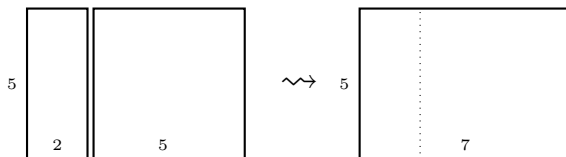
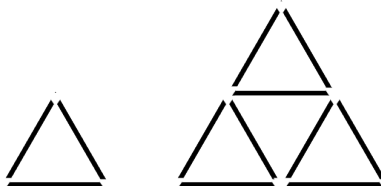


Instructions: Same rules as usual - turn in your work on separate sheets of paper. You must justify all your answers for full credit.

- (8pts) 1. For each sequence given below, find a closed formula for a_n , the n th term of the sequence (assume the first terms are a_0) by relating it to another sequence for which you already know the formula. In each case, briefly say how you got your answers.
- (a) 4, 5, 7, 11, 19, 35, ...
 - (b) 0, 3, 8, 15, 24, 35, ...
 - (c) 6, 12, 20, 30, 42, ...
 - (d) 0, 2, 7, 15, 26, 40, 57, ... (Cryptic Hint: these might be called “house numbers”)
- (8pts) 2. Starting with any rectangle, we can create a new, larger rectangle by attaching a square to the longer side. For example, if we start with a 2×5 rectangle, we would glue on a 5×5 square, forming a 5×7 rectangle:



- (a) Create a sequence of rectangles using this rule starting with a 1×2 rectangle. Then write out the sequence of *perimeters* for the rectangles (the first term of the sequence would be 6, since the perimeter of a 1×2 rectangle is 6 - the next term would be 10).
 - (b) Repeat the above part this time starting with a 1×3 rectangle.
 - (c) Find recursive formulas for each of the sequences of perimeters you found in parts (a) and (b). Don't forget to give the initial conditions as well.
 - (d) Are the sequences arithmetic? Geometric? If not, are they *close* to being either of these (i.e., are the differences or ratios *almost* constant)? Explain.
- (8pts) 3. If you have enough toothpicks, you can make a large triangular grid. Below, are the triangular grids of size 1 and of size 2. The size 1 grid requires 3 toothpicks, the size 2 grid requires 9 toothpicks.



- (a) Let t_n be the number of toothpicks required to make a size n triangular grid. Write out the first 5 terms of the sequence t_1, t_2, \dots
- (b) Find a recursive definition for the sequence. Explain why you are correct.
- (c) Is the sequence arithmetic or geometric? If not, is it the sequence of partial sums of an arithmetic or geometric sequence? Explain why your answer is correct.
- (d) Use your results from part (c) to find a closed formula for the sequence. Show your work.