Strand: Patterning and algebraic reasoning  
Band: Middle Years  
Standard: 4  
Year Level: 7

Key Idea

Students analyse mathematical structures and use algebraic formulae to represent situations. They further develop the capacity to express themselves, and to solve problems involving linear relationships. [T] [C] [KC1] [KC6]

Students demonstrate, record and report on logical and critical thought processes by searching for and abstracting generational algebraic representations from patterns drawn from current social situations. [In] [T] [KC2]

Outcome

4.9 Analyses, creates and generalises numeric and visual patterns to solve problems in a range of applications. [F] [T] [KC1] [KC6]

4.11 Models contextualised situation, making connections and analysing change. [In] [T]

Task/Activity

Using the assessment tasks provided in exemplar section, students demonstrate knowledge and understanding of number patterning, simple algebraic rules and their application

Examples of evidence towards achievement of outcomes

Students:

- Analyse – demonstrate ability to find pattern in sequences and problems provided.
- Create – demonstrates ability to author own number patterns.
- Generalise numeric and visual patterns to solve problems – demonstrates ability to identify rules and apply them to solve problems.
- Model contextualised situation – identifies rules from written problem and identifies the change.
Exemplar/Description
This assessment assumes that students have a basic understanding of the rules of algebra and their simple application as required in standard 3

A. Complete the series
   (a) 2, 4, 6, 8, ___, ___, ___, ___.
   (b) 30, 26, 25, 21, ___, ___, ___, ___.
   (c) 31, 29, 23, 19, ___, ___, ___, ___.
   (d) 3, 10, 31, 94, ___, ___, ___.
   (e) Own number sequence.

B. Number lines
   (a) Complete the number line

   3.2 \hspace{1cm} 3.6 \hspace{1cm} 4.4 \hspace{1cm} 5.6

   (b) Place the following fractions on a number line

   2/3, 5/6, ¾, 11/12

   (c) Create a number line for a partner to solve.

C. Rule identification
   (d) If the rule is $\Delta = \square - 3$ fill out the table

<table>
<thead>
<tr>
<th>$\square$</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>19</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (e) Find the rule and complete the table

<table>
<thead>
<tr>
<th>$\square$</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>14</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\checkmark$</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write the rule ____________________________________________________________
D. Application

Four pieces of wood of equal length are joined to make a square framework

More pieces of wood are added to make 2, 3, 4, & … squares as shown in the diagram.

(a) Using columns headed ‘S’ for the number of squares and ‘P’ for the number of pieces of wood needed, draw up a table of values for 1, 2, 3, & 4 squares.

(b) Extend the table to show the number of pieces of wood needed for 5 squares and 7 squares.

(c) Use the table to find the rule connecting ‘P’ and ‘S’.

(d) Use the rule to find the number of pieces of wood needed to make 10 squares and 15 squares.

Answers

A. Complete the series

(a) 2, 4, 6, 8, 10, 12, 14, 16  (even numbers)

(b) 30, 26, 25, 21, 20, 16, 15, 10.  (-4, -1)

(c) 31, 29, 23, 19, 17, 13, 11, 7.  (descending prime numbers)

(d) 3, 10, 31, 94, 283, 850, 2551.  (x3 +1)

(e) Own number sequence.

B. Number lines

(a) Complete the number line

2 3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8 5 5.2 5.4 5.6 5.8 6

(b) Place the following fractions on a number line

\( \frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{11}{12} \)

(c) Create a number line for a partner to solve.
C. Rule identification
(a) If the rule is \( \Box = \Delta - 3 \) fill out the table

<table>
<thead>
<tr>
<th>( \Box )</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>19</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta )</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>11</td>
<td>16</td>
<td>18</td>
</tr>
</tbody>
</table>

(b) Find the rule and complete the table

<table>
<thead>
<tr>
<th>( \Box )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>12</th>
<th>14</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \downarrow )</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>24</td>
<td>28</td>
<td>38</td>
</tr>
</tbody>
</table>

Write the rule: \( \Box = \downarrow + \Box \)

D. Application
Four pieces of wood of equal length are joined to make a square framework

More pieces of wood are added to make 2,3,4, & …… squares as shown in the diagram.

(f) Using columns headed ‘S’ for the number of squares and ‘P’ for the number of pieces of wood needed, draw up a table of values for 1,2,3, & 4 squares.

(g) Extend the table to show the number of pieces of wood needed for 5 squares and 7 squares.

(h) Use the table to find the rule connecting ‘P’ and ‘S’.

(i) Use the rule to find the number of pieces of wood needed to make 10 squares and 15 squares.

<table>
<thead>
<tr>
<th>S</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>22</td>
</tr>
</tbody>
</table>

\( P = 3S + 1 \)

For 10 squares
\[ P = (3 \times 10) + 1 \]
\[ = 30 + 1 \]
\[ = 31 \]

For 15 squares
\[ P = (3 \times 15) + 1 \]
\[ = 45 + 1 \]
\[ = 46 \]