A small sample of our collection of rich problem solving and reasoning activities designed to deepen children’s understanding of the Number strands (place value and calculation) of the National Curriculum for Mathematics and improve their arithmetical proficiency.

The essential maths toolkit
ArithmeKit 3 offers a range of 120 problem solving and reasoning activities to strengthen and deepen understanding of key number and calculation skills and strategies.

The 24 skills and strategies, essential elements of any successful mathematician’s toolkit, have been carefully selected to develop pupils’ conceptual understanding. By exploring the structure of mathematics and noticing relationships, the activities aim to improve fluency in calculation, develop a secure and deep understanding, help pupils make connections and address the requirements of the end of Key Stage 1 and 2 Arithmetic national assessments.

Each section has 2 pages containing 5 activities:

- An activity to develop fluency – just do it! Then use higher order thinking skills to create your own challenge.
- An activity to explore relationships and the structure of an aspect of number. Ask ‘What do you notice?’ to dig deeper.
- A ‘true or false’ statement to investigate further. Do you agree with Colin or Coco? Explore a conjecture by asking ‘When is it true?’
- A missing number activity to develop fluency – just do it! Then use higher order thinking skills to create your own challenge.
- Convince Colin or Coco using resources or jottings.

With thanks to Deborah McCarthy, Chris Tomkins, Suzanne Matthews and Duncan Russell.

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Partition a 2-digit number in different ways

Now try these:

Partition 43:

What do you notice?

What do you notice?

Partition some numbers of your own into a multiple of ten and the rest:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>4 + 60</td>
</tr>
<tr>
<td>64</td>
<td>40 + 4</td>
</tr>
<tr>
<td>64</td>
<td>6 + 58</td>
</tr>
<tr>
<td>64</td>
<td>34 + 30</td>
</tr>
<tr>
<td>64</td>
<td>4 + 54</td>
</tr>
<tr>
<td>64</td>
<td>34 + 30</td>
</tr>
<tr>
<td>64</td>
<td>5 + 59</td>
</tr>
<tr>
<td>64</td>
<td>4 + 54</td>
</tr>
</tbody>
</table>

Create your own odd one out puzzle involving partitioning 2-digit numbers in different ways:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>30 + 23</td>
<td>20 + 43</td>
</tr>
<tr>
<td>63</td>
<td>60 + 3</td>
</tr>
<tr>
<td>20 + 10 + 16</td>
<td>20 + 26</td>
</tr>
<tr>
<td>40 + 6</td>
<td>30 + 16</td>
</tr>
<tr>
<td>55</td>
<td>50 + 5</td>
</tr>
<tr>
<td>10 + 15</td>
<td>50 + 5</td>
</tr>
<tr>
<td>35 + 14</td>
<td>20 + 14</td>
</tr>
<tr>
<td>30 + 14</td>
<td>34</td>
</tr>
</tbody>
</table>

Spot the odd one out in each set:
Partition a 2-digit number in different ways.

Create your own bar model diagrams for other numbers. Can you do it using the digits 0, 2, 3, 4, 5, 6, 7, 8, and 9 once each?

<table>
<thead>
<tr>
<th>8</th>
<th>3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Fill in the missing digits to partition 46.

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Do you agree with Colin? When is this true？

Colin says, “There are 5 ways of partitioning a 2-digit number into tens and the rest.”

24 + 30 = 40 + 14

Convince Coco:

32 + 20 = 40 + 42

Youself using practical resources, convince yourself.
Create your own missing digit problem.

to make all the statements true.

Use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 once each,

Is there only one way to solve this problem?

Put a digit in each box to make the statements true:

\[
\begin{align*}
6 \times & = 12 \\
5 \times & = 30 \\
6 \times & = 36 \\
\div & = 6 \\
\times & = 24 \\
\end{align*}
\]

Recall and use multiplication and division facts for the 6 times table.
Recall and use multiplication and division facts for the 12 times table.

What do you notice?
What do you notice?
What's missing?
Create your own matching pairs problem.

Find the matching pairs:

Build the first five multiples of 12 with base 10 resources:

12 × 6
12 × 7
12 × 8
6 × 12
7 × 12
8 × 12
0 × 12
12 ÷ 12
60 ÷ 12
36 ÷ 12
144 ÷ 12

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Solve problems using percentage and decimal equivalents.

What do you notice?

Write the equivalent fractions:

<table>
<thead>
<tr>
<th>30%</th>
<th>70%</th>
<th>10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>0.7</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Write the equivalent fractions as hundredths and then in their lowest form:

<table>
<thead>
<tr>
<th>40%</th>
<th>80%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Find the matching pairs:

<table>
<thead>
<tr>
<th>75%</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

What is missing?

Create your own matching pairs problem involving decimals and percentages.

What do you notice?

Write the equivalent fractions:

<table>
<thead>
<tr>
<th>40%</th>
<th>80%</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.8</td>
<td>0.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>75%</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td></td>
</tr>
</tbody>
</table>

Create your own matching pairs problem involving decimals and percentages.
Create your own missing digits problem.

Is there only one way to solve this problem?

\[
\frac{s}{1} = 33.3\% \quad \text{(to 1 dp)}
\]

\[
\begin{array}{c}
\square \square \square \square \square = 0.6 \\
\square \square \square \square \square = 0.09 \\
\square \square \square \square \square = 0.006
\end{array}
\]

These statements:
Using the digits 0-9 once, complete

Coco thinks that more are correct than incorrect.

Colin thinks that all correct.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Can't do yet</th>
<th>Can do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Explain about 10s and 1s in 2 digit numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  Compare and order numbers to 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3  Partition a 2 digit number in different ways</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4  Use known facts to 10 to derive other facts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5  Add multiples of 10 to a 2 digit number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6  Add a single digit number to a 2 digit number using known facts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7  Use rounding to add near multiples of 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8  Partition the second number to add 10s then 1s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9  Partition and recombine to add</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Use known facts to 10 to derive other facts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Subtract multiples of 10 from a 2 digit number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Subtract a single digit number from a 2 digit number using number facts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Find the difference between two numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Partition the second number to subtract 10s then 1s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Use rounding to subtract near multiples of 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Recall and use facts for the 2 times table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Recall and use facts for the 10 times table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 Recall and use facts for the 5 times table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Double numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Recognise odd and even numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 Solve multiplication problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 Halve numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23 Use sharing to solve division problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Use grouping to solve division problems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>