

Please complete the following questions by Wed January 12th at 9:00 am. Show all your reasoning. Use diagrams to illustrate questions 3,4 and 5.

1. For the following sequences, find a recursive formula and a general formula
 - (a) 10,7,4,1,...
 - (b) 3,-6,12,-24, ...
2. A sequence is defined by the relation $u_n = u_{n-1} + 5$ with $u_1 = 3$. Find a general formula for the sequence and hence find the 30th term.
3. A ball is dropped and bounces to $3/4$ of its original height. On each successive bounce its height is reduced further by a factor of $3/4$. If the ball is released from a height of 4 feet, find
 - (a) the maximum height it reaches after the first, second, third, and fourth, bounce.
 - (b) how many bounces it takes before the ball no longer bounces higher than 6 inches above the ground.
 - (c) a recursive formula for the height after n bounces.
 - (d) a general formula for the height after n bounces.
4. Consider the problem of stacking balls in the shape of a square pyramid. On the top there is one ball, on the next level there are 4 balls arranged in a square on the next level there are 9 balls arranged in a square and so on. The total number of balls in a square pyramid with n levels is called a square pyramidal number.
 - (a) What is the total number of balls in a pyramid of 2 levels? 3 Levels? 4 Levels?
 - (b) How high a pyramid could you build with 100 balls?
 - (c) Find a recursive formula for the n th square pyramidal number.
 - (d) Challenge for the mathematically inquisitive: Find a general formula the n th square pyramidal number.
5. A drone bee is a male bee in a hive whose sole purpose in life is to fertilize the eggs produced by the queen bee. Interestingly fertilized eggs always result in female bees. A new drone is produced from an egg which is not fertilized. Consequently a drone bee has a mother (the queen) but no father! On the other hand, as a female the queen bee has both a mother and a father.
 - (a) How many grand parents does a drone have?
 - (b) How many great grand parents does it have? How many great great grand parents? What sequence is this?
 - (c) Find an recursive definition for the resulting sequence?