**Directions:** Solve the following problems. All written work must be your own. See the course syllabus for detailed rules.

1. Prove that if it is possible to tile an $m \times n$ grid with $4 \times 1$ rectangular tiles, then at least one of the side lengths is divisible by 4. (Hint: find a way to color the grid with 4 colors so that each tile covers one cell of each color.)

2. [SS 1.3.1] Let $a_0 = 0$ and $a_n = 3a_{n-1} + 2$ for $n \geq 1$.

   (a) Find the first few values of the sequence $a_n$ and use this to guess a general formula.

   (b) Use induction to prove that your general formula from part (a) is correct.