1. The term "racist" can be defined to mean

"The belief that all members of a race uniformly possess characteristics or abilities held by some of that race, especially to distinguish it as inferior or superior to other races."

Explain IN ONE OR TWO SHORT SENTENCES how the idea of mathematical proof is incompatible with racist thought.

2. A theorem is a statement that has a proof, so the truth of the statement is beyond doubt in all situations where it applies. However, in the "Template for doing Mathematics", having a proof might not lead to fame and fortune because the original problem has not been solved and we may have to "circle back". If a proof is such a great thing, why might it be necessary to continue working on the original problem after providing proofs of the conjectures?
3. Suppose that the rate of use of a rare mineral "Hallium" is growing exponentially, doubling every 15 years

   (a) Suppose about half the known world supply of Hallium has been used up in the last 100 years. Does that (and the information above) mean that there is another 100 years worth of Hallium left in the world? Why or why not?

   (b) Suppose a discovery is made that doubles the world supply of Hallium. Assuming the same rate of growth of usage of Hallium, now is there enough for another 100 years? Why or why not?

4. (a) Suppose a rumor spreads by each person who knows the rumor telling one new person the rumor every hour. If one person starts the rumor, how long will it take until about 1000 people know the rumor? Justify your answer in a sentence.

   (b) How much total time will it take until 2000 people know the rumor? (Justify your answer in a short sentence using part a)

   (c) Approximately how much time will it take until $1,000,000,000$ know the rumor? (Justify your answer in a short sentence using part a)
5. The graphs below show the population this year vs. the population next year for two exponential growth models with harvesting. One is for mosquitoes that are heavily harvested and the other is elephants with small harvesting. (The solid line is the model graph, the dashed line is the line where “population this year = population next year”).

(a) Which is which? (Explain in a sentence how you know.)

(b) Approximate how large the harvesting rate would have to be in order to drive a mosquito population of 3000 extinct.
6. (a) If we flip four coins (each has a “heads” side and a “tails” side), how many possible outcomes are there? (You do NOT need to make a list, just find the number of outcomes and justify your count).

(b) Under the Equally likely outcomes model, what is the probability of getting at least 3 heads? Justify your answer.

7. Suppose an opinion poll finds that 57% of a sample will vote “yes” on a particular issue with a margin of error of plus or minus 9% at the 95% confidence level. State precisely what you can say from this information.
8. Suppose a poll in a 2 candidate race has a margin of error of plus or minus 16%. This is a very large margin of error. How much larger would the sample need to be in order to have a margin of error of only plus or minus 4%?

9. Suppose you conduct a poll for a two candidate race. You find that 56% of 18-24 year olds support candidate A while 42% of those 25 and above support candidate A. You compute the Log-odds-ratio of your data and find it is 0.288. From the data of your sample, you compute the margin of error at the 95% confidence level for the log-odds-ratio and find it is 0.182.

(a) Verify that you are 95% confident that there is an association between age and proportion of support for candidate A? (That is, what (easy) computation do you have to do to justify this statement?)

(b) It is, of course, tempting to claim that candidate A's stand on the issues appeals more to younger voters. What are possible lurking variables for cases like this? (Name at least two.)