Please discuss the following questions with your assigned groups. You may take notes on all items you discuss with your classmates, however you are to write up your solutions independently of one another and without assistance. Your solutions should be written up carefully and neatly on a separate sheet of paper. You should write in **complete sentences** and explain all steps taken and tools used (such as theorems or results from class) in reaching your final answers. *Please also include at the top of your write-up a list of people with whom you discussed these problems.*

1. Below is the "hat problem" from last week's worksheet. Show mathematically (i.e. symbolically) that the reasoning you gave as a solution is a valid argument. That is, state your hypotheses and show that you can logically deduce you conclusion.

    A box contains 3 black and 2 white hats. Three people standing in a line are facing forward and each can see only the person or persons in front of her. Each of the three people had one of the hats placed on her head but does not see which color. Each person can, however, see any hats in front of her and each knows what hats were in the box to begin with. When the person in the rear is asked what color her hat is, she replies, "I don't know." When the person in the middle is asked, she answers, "I don't know." When the person in front is asked, she responds, "I know what color my hat is." What color is it?

2. You are a contestant on a game show. In front of you are two doors – behind one door is a new car, behind the other is a goat. There are two game show hosts, one standing in from of each door. One host always tells the truth and the other always lies, though you do not know which is which. You can ask just one yes-or-no question of one of the hosts, then you must choose one door and will win the prize behind it. What question should you ask?

    a. Explain how you chose your question.
    b. Show symbolically that your reasoning is a valid argument. That is, state your hypotheses and show that you can logically deduce your conclusion.

3. You sit down on a park bench one afternoon next to a man who turns out to be a very talkative father. He begins telling you about his children and mentions how many daughters he has. When you ask how many sons he has, he says:

> "Each of my children has the same number of brothers and the same number of sisters as each of the other children."

How many sons does he have?

   a. Explain how you figured out the number of sons.
   b. Show symbolically that your reasoning is a valid argument. That is, state your hypotheses and show that you can logically deduce your conclusion.