true’ may cause some confusion. Encourage students to see them as an opportunity to reason, justify and argue their results. The purpose of these tasks is to encourage students to prove and give reasons for their answers. The statements are debatable and therefore provide great scope for class discussion.
* Students may not notice that there is no starting point named for Parts B and C. If not, draw their attention to this and ask questions to prompt them to continue their investigation – *Do you think starting at a number other than 0 might change how you answer the question?*; *What else might you need to do to decide if these statements are always true, sometimes true or never true?*
* **Further Extension**: After completing Part D, you may choose to ask students to consider and then explain their thinking – *Is it also always true the other way round?*; *Is every number I land on when counting in threes the same as when I count in sixes?*

**Anticipated Student Responses:**

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| --- | --- |
| **Part A** | **Part B** |
| Sample:  Starting on 3 and count in fives and then count in tens.  Table  Description automatically generated  Sample response:  *All the numbers I landed on were in two columns only when I counted in fives.*  *When counting in tens I landed on numbers in one column only.*  *When counting in tens from 3 I landed on every second number I landed on when I counted in fives. I think this is because 5 is half of 10. All the numbers I land on have 3 or 8 in the units place when I counted in fives. They only had 8 in them when I counted in tens.* | Example of counting, starting from 0  Key to shading:  Count in fives: pink  Count in fives and take away 2: blue  Count in threes: yellow  A picture containing application  Description automatically generated  Students may reason it is sometimes true as some of the numbers they land on are the same.  However, to count in threes from any number, you need to always make jumps of three or move along three squares on a 100-square. If you count from 0 in threes, the first five numbers are 3, 6, 9, 12, 15. The first five numbers you land on when you count in fives and then take away 2 are: 3, 8, 13, 18, and 23. They do not match, so it is never true. |
| **Part C** | **Part D** |
| If you start your count in tens on 0 or a multiple of 10, the statement is always true.  However, if you start on any other number the statement is never true.  Therefore, sometimes true is the best option. | This statement can be argued as always true as, when counting in sixes, every number is also a multiple of 3. |
| **Extension** | |
| The extension is open to allow students to explore. If they have used both the 100-squares on page 72, provide them with an additional photocopy of a 100-square. Encourage them to use a colour code or symbolic code to record their different patterns. | |

**Shape and Space:** 2D Shapes

**18. Making Rectangles**

In this task, students explore and solve practical problems using 2D shapes. Students are tasked to visualise and create rectangles using the shapes found in a tangram square.

**Focus Skills:**

* *Applying and problem-solving*: Recognise solutions to problems.
* *Communicating and expressing*: Discuss and record the result of mathematical activities using diagrams, pictures and symbols.
* *Understanding and recalling*: Understand and recall terminology and facts.

**Teaching Points:**

* Examine the image of the tangram on page 40 with the class. Alternatively, display a copy on the board. Discuss what the students can see. Encourage them to think of any questions they might have about this image. Some observations may include:
  + The different shapes and colours.
  + Some students might notice that they are placed together to make a square.
* Introduce the concept of a tangram: a traditional Chinese puzzle made up of seven 2D shapes (tans) that can be arranged to make different shapes.
* In the Maths Talk aspect of the lesson, students are encouraged to describe the seven shapes that make up a tangram. If students are interested in the name of the tan labelled ‘7’, explain that it is called a parallelogram.
* A printable copy of the tangram could be distributed to support students as they explore the tans. Encourage them to cut out the seven tans and discuss in groups or pairs what they see. Understanding how the tans work together to make rectangles is invaluable to this question.
* This task requires students to make rectangles using some or all of the seven tans. Discuss what makes a shape a rectangle with the class.
* Students will use their knowledge of a rectangle’s properties and their visualising skills to solve each part of the task. Encourage students to explore the different ways they can make a rectangle and to play with the tans to test out different possibilities.
* The Top Tip! will be important to students as they solve Part A and may result in a lot of discussion. Emphasise that a square is a special type of rectangle as it has parallel lines that are the same and all the angles are right angles. Students may ask *– Is a rectangle a square?* Encourage them to use their understanding of what makes a square unique to reason this out.

|  |
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* For students who are struggling in Part C, place three tans in the correct position and encourage them to work out which other two tans to use and where to place them.

**Anticipated Student Responses:**

|  |  |
| --- | --- |
| **Part A** | **Part B** |
| Two small triangles:    Two large triangles: | One square and two small triangles:    One medium triangle and two small triangles:    Two small triangles and one parallelogram: |
| **Part C** | |
| Possible rectangles include:  *Note: the same tans can be rotated to make slightly different rectangles.*   |  |  |  | | --- | --- | --- | | Two large triangles, two small triangles and one parallelogram: | Two large triangles, two small triangles and one square: | Two large triangles, two small triangles and one medium triangle: | | |
| **Extension** | |
| Sample solutions using seven tans: | |

**Measures:** Capacity

**25. Bubbles**

In this task, students use their understanding of measuring and recording capacity, using litre, litre and litre, in a problem-solving context. There is also potential to make this task a hands-on measuring task by providing the students with measuring tools and liquid to compare amounts and find equivalences.

**Focus Skills:**

* *Communicating and expressing*: Discuss and explain mathematical activities.
* *Integrating and connecting*: Recognise mathematics in the environment.
* *Reasoning*: Justify the processes and results of mathematical activities.

**Teaching Points:**

* Begin by reading and discussing the bubble mixture recipe on page 54. Ask questions, such as – *What ingredients do Maya and Danny need?*; *What equipment do they need?*; *Which ingredient do they need the most of? How do you know?*; *What capacity of bowl would you suggest Maya and Danny use? Why?*; *How many steps must they follow? What is the second step?*

Ask students to explain why we need to follow exact measurements.

* Encourage students to think about how they could measure the amount of each liquid. You may choose to make this a more, practical, hands-on task. If so, provide measuring cups or containers marked in quarters so that students have the opportunity to measure out and compare the different liquid amounts.
* The purpose of this task is to encourage students to become confident with exchanging equivalent amounts, e.g. 1 litre is the same as four, litres. Practical measuring will support this.
* In Part A, most students will confidently find one way of dividing the mixture between two containers. For example, filling the first container up to the 1 litre mark and the fourth container up to the litre mark.
* Finding a second way may prove more challenging for some students. Encourage them to see how the containers are the same, e.g. each hold at least of liquid, three of them hold at least a litre of liquid.
* For students who are measuring confidently and show a good understanding of fractions, encourage them to find a second combination that does not include the first container; this will move them to explore how they can break up 1 litre.
* Using cubes to show the relationship between quarters, halves and a whole litre would be beneficial for all students. For example, single blue cubes to represent quarters, 2 red cubes to represent half litres and 4 yellow cubes to represent 1 litre.
* In Part B, students should be able to double the amount of water confidently but may be less sure how to double a litre. If they are struggling, remind students that if they double they will have twice as much. Using the cubes, as described above, work together to show that equal , so double litre of washing-up liquid would be a litre of washing-up liquid.
* Remind students, as necessary, that they need to use the double mixture amount from Part B to solve Parts C, D and E.
* For further extension, ask students to work out how they could divide the mixture between the containers in Parts C and D to use the most containers.
* The extension task could also be explored practically with 2 litre and 1 litre containers and water.

**Anticipated Student Responses:**

|  |  |
| --- | --- |
| **Part A** | **Part B** |
|  | 2 litres of water  litre of washing-up liquid |
| **Part C** | |
|  | |
| **Part D** | |
|  | |
| **Part E** | |
|  | |
| **Extension** | |
| Fill the 1 litre jug with water and pour it into the 2 litre jug. Fill the 1 litre jug again and pour water into the 2 litre jug that is now holding 1 litres of water, to fill it. You will need to use litre of the water to fill it. This will leave 1 litre of 1 water in the 1litre jug. | |

**Data:** Representing and Interpreting Data

**30. The Minibeast Hunt**

This task encourages students to apply their understanding of data and number in a real-life context. It also encourages students to examine different combinations of minibeasts and use a graph or pictogram to represent this information.

**Focus Skills:**

* *Applying and problem-solving*:Apply concepts and processes in a variety of contexts.
* *Integrating and connecting*: Recognise the relationship between verbal, concrete, pictorial and symbolic modes of representing numbers.
* *Implementing*: Execute procedures efficiently.

**Teaching Points:**

* Read Part A of the problem with the class. Link each image with its corresponding name. Encourage the students to think of possible combinations of minibeasts. Some students may like to use interlocking cubes or counters to represent the different types of minibeast.
* In the Maths Talk aspect of this lesson, the students are encouraged to think about any difficulties the children in 2nd Class faced collecting the data. Some observations may include:
  + Minibeasts can be difficult to see.
  + They may have only spent a few minutes looking.
  + They might not know which ones they already counted.
* Ask students to have a look at the grid on page 65 – *What do you think we have to do here?*
* Discuss the purpose of a graph to show findings. Students may reason that graphs need to be clear and precise, so information is easily read. Ask students to discuss the features that pictograms and block graphs have in common as well those that are different.
* Encourage students to think about how they will lay out their graph or pictogram before they start. Ask questions, such as – *Do you think you will use all the space?*; *Will you include any labels?*; *Should you have a title? Where would you include it?* Encourage them to leave the first column and the last row for any labels (at least).
* Discuss how they will represent each of the different minibeasts. For example, they may draw small pictures of each minibeast for labels or as part of their pictogram or use letter abbreviations. Where appropriate, encourage students to include a key so that others can interpret their graph or pictogram correctly.
* Some students may benefit from additional support. Help them to plan out what their graph or pictogram might look like, e.g. draw lines to show them where to write their titles and labels.
* **Further Extension**: Increase the number of minibeasts and ask students to devise a new bar chart or pictogram. Encourage them to keep the number at a reasonable amount, e.g. *How likely are we to see 100 ladybirds compared to 6 ladybirds?* Encourage them to share with a peer and ask them to find out how many minibeast they found in total.

**Anticipated Student Responses:**

|  |  |
| --- | --- |
| **Part A** | **Part B** |
| Possible combinations include:   |  |  |  |  | | --- | --- | --- | --- | | **Ladybird** | **Spider** | **Butterfly** | **Bee** | | 4 | 4 | 4 | 5 | | 5 | 5 | 5 | 2 | | 3 | 3 | 3 | 8 | | 6 | 6 | 3 | 2 | | 4 | 3 | 7 | 3 | | Number of minibeasts  Type of minibeast |
| **Extension** | |
| Students may choose to record the data in a pictogram or chart, for example.  Number of minibeasts found on the hunt  Ladybirds  Spiders  Butterflies  Bees  = 1 minibeast | |