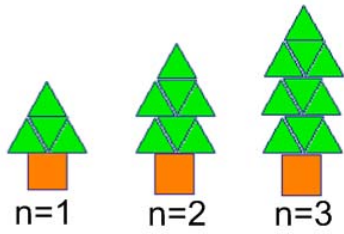
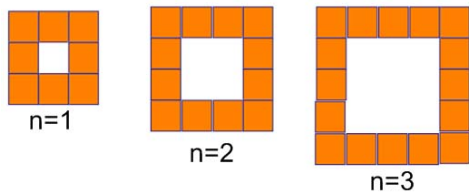


Pattern problems. For each, find and explain the pattern.

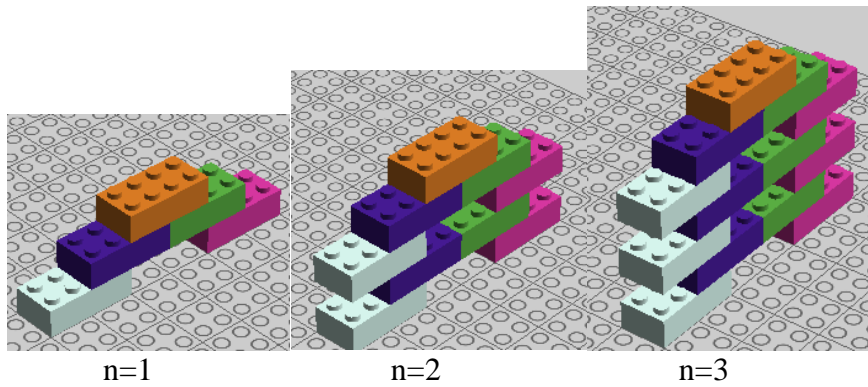
1. Number of pattern blocks needed at step n .



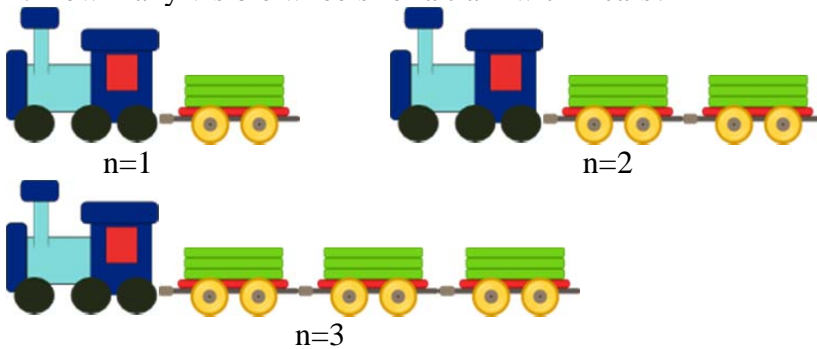
2. Number of pattern blocks needed at step n .



3. Number of LEGOs needed at step n



4. How many visible wheels for a train with n cars?

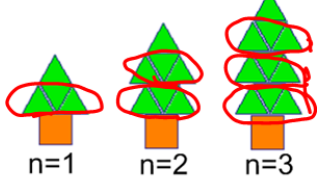


Solutions:

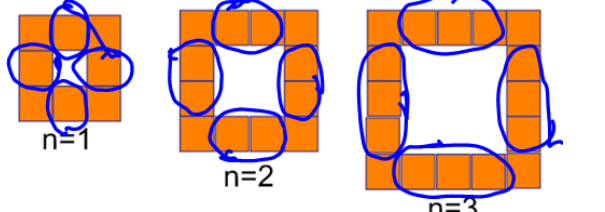
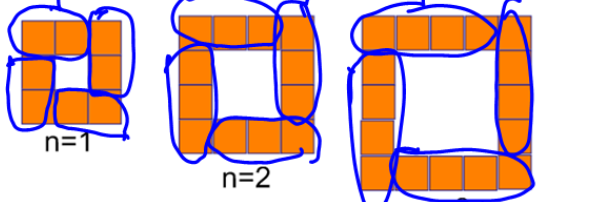
All answers should have

- groups circled
- how many in each group and the number of groups explained
- the number of left overs to be added on explained
- the final formula

1. Number of pattern blocks needed at step n.

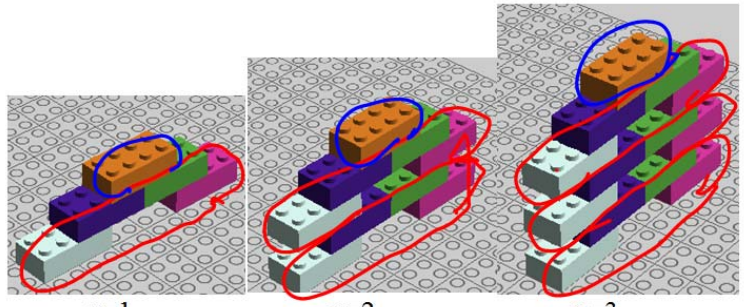
| | |
|--|--|
|  <p>n=1 n=2 n=3</p> | <p>Each group (circled in red) has 3 pattern blocks. The number of groups is the same as n, so there are n groups of 3 circled pattern blocks ($3n$).</p> <p>There is one more block on the top and one at the bottom ($+1+1$)</p> <p>$3n+1+1$ or $3n+2$</p> |
|--|--|

2. Number of pattern blocks needed at step n. There are many ways to find this pattern. Here are two of the most common:

| | |
|--|---|
|  <p>n=1 n=2 n=3</p> | <p>At each step there are 4 groups circled, and each group has n squares in it (4 groups of $n = 4n$). There are 4 more squares on the corners of each, so $+4$.</p> <p>$4n+4$</p> |
|  <p>n=1 n=2 n=3</p> | <p>At each step there are 4 groups circled, and each group has one more than n squares ($n+1$). 4 groups of $n+1$: $4(n+1)$</p> |

3. Number of LEGOs needed at step n

This is the pattern I see. Other groupings are possible

| | |
|--|---|
|  <p>n=1 n=2 n=3</p> | <p>The red circled groups have 4 LEGOs. There are n red circled groups at step n. There are n sets of 4, which is $4n$ circled in red.</p> <p>There is one extra LEGO on top, so $+1$.</p> <p>$4n+1$</p> |
|--|---|

4. How many visible wheels for a train with n cars?

| | |
|--|---|
| <p>The image shows three diagrams of trains. Each diagram consists of a locomotive and a certain number of cars. The locomotive has three visible wheels, which are circled in blue. Each car has two visible wheels, which are circled in red. The number of cars is labeled as $n=1$, $n=2$, and $n=3$ respectively. In the $n=1$ diagram, there is one car with 2 visible wheels. In the $n=2$ diagram, there are two cars, each with 2 visible wheels. In the $n=3$ diagram, there are three cars, each with 2 visible wheels.</p> | <p>There are 2 visible wheels on each car (circled in red), and there are n cars. There are n sets of 2 wheels. The locomotive has 3 visible wheels, so $+3$. $2n+3$.</p> |
|--|---|