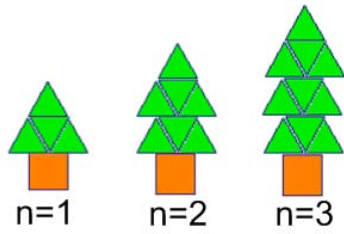
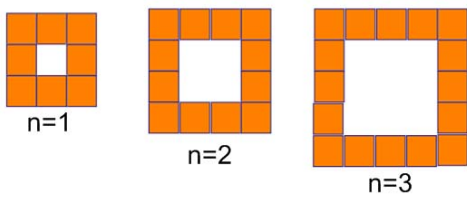


Pattern problems. For each, find and explain the pattern.

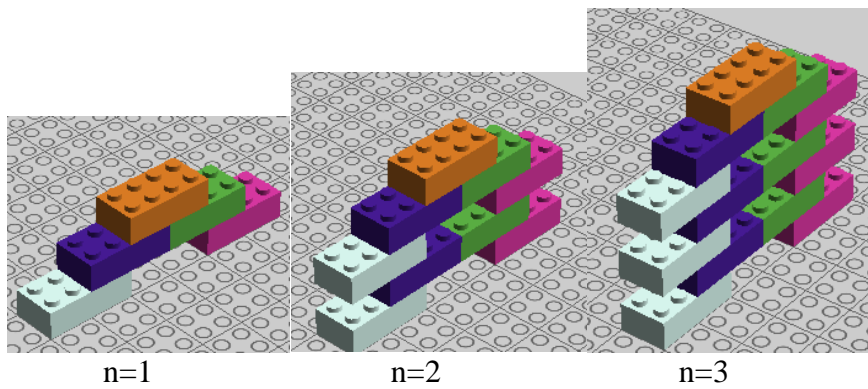
1. Number of pattern blocks needed at step n .



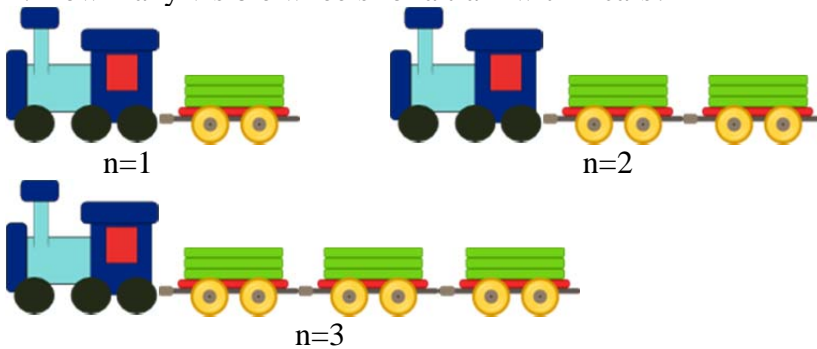
2. Number of pattern blocks needed at step n .



3. Number of LEGOs needed at step n



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

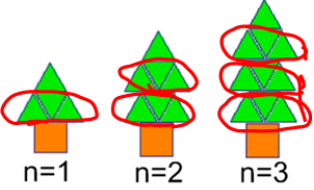


Solutions:

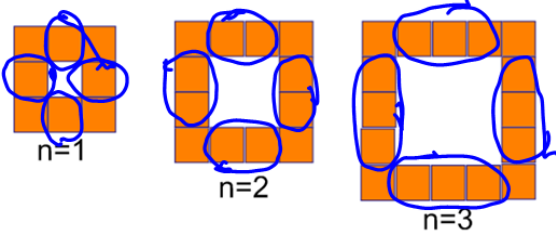
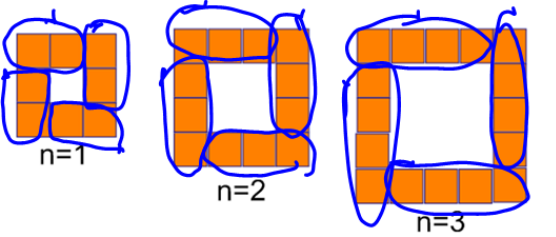
All answers should have

- 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.

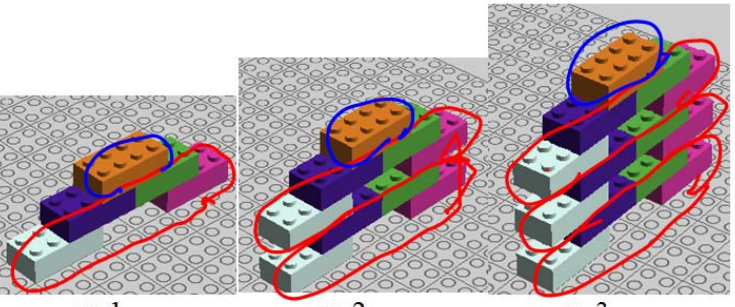
 <p>n=1 n=2 n=3</p>	<p>Each group (circled in red) has 3 pattern blocks. The number of groups is the same as n, so there are n groups of 3 circled pattern blocks ($3n$).</p> <p>There is one more block on the top and one at the bottom ($+1+1$)</p> <p>$3n+1+1$ or $3n+2$</p>
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2. 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>
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4. How many visible wheels for a train with n cars?

<p>The diagrams show three trains. The first train has one locomotive and one car. The locomotive has 3 visible wheels (circled in blue) and the car has 2 visible wheels (circled in red). The second train has one locomotive and two cars. The locomotive has 3 visible wheels (circled in blue) and each of the two cars has 2 visible wheels (circled in red). The third train has one locomotive and three cars. The locomotive has 3 visible wheels (circled in blue) and each of the three cars has 2 visible wheels (circled in red).</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>
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