**Count the Quilt Blocks**

Paul and Tom were working on predicting the number of quilt blocks (unit squares) in the following pattern:

![Figures 1 to 4](image)

1. Use the above figures, complete the following table:

<table>
<thead>
<tr>
<th>Figure Number</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Unit Squares</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Is the relation between the “Figure Number” and the “Number of Unit Squares” a function? Why or Why not?

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3. Write the first seven terms of the sequence for the number of unit squares.

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4. What kind of sequence is this? Justify your reasoning.

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5. If $a_1$ denotes the first term of the sequence and $r$ represents the common ratio, then find the values of $a_1$ and $r$.

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6. Write the “Recursive Formula” to find the $n^{th}$ term $a_n$ for this sequence.

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7. Complete the following table:

<table>
<thead>
<tr>
<th>Fig No.</th>
<th>(n)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of unit squares $(a_n)$</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of unit squares $(a_n)$ (in factored form &amp; use prime factors)</td>
<td>5*1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of unit squares $(a_n)$ (in exponential form in terms of the common ratio)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Observe the conversation between Paul and Tom:

Paul: This one works a lot like the last quilt pattern to me. The only difference is that the pattern is doubling, so I knew it was exponential. I thought that it starts with 5 blocks and doubles, so the \( n \)th term of the sequence is \( a_n = 5(2)^n \)

Tom: I don’t know about that. I agree that it is an exponential function—just look at that growth pattern. However, I used the numbers in the table and got \( a_n = 5(2)^{n-1} \).

8. What is different about the process that Paul and Tom used to come to create their equations?

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9. Who is right? Why? Write the correct **explicit formula** to find the \( n \)th term \( a_n \) of the geometric sequence.

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10. Use the above explicit formula, find the number of unit squares in Fig. 8, Fig.12, and Fig.15?

   Number of squares in Fig.8, \( a_8 \) = ____________________________

   Number of squares in Fig.12, \( a_{12} \) = ____________________________

   Number of squares in Fig.15, \( a_{15} \) = ____________________________

11. Which figure will have 327,680 unit squares? Explain your reasoning.

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_____________________________________________________________________
12. Complete the following table and graph the sequence:

<table>
<thead>
<tr>
<th>Figure Number (n)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unit squares $a_n$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. Should we connect the points on the graph? Explain your reasoning.

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14. Use technology, derive the exponential function f(x) for this sequence.

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15. What can you conclude about the recursive formula, explicit formula, and the function form of this geometric sequence?

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16. Write a real life example for a geometric sequence and express it as an exponential function.

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Practice problems: