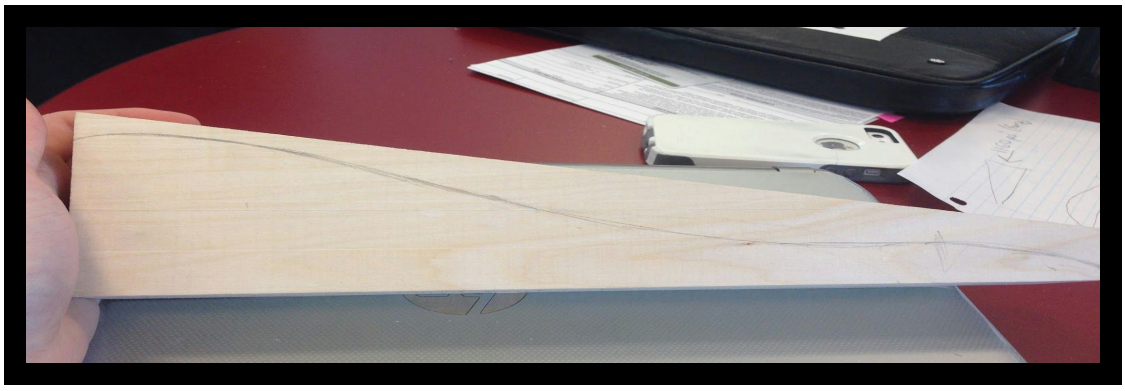
April 3, 2015
MHF4UI

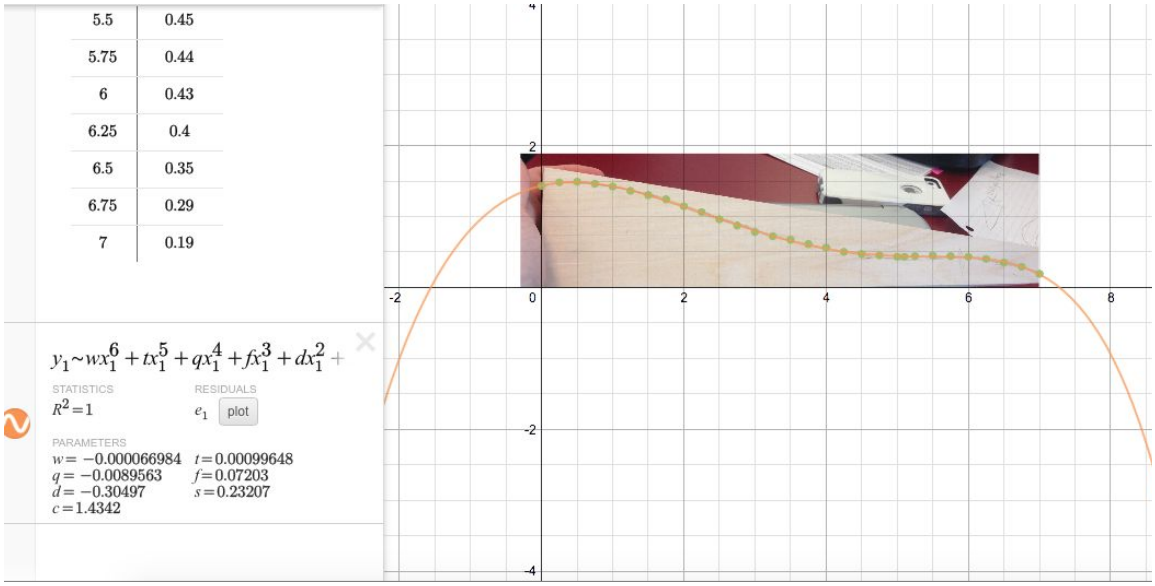
The CO2 Racer Challenge



The CO2 Racer Challenge
Thinking Assignment #1
Day 1

1) Using technology, take a side profile picture of the block of wood that you will be using to make your car.
2) Insert this picture into Desmos and place the bottom left corner of the wood block at the origin.
3) Using a polynomial equation of your own design, create and draw a curve that will represent the overall shape of your race car. Be sure to discuss your design with your group members as they are the ones building the race car.
4) Save a copy of your Desmos film and make sure you share it with your group members. Include a link to your Desmos file below. Feel free to draw or record your design directly onto your race car.

My Desmos File is available here: https://www.desmos.com/calculator/p3bwgwrdjw

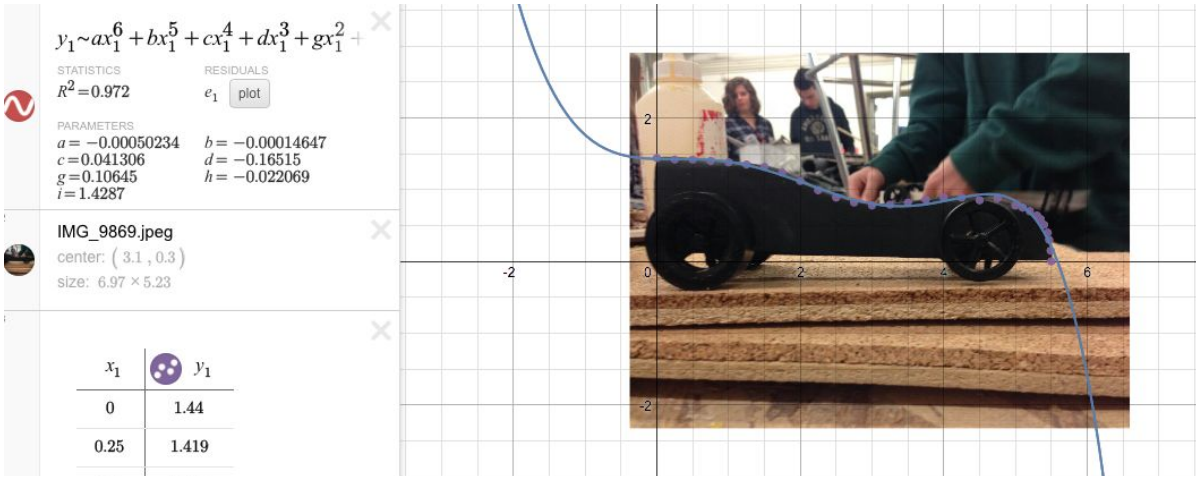


$f(x)=-0.000066984x^6+0.00099684x^5-0.0089563x^4+0.07203x^3-0.30497x^2+0.23207x+1.4342$

The CO2 Racer Challenge

Thinking Assignment #1
Day 2

1) Take a profile picture of your finished race car.
2) Determine the speed of your car by measuring the distance it has travelled and dividing by the time in seconds it took to travel that distance. Show your calculation below.
3) Insert your picture into Desmos and place the bottom left corner of your race car at the origin.
4) Using a polynomial regression that is the same degree as your original design curve, determine a curve of best fit for your Race Car. Record your equation and r-squared value below. Include a picture of your graph or a link to your Desmos file.



My Equation: https://www.desmos.com/calculator/dbtykowzbz
$f(x)=-0.00050234x^6-0.00014647x^5+0.041306x^4-0.16515x^3+0.10645x^2-0.022069x+1.4287$

My r-squared value : 0.972

Speed = $\frac{distance\ (meters)}{time\ (seconds)}$

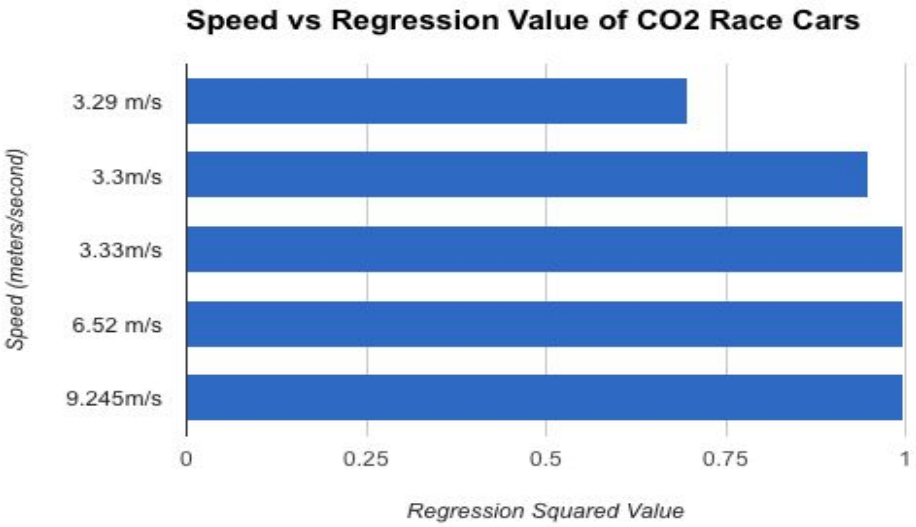
$= \frac{22}{2.65}$

$= 8.3$ m/s

5) **Collect speed and r-squared values from at least five other teams. Using your collected data, do you feel that there is a relationship between the r-squared value and the speed of the race cars? Fully justify your answer.**

Based on the data collected, I believe there not to be a relationship between the r-squared value and the speed. Analyzing the data, it is seen that two race-cars of almost the same speed had widely different r-squared values. While the first race-car had a speed of 3.3 m/s with a r-squared of 0.949, the second race-car had a speed of 3.33 m/s and a r-squared of 0.997 accounting for a difference of 0.048 in the r-squared value. Furthermore, when the data is graphed there seems to be an increasing trend visible; however, when inspected carefully, there seems to be similar r-squared values for three cars of different speeds. For example, a car with a speed of 3.33 m/s had a r-squared value of 0.997 while a separate race cars with speeds of 6.52 m/s and 9.245 m/s also had a r-squared values of 0.997.

Additionally, I believe that the r-squared value is a representation of the accuracy of each group's original design. The design itself has a great impact on the speed of the race car; thus creating a relationship between the two factors to a certain degree. However, one could have a very high r-squared value, but a poor design which would reflect in the speed.



r-squared	Speed (m/s)
0.949	3.3
0.997	9.245
0.997	6.52
0.997	3.33
0.697	3.29

6) Are there other factors that may impact the speed of your race car?

The design of the race car had a great impact on the speed as it contributed greatly to the aerodynamics of the racecar. Subsequently, the size of the racecar also impacted speed as, a larger body allowed for extra unnecessary weight. Subsequently, the final product had a layer of

paint; the amount and type of paint adds weight which can once again increase unnecessary weight. Additionally, the race course had a ceiling fan. As the racecars themselves where small in size and light in weight, this would have had a greater impact on them. This could have contributed to additional drag on the racecars. Withal, the surface of the track also contributed in this situation. The track, like any, was not absolutely smooth; this would not allow for a smooth race as there are certain barriers (i.e. debris) reducing the racecars speed.

7) **What design changes would you make if you were to build a race car again?**

Given the opportunity, we would have designed the next racecar more aerodynamic in terms of design. Our first design lacked a sharp nose, with the addition of a triangular shaped nose this would allow the car to cut through the air as opposed to a flat nose -increasing the surface area allowing for additional drag to be present. Additionally, the current design had a curve present when looked from the side. In the future a simple triangular shape would aid in the aerodynamics of the car as the present curves allowed for air to slow it down. Furthermore, a smaller car would decrease weight; thus, allowing the car to get rid of any unnecessary weight. Moreover, the indicated changes would allow the car to be more successful in the future.