

### **The Bee Family Tree**

Drones, or male bees, come from unfertilized eggs laid by queen bees. Thus, genetically, a drone has a mother but no father. Female bees are either queen bees or worker bees, and they hatch from fertilized eggs, thus a queen bee has a genetic mother and father. Note that queen bees lay eggs and worker bees don't.

We will call parents Level 1 ancestors. Grandparents will be Level 2 ancestors; great-grandparents Level 3 ancestors etc. Thus a drone has one Level 1 ancestor and a queen has two Level 1 ancestors.

How many grandparents (Level 2 ancestors) does a drone have? A queen? You should see that the answers are 2 and 3, respectively.

Here are some questions to explore about the bee family tree:

- How many Level 5 ancestors does a drone have? A queen? Find a representation that clearly demonstrates your answer. For this and most of the rest of the questions, assume that there is no cross-breeding, i.e. that each bee in the family tree is a different bee (no mating between third cousins once removed, etc.)
- How about Level 10 ancestors? Level 20? You might (or might not) want to find a different representation to help explore this question. Look for patterns. Consider using a spreadsheet (note that I have a video that's quite relevant to this question, but I'm not going to tell you which one just yet).
- How can you create a convincing explanation that your answers for Level 20 are correct? If you found your answers by using a pattern, can you explain how the pattern you found connects to the information about bees given in the problem?
- Assuming no cross-breeding, how many Level 5 genetic ancestors do you have? Level 10? Level 20? Compare your number of ancestors to the bees. Is the assumption of no cross-breeding realistic? Why or why not?

Note that I will collect this as your first "regular homework." Please read the guidelines on writing up regular homework.