ME EN 2450
Ryan Dalby u0848407
AID02

Modeling Train Motion:
Bisection Method- answer: 529.320240020752 m/s Iterations: 21 eT:5.738753580522209e-05%
Modified Secant Method: answer: 529.3199363664439 m/s Iterations: 14
eT:2.0660456783705307e-08%
Mullers Method- answer: 529.3197848462762 m/s Iterations: 9 eT:2.8604780857741632e-05%

Here we see that Muller's method converged in the least amount of iterations. The termination criteria for all methods was the approximate relative error. A closed form solution was then found so the true relative error eT could be found. Although eT isn't the lowest for Muller's method it went through fewer iterations. The value of eT is likely situationally dependent on how the method converges for different problems.

Propulsion System Design:
v was found using mullers method

	P0(Pa)	m(kg)	rp(m)	rg(m)	v(m/s)	iterations	True v(m/s)	True Relative Error(%)
0	137895.2	1	0.05	0.050	748.647368	12.0	748.647736	0.000049
1	137895.2	10	0.05	0.005	235.145315	13.0	235.145369	0.000023
2	275790.4	3	0.20	0.005	334.806790	13.0	334.806867	0.000023
3	413685.6	1	0.20	0.050	1296.781742	12.0	1296.782179	0.000034
4	413685.6	10	0.05	0.005	409.149350	13.0	409.149439	0.000022

From this chart, we can see that the model we made is not very good since the velocity values are not realistic for a small train. Our numerical methods were verified by comparing to the closed form solution which had close values. We cannot validate our model though since the answers are very unrealistic thus the equations/and or assumptions to get the equations we used likely do not model the train motion very well.

To make this model we likely cannot assume steady-state conditions and we also must more accurately find mass and volume/shape of our train. We should also better analyze the piston system for how it will translate to a force and determine other losses of energy from the train moving.