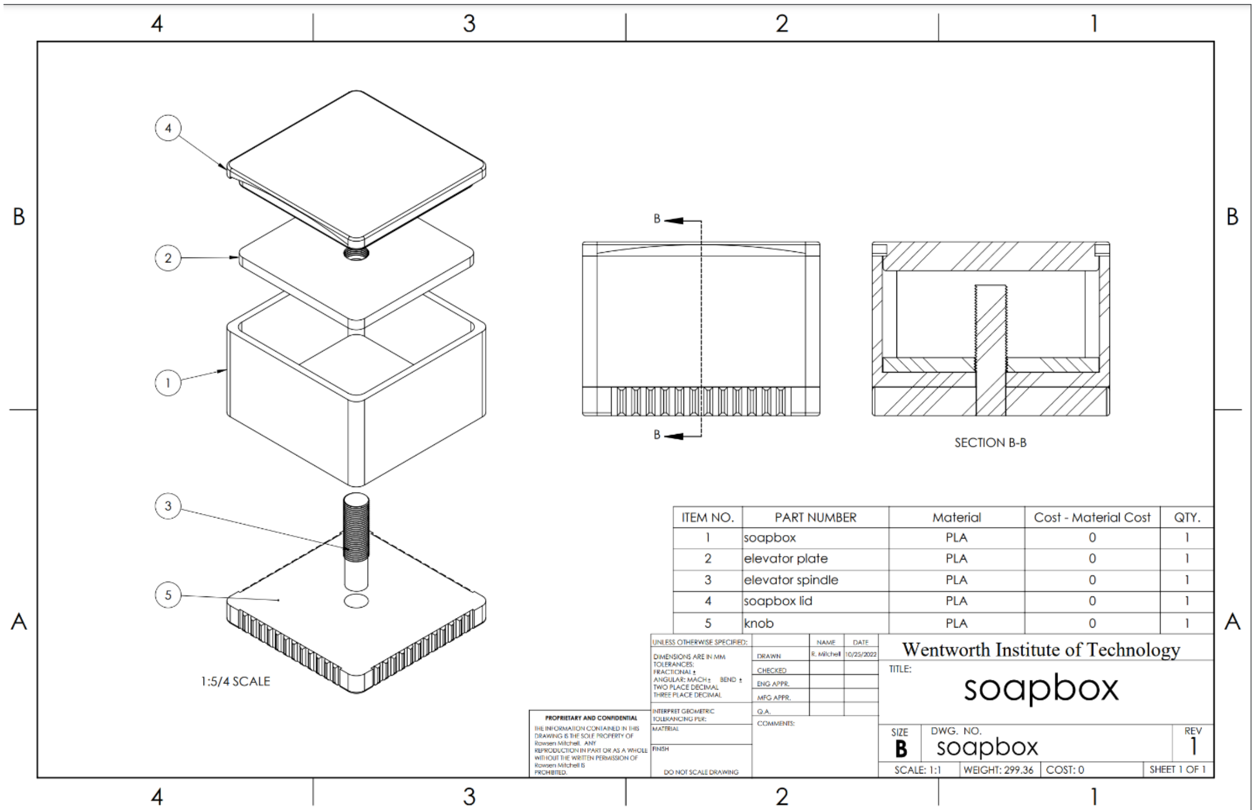
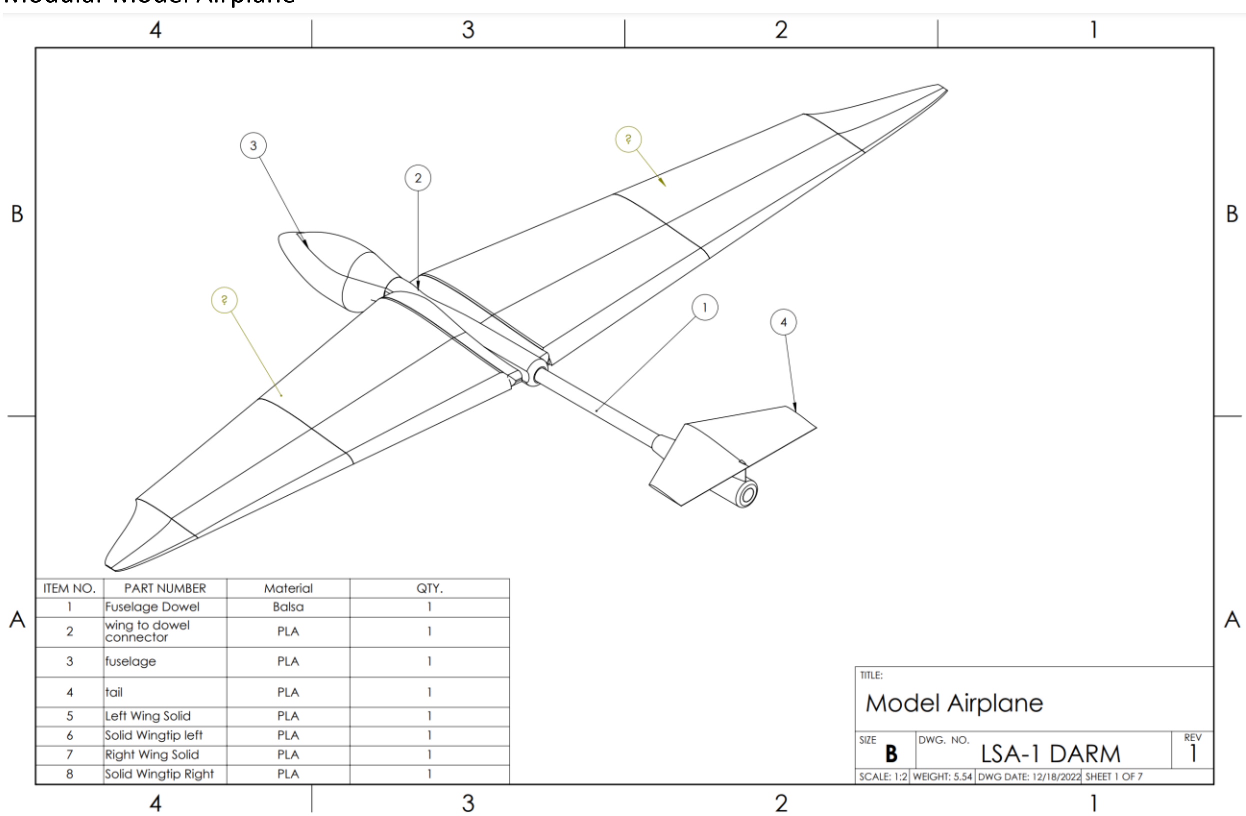
Reusable Soap Box

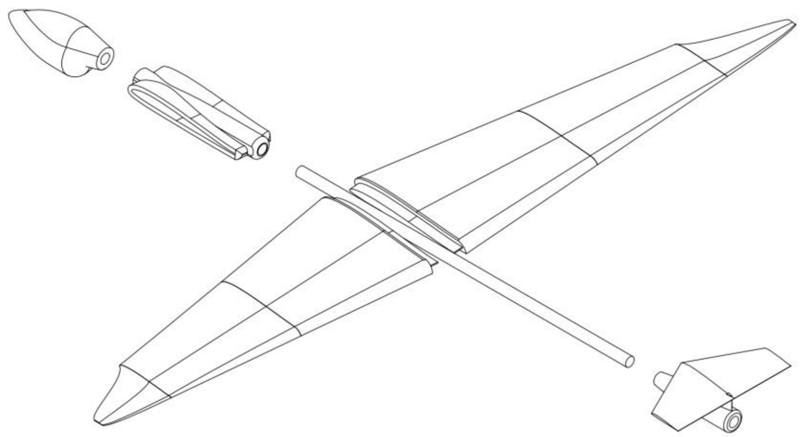


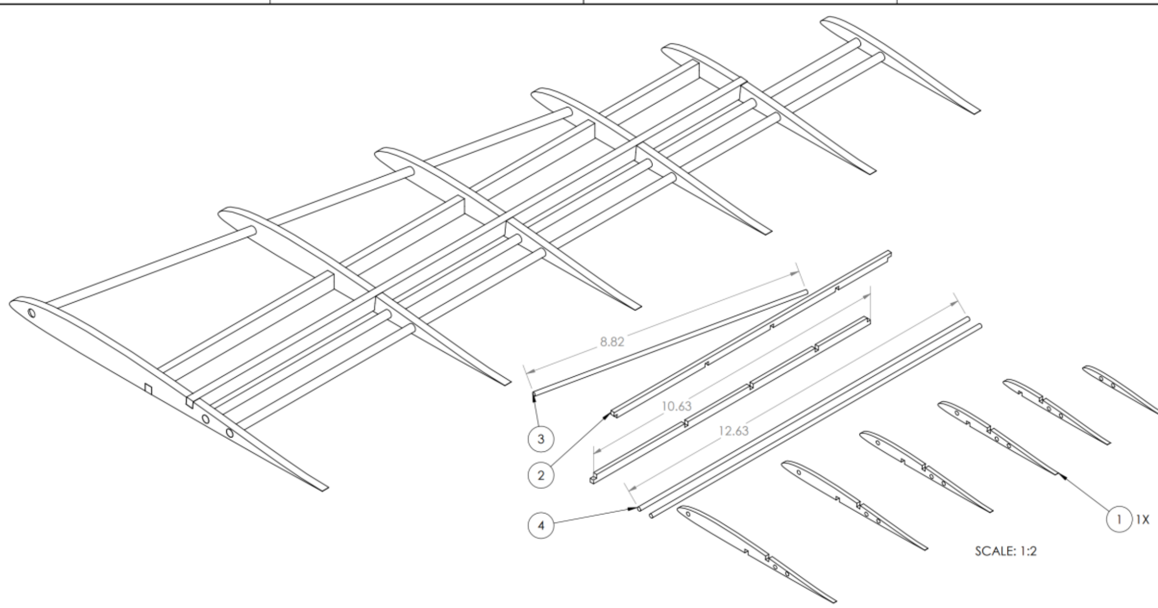
ITEM NO.	PART NUMBER	Material	Cost - Material Cost	QTY.
1	soapbox	PLA	0	1
2	elevator plate	PLA	0	1
3	elevator spindle	PLA	0	1
4	soapbox lid	PLA	0	1
5	knob	PLA	0	1

Modular Model Airplane



ITEM NO.	PART NUMBER	Material	QTY.
1	Fuselage Dowel	Balsa	1
2	wing to dowel connector	PLA	1
3	fuselage	PLA	1
4	tail	PLA	1
5	Left Wing Solid	PLA	1
6	Solid Wingtip left	PLA	1
7	Right Wing Solid	PLA	1
8	Solid Wingtip Right	PLA	1



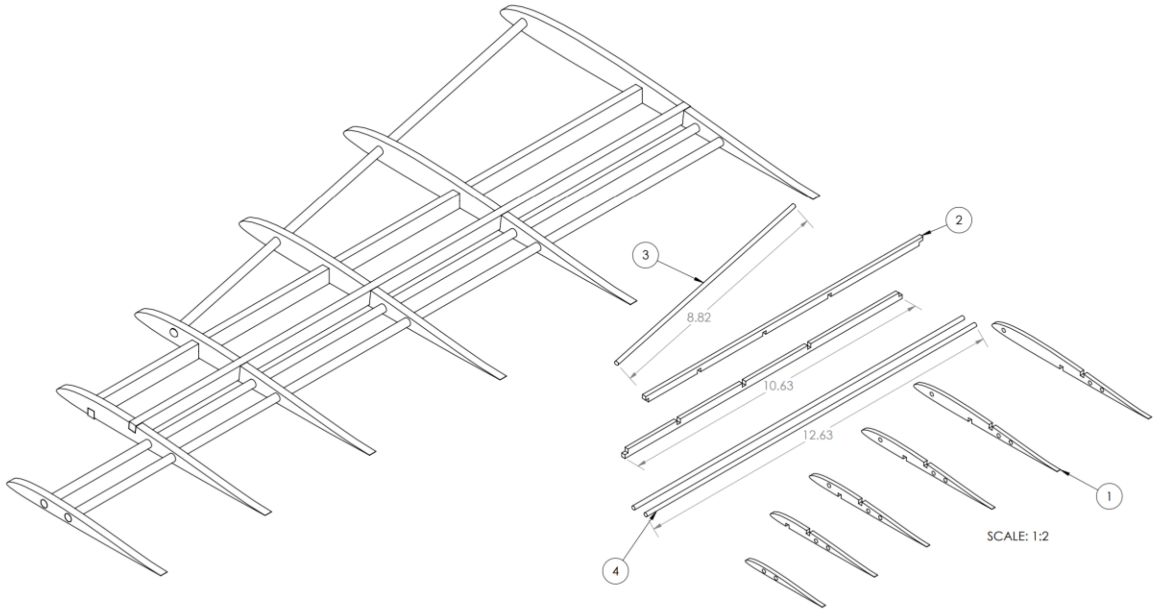


ITEM NO.	PART NUMBER	Material	COST	QTY.
1	wing2.0	PLA		1
2	wing top and bottom	PLA		2
3	Wing dowel .125 L1	Balsa		1
4	Wing dowel .125 L2	Balsa		2

TITLE: Model Airplane

SIZE: B | DWG. NO.: Right Wing Assembly | REV: 1

SCALE: 1:1 | WEIGHT: 0.07 | SHEET 3 OF 7



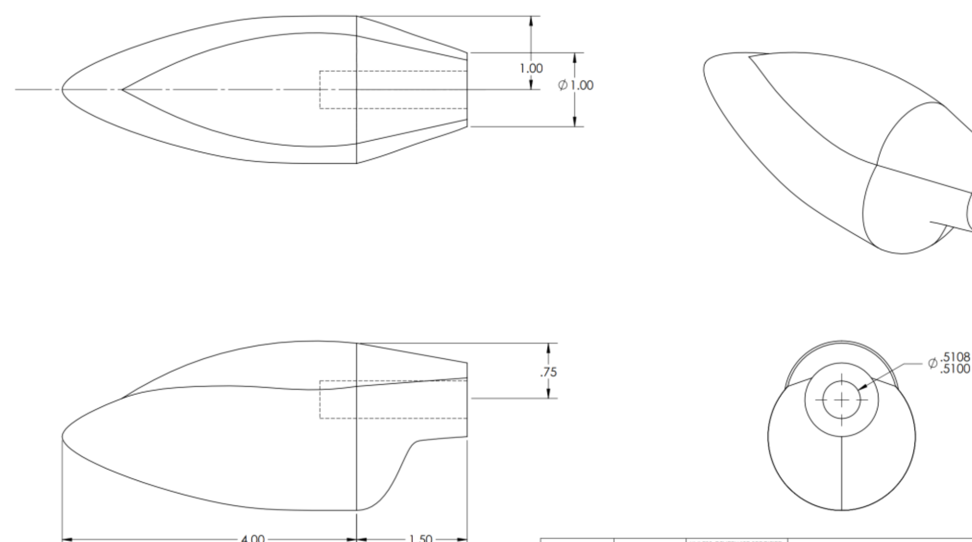
ITEM NO.	PART NUMBER	Material	COST	QTY.
1	wing2.5	PLA		1
2	wing top and bottom'	PLA		2
3	Wing dowel .125 L1	Balsa		1
4	Wing dowel .125 L2	Balsa		2

TITLE:

Model Airplane

SIZE: **B** | DWG. NO.: Left Wing Assembly | REV: 1

SCALE: 1:1 | WEIGHT: 0.07 | SHEET 4 OF 7



NEXT ASSY | USED ON

APPLICATION

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL: PLA

COST

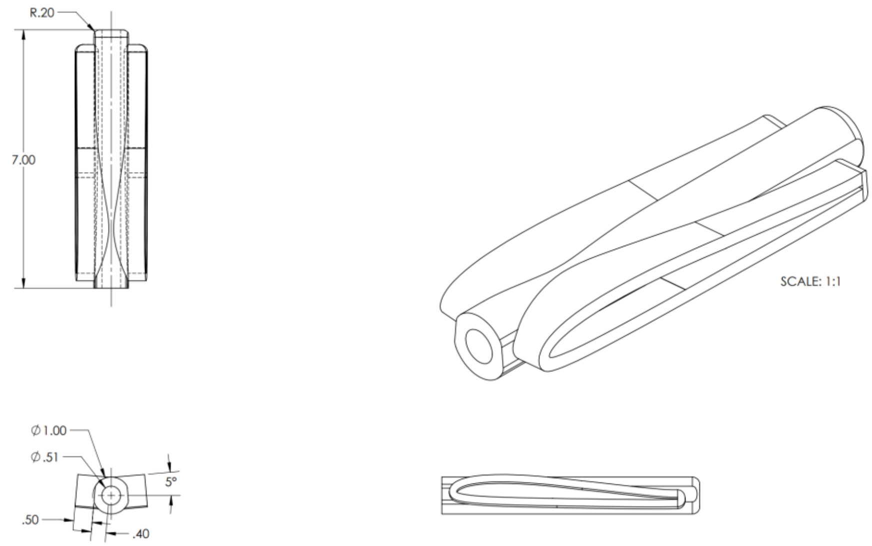
DO NOT SCALE DRAWING

TITLE:

Model Airplane

SIZE: **B** | DWG. NO.: LSA-1 DARMfuselage | REV: 1

SCALE: 1:1 | WEIGHT: 0.53 | SHEET 5 OF 7



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		UNLESS OTHERWISE SPECIFIED:	
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ± THREE PLACE DECIMAL ±	TITLE: Model Airplane
		INTERPRET GEOMETRIC TOLERANCING PER:	
		MATERIAL PLA	SIZE B · DWG. NO. FUSELAGE/DOWEL CONNECTOR · REV
NEXT ASSY	USED ON	COST	
APPLICATION		DO NOT SCALE DRAWING	SCALE: 1:2 · WEIGHT: 0.31 · SHEET 6 OF 7

Using Excel to integrate with multiple methods

Rawsen Mitchell
Cournoyer
CALC II

THQ Area by Midpoint Rule

i	Xi	f(Xi)	ΔX	Ai
1	1.5	1.991862	1	1.991862
2	2.5	1.949199	1	1.949199
3	3.5	2.703302	1	2.703302
4	4.5	4.44529	1	4.44529
		Sum of areas =		11.08965
		Exact Area =		
			Error =	11.08965
			% Error =	#DIV/0!

I was not able to find an exact value due to it not having an antiderivative, so I will base my observations off of this estimation.

i	Xi	f(Xi)	ΔX	Ai
1	1.25	2.233819	0.5	1.11691
2	1.75	1.879054	0.5	0.939527
3	2.25	1.874121	0.5	0.93706
4	2.75	2.068447	0.5	1.034224
5	3.25	2.441689	0.5	1.220844
6	3.75	3.023721	0.5	1.511861
7	4.25	3.881269	0.5	1.940634
8	4.75	5.122849	0.5	2.561425
		Sum of areas =		11.26248
		Exact Area =		
			Error =	11.26248
			% Error =	#DIV/0!

This value is higher than when we used 4 rectangles, which is expected of the rectangle/midpoint method.

i	Xi	f(Xi)	ΔX	Ai
1	1.125	2.433752	0.25	0.608438
2	1.375	2.091941	0.25	0.522985
3	1.625	1.923188	0.25	0.480797
4	1.875	1.854811	0.25	0.463703
5	2.125	1.854206	0.25	0.463551
6	2.375	1.905997	0.25	0.476499
7	2.625	2.003385	0.25	0.500846
8	2.875	2.144475	0.25	0.536119
9	3.125	2.330613	0.25	0.582653
10	3.375	2.565644	0.25	0.641411
11	3.625	2.855627	0.25	0.713907
12	3.875	3.208837	0.25	0.802209
13	4.125	3.635941	0.25	0.908985
14	4.375	4.150326	0.25	1.037582
15	4.625	4.768574	0.25	1.192143
16	4.875	5.511075	0.25	1.377769
		Sum of areas =		11.3096
		Exact Area =		
			Error =	11.3096
			% Error =	#DIV/0!

This value is rising, but in smaller increments. It seems to run towards the 11.32+.005 range.

As we divide the area into smaller rectangles, the value rises closer to 11.32+.01. On a separate sheet, I performed the approximation with 64 and 128 intervals. The value continued to rise, but the values increased substantially less than the previous three sums. The average area calculated by 64 intervals and 128 intervals respectively were 11.325 and 11.3256. From my observations, the value 11.326 would be a reasonable average. A reasonable number of decimal places would be to the ten thousandths (11.3256).

Rawsen Mitchell
CALC II
Cournoyer

Simpsons Rule THQ

i	Xi	f(Xi)	Xmid	f(Xmid)	ΔX	M	T	S
0	0	0						
1	0.5	1.96875	0.25	0.499023	0.5	0.249512	0.492188	0.330404
2	1	7	0.75	4.262695	0.5	2.131348	2.242188	2.168294
3	1.5	10.40625	1.25	9.448242	0.5	4.724121	4.351563	4.599935
4	2	0	1.75	8.086914	0.5	4.043457	2.601563	3.562826
						Sum of areas =		10.66146
						Exact Area =		10.66667
							Error =	0.005212
							% Error =	0.048859

i	Xi	f(Xi)	Xmid	f(Xmid)	ΔX	M	T	S
0								
1	0.25	0.499023	0.125	0.124969	0.25	0.031242	0.062378	0.041621
2	0.5	1.96875	0.375	1.117584	0.25	0.279396	0.308472	0.289088
3	0.75	4.262695	0.625	3.029633	0.25	0.757408	0.778931	0.764582
4	1	7	0.875	5.612091	0.25	1.403023	1.407837	1.404627
5	1.25	9.448242	1.125	8.322968	0.25	2.080742	2.05603	2.072505
6	1.5	10.40625	1.375	10.21011	0.25	2.552528	2.481812	2.528956
7	1.75	8.086914	1.625	9.794037	0.25	2.448509	2.311646	2.402888
8	2	0	1.875	4.950714	0.25	1.237679	1.010864	1.162074
						Sum of areas =		10.66634
						Exact Area =		10.66667
							Error =	0.000329
							% Error =	0.003083

i	Xi	f(Xi)	Xmid	f(Xmid)	ΔX	M	T	S
0								
1	0.125	0.124969	0.0625	0.031249	0.125	0.003906	0.007810593	0.005208
2	0.25	0.499023	0.1875	0.281018	0.125	0.035127	0.038999557	0.036418
3	0.375	1.117584	0.3125	0.77827	0.125	0.097284	0.101037979	0.098535
4	0.5	1.96875	0.4375	1.515222	0.125	0.189403	0.192895889	0.190567
5	0.625	3.029633	0.5625	2.474936	0.125	0.309367	0.312398911	0.310378
6	0.75	4.262695	0.6875	3.62766	0.125	0.453457	0.455770493	0.454228
7	0.875	5.612091	0.8125	4.927157	0.125	0.615895	0.617174149	0.616321
8	1	7	0.9375	6.307054	0.125	0.788382	0.788255692	0.78834
9	1.125	8.322968	1.0625	7.677169	0.125	0.959646	0.957685471	0.958993
10	1.25	9.448242	1.1875	8.919858	0.125	1.114982	1.110700607	1.113555
11	1.375	10.21011	1.3125	9.886348	0.125	1.235793	1.228647232	1.233411
12	1.5	10.40625	1.4375	10.39307	0.125	1.299134	1.28852272	1.295597
13	1.625	9.794037	1.5625	10.21802	0.125	1.277253	1.262517929	1.272341
14	1.75	8.086914	1.6875	9.097066	0.125	1.137133	1.117559433	1.130609
15	1.875	4.950714	1.8125	6.720294	0.125	0.840037	0.814851761	0.831642
16	2	0	1.9375	2.728364	0.125	0.341045	0.309419632	0.330504
						Sum of areas =		10.66665
						Exact Area =		10.66667
							Error =	2.37E-05
							% Error =	0.000222

Summaries

4 intervals:
The approximate area is 10.66146. This value is much closer to the exact area than the trapezoid and midpoint formulas.

8 intervals:
The aproximate area is 10.66634, which is rising closer to the exact value.

16 intervals:
The approximate area is 10.66665, which is practically the exact area.

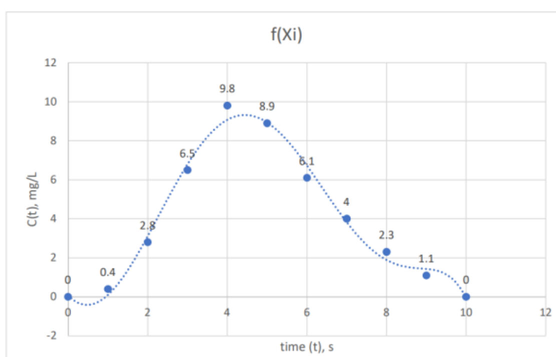
Overall, using Simpson's Rule proved to be much more accurate than the midpoint or trapezoid formulas. The percentage error at 4 intervals was .048859%, which is well under the percent error for the previous two approximation methods.

Rawsen Mitchell
Cournoyer CALC II

DYE-DILUTION THQ

November 28th, 2022

i	Xi	f(Xi)	ΔX	Ai
0	0	0		
1	1	0.4	1	0.2
2	2	2.8	1	1.6
3	3	6.5	1	4.65
4	4	9.8	1	8.15
5	5	8.9	1	9.35
6	6	6.1	1	7.5
7	7	4	1	5.05
8	8	2.3	1	3.15
9	9	1.1	1	1.7
10	10	0	1	0.55
	Sum of areas (mg/L•s) =			41.9
		Amount of Dye (mg) =		5
	Flow Rate/Cardiac Output (L/s) =			0.12
Flow Rate/Cardiac Output (L/min) =				7.16
Flow Rate/Cardiac Output (L/hr) =				429.59



The sum of the area under the curve is approximately 41.9 mg/L•s. This is found by taking the time (t) values given and putting them in the Xi column to represent the amount of intervals and (rectangles) under the graph. The concentration of dye in the atrium (c(t)) is inserted into the f(Xi) column because it is the value presented by the function at a time (t). With the relationship between A (amount of dye) and F (flow rate/cardiac output) being A = F {0-t}∫c(t)dt, we can rearrange the formula to find F, F = A/({0-t}∫c(t)dt). Once we solve for the area using the trapezoid rule, we can use the resulting value in the derived equation to solve for F. With the numbers plugged in, it looks like this: F = (5mg)/(41.9mg/L•s). We cancel out the mg for our units to find L/s and compute the numbers, resulting in .12 L/s. This is a very small number, so I took it upon myself to include the Cardiac Output in minutes and hours as well.