Sidewalk Patterns

In Prague some sidewalks are made of small square blocks of stone.

The blocks are in different shades to make patterns that are in various sizes.

Pattern #1

Pattern #2

Pattern #3

Draw the next pattern in this series.

Pattern #4
1. Complete the table below

<table>
<thead>
<tr>
<th>Pattern number, n</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
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<td>Total number of blocks</td>
<td>25</td>
<td>81</td>
<td>169</td>
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</table>

2. What do you notice about the number of white blocks and the number of gray blocks? 
   
   There is 1 more gray block than white block.

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.
   
   a. Fill in the blank spaces in this list.
      
      \[ 25 = 5^2 \quad 81 = 9^2 \quad 169 = 13^2 \quad 289 = 17^2 \]

   b. How many blocks will pattern #5 need? 
      
      \[ 21^2 \text{ or } 441 \]

   c. How many blocks will pattern #n need? 
      
      \[ (4n+1)^2 \]

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.
   
   \[ \text{Subtract } 1 \text{ from the total number and then divide that by } 2. \]

   b. Pattern #6 has a total of 625 blocks. 
      
      How many white blocks are needed for pattern #6? 
      
      \[ 312 \text{ blocks} \]
      
      Show how you figured this out.
      
      \[ (625 - 1) = 624 \quad \frac{624}{2} = 312 \]
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2. What do you notice about the number of white blocks and the number of gray blocks?

\[ \text{gray} = \text{white} + 1 \]

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

a. Fill in the blank spaces in this list.

\[ 25 = 5^2 \quad 81 = \frac{9^2}{3} \quad 169 = \frac{13^2}{3} \quad 289 = 17^2 \]

b. How many blocks will pattern \#5 need?

\[ 21^2 \]

c. How many blocks will pattern \#n need?

\[ (4n+1)^2 \]

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

\[ x + x + 1 = t \]

so \[ x = \frac{t-1}{2} \]

\[ \text{gray} = \text{white} + 1 \] so \[ \text{gray} + \text{white} = \text{total} \]

b. Pattern \#6 has a total of 625 blocks.

How many white blocks are needed for pattern \#6? Show how you figured this out.

\[ x + x + 1 = 625 \]

\[ 2x + 1 = 625 \]

\[ 2x = 624 \]

\[ x = 312 \]

\[ \frac{312}{\text{blocks}} \]
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Pattern #1

Pattern #2

\[10 + 2\frac{1}{2} = 4\]

Pattern #3

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2. What do you notice about the number of white blocks and the number of gray blocks?

\[ \text{No. of white} = \text{gray} + 1 \]

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

a. Fill in the blank spaces in this list.

\[ 25 = 5^2 \quad 81 = 9^2 \quad 169 = 13^2 \quad 289 = 17^2 \]

b. How many blocks will pattern \#5 need?

\[ 21^2 \]

c. How many blocks will pattern \#n need?

\[ (4n + 1)^2 \]

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

You can subtract 1 from the total \# and then \( \div 2 \)

b. Pattern \#6 has a total of 625 blocks.

How many white blocks are needed for pattern \#6?

Show how you figured this out.

\[ 625 - 1 = 624 \Rightarrow 624 \div 2 = 312 \]
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2. What do you notice about the number of white blocks and the number of gray blocks?

There is always 1 more gray than a white block.

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

a. Fill in the blank spaces in this list.

\[ 25 = 5^2 \quad 81 = 9^2 \quad 169 = 13^2 \quad 289 = 17^2 \]

b. How many blocks will pattern #5 need? \[ 21 \]

c. How many blocks will pattern \(n\) need? \[ 4n+1 \] blocks

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

\[ \text{# of white blocks} = \frac{\text{total # of blocks} - 1}{2} \]

b. Pattern #6 has a total of 625 blocks.

How many white blocks are needed for pattern #6? 

312 white blocks

Show how you figured this out.

\[ w = \frac{\text{total} - 1}{2} \]
\[ w = \frac{625 - 1}{2} \]
\[ w = 624 \div 2 \]
\[ w = 312 \]
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2. What do you notice about the number of white blocks and the number of gray blocks?

The gray blocks always have 1 more than the white blocks.

3. The total number of blocks can be found by squaring the number of blocks along one side of the pattern.

   a. Fill in the blank spaces in this list.

   \[ 25 = 5^2 \quad 81 = q^2 \quad 169 = b^2 \quad 289 = 17^2 \]

   b. How many blocks will pattern #5 need?

   441 blocks

   c. How many blocks will pattern #n need?

   \((n \times 4 + 1)^2\)

4. a. If you know the total number of blocks in a pattern you can work out the number of white blocks in it. Explain how you can do this.

You can use the equation \(x + (x+1)^2\) the total # of blocks.

   \(x\) will be the # of white blocks.

b. Pattern # 6 has a total of 625 blocks.

   How many white blocks are needed for pattern #6?

   Show how you figured this out.

   \[ x + (x + 1)^2 = 625 \]

   \[ 2x + 1 = 624 \]

   \[ x = 312 \]

   312 white blocks