Modeling an Ironman Race

June 30, 2018

Uses Algebra 1 concepts

A triathlon is a 3 sport event consisting of swimming, biking, and running (in that order). Triathlons can be of various lengths. The longest distance being that of the Ironman distance triathlon. This race totals in 140.6 total miles. The breakdown is as follows; 2.4 miles swimming, 112 miles biking, and 26.2 miles running. Simon is preparing to do his first Ironman triathlon and wants to have a realistic idea of how his race might go. Create a model that represents a realistic Ironman race.

1. What assumptions are you making?

2. What are your variables?

3. Write your model.

4. Tell about your results.

5. Graph your results

6. How could you have modeled the Ironman race in a different way?

Prepared by Cameron Cook, Suzanne Lenhart and Greg Wiggins for NIMBioS

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1. What assumptions are you making?

   I will assume Simon swims 2mph for the entirety of the swim component, bikes 16mph for the entirety of the bike component, and runs 7mph for the entirety of the run component. I will also assume that he instantly begins each new piece of the race(i.e. takes no time to transition from one piece to another)

2. What are your variables?

   Time t is the amount of time elapsed (since the beginning of the race) when the competitor has completed a distance d in miles. You could model this situation a number of ways. Note it is not often time is the dependent variable in models, but in this case it makes since to consider this as your race time depends on how fast you travel a certain distance.

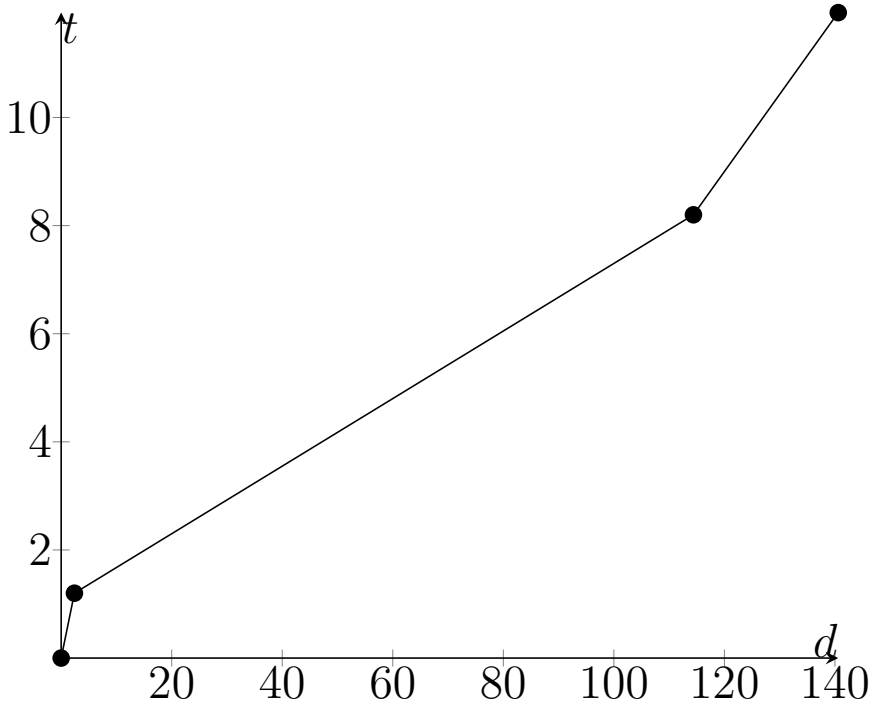
3. Write your model.

$$t(d) = \begin{cases} \frac{d}{2} & 0 \leq d \leq 2.4 \\ 1.2 + \frac{d-2.4}{16} & 2.4 < d \leq 114.4 \\ 8.2 + \frac{d-114.4}{7} & 114.4 < d \leq 140.6 \end{cases}$$

4. Tell about your results.

   The total time is 11.94 hours. The first piece was the simplest to determine since we were starting from time 0. Time= Distance/Velocity, so the time during that component is determined by distance/2. Now, for the next two piece if we want our function to model the accumulated time for the whole race we need to start the second leg, the bike, at the time the swim leg ended, thus the 1.2 hour shift. We also want to consider the triathlon as an accumulation of the three events. Thus, we want the bike event to start at mile 2.4 and we show that mathematically with the independent variable shift before dividing the distance by the velocity to obtain the time spent completing that component. The running piece was calculated similarly to the biking piece. Also, note that the slope is not the speed. So a larger slope does not mean a higher speed.

5. Graph your results



6. How could you have modeled the Ironman race in a different way?

   One could consider each piece separately. One could also model distance as a function of time (Probably a more common way to do this), or velocity or model time as a function of velocity. Or, one could model velocity as a function of time or distance. Distance vs time is nice as the slope would be the speed of the athlete in each piece, the times spent in each event would need to be found in order to write the piecewise function.

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