Mathematical Modeling Task – Modeling with Linear Functions

I was watching the running events at the IAAF Athletics Championships from Beijing running earlier this year and was very impressed with how FAST these athletes are!!!!! So I started thinking about winning championships and what sort of time it would take to win a championship at a running event. Here is a link to Usain Bolt's run of 9.79s to win the 100m race and, being a Math teacher, of course I wondered if there was a trend in the records of gold medal winning times (or distances) over the past 50 years or so. I also wondered that if a trend does exist, can I develop a mathematical model for the trend and use that trend to make predictions? Hence, your PROJECT came to my mind!!! HAHA!!

So you will select an Olympic/IAAF event that both Men and Women have been competing in since 1948. You will use linear functions to model the winnings times/distances of both the men's and women's gold medal times/distances from these previous Olympic Games. You will determine the linear equations that best models your data. Then you will use your linear functions in order to find and interpret the intersection point.

In this project, then, you will take the role of a reporter whose job is to display trends in men's and women's gold medal winning times/distances in a particular event (Other roles are possible – discuss ideas with us!!). You will then analyze these trends to make future predictions about the winning times/distances in the men's and women's events. Your finished product will be *a newsletter, article, poster, or television report (video)* ,etc…. that includes all of the items addressed below.

PART 1 – DATA:

1. Select an Olympic event in which both men and women have been competing in since the 1948 Olympics. Research to find the winning time/distance for both the M and W for each Olympiad and tabulate your data. Cite your source(s).

PART 2 – ANALYSIS – TRENDS:

2. Decide upon the independent and dependent variables you wish to use and also HOW to use them.

3. Prepare a properly presented scatter-plot of the Men's data.
4. Using this HAND DRAWN graph, draw your best approximation of the line of best fit.
5. Determine the slope of this line you drew. Explain what the slope of your line means.
6. Determine the y-intercept of your line. Explain what the y-intercept of your line means.
7. Write the equation of your line.

8. Now, using technology, prepare a scatter-plot and use the technology to draw the line of best fit and state its equation. Make sure you include this graph in your report as well.
9. Compare and contrast the slopes & intercepts of the two equations (your equation and the equation from the technology). Explain why these should/should not be similar.
10. State the domain and range of your linear function. EXPLAIN the rationale behind your stated domain and range

11. Repeat the process (parts 3 – 10) with the Women's data.

PART 3 – ANALYSIS – PREDICTIONS:

12. Predict the winning times/distances for the 2016 Olympics in Rio de Janeiro
13. Extend your linear functions (the MEN's and WOMEN's functions) as necessary in order to find the intersection point of the 2 linear functions. Determine this intersection point from the graph and interpret its meaning in context. Explain whether or not your result is reasonable.
14. Use algebraic methods to VERIFY your graphically determined intersection point

PART 4 – EXTENSION – IS IT REALLY TRUE THAT……??

15. Mr. S has decided that the data for this event is really EXPONENTIAL in nature, not linear. Therefore, determine the equation (in the form of $f(x) = ab^x + c$) for the data for the Men and Women. State what the parameters a,b,c represent in the context of this question. Now, do the two functions intersect? If so where and verify. If not, why not?