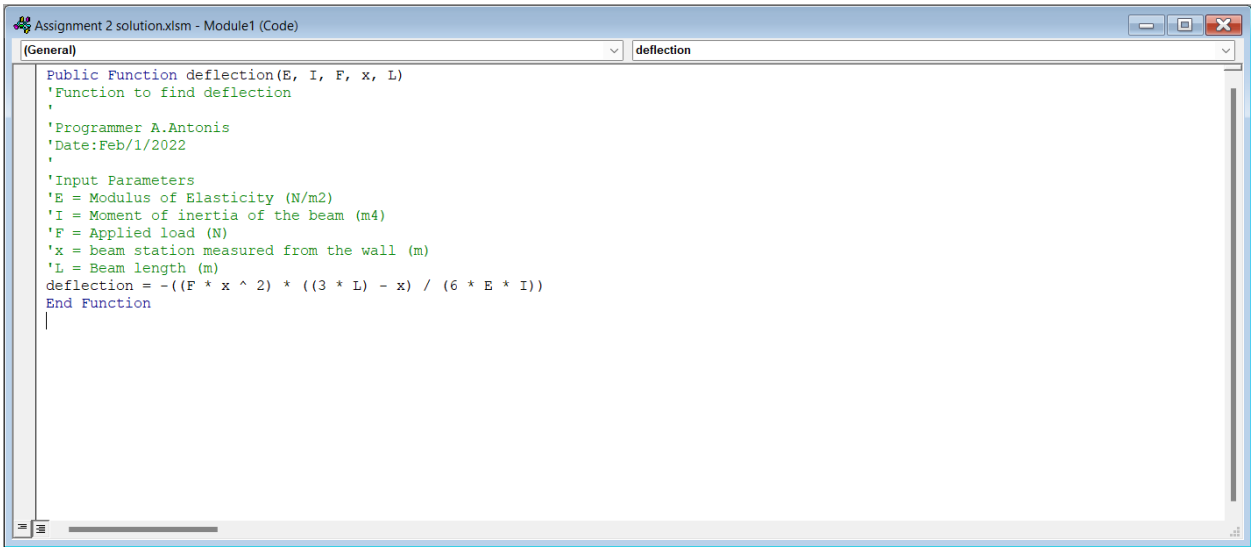
ASSIGNMENT 2 SOLUTION

Problem 1

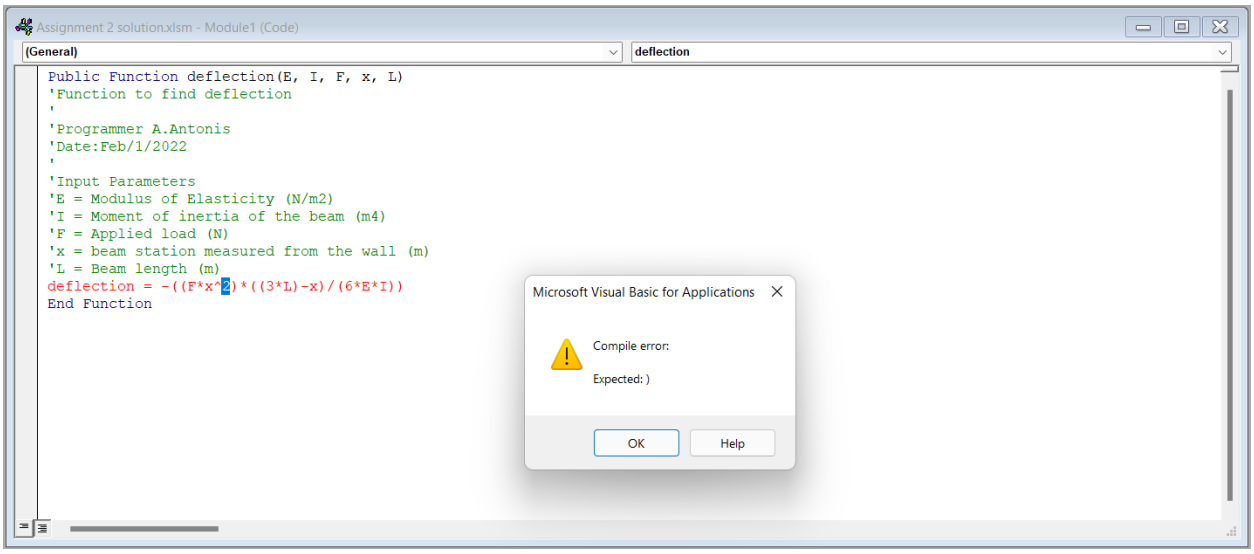
a) Create a function in Excel (using VBA) to calculate the deflection of the beam at any point x. The function should produce the deflection (d) given the values of E, I, F, x, and L to estimate the deflection at point x.
b) Use the function created above to estimate the deflections along the seven-meter beam every 20 centimeters. You should create a table in Excel to call the function and estimate the deflection every 20 centimeters. Use the numerical values F = 5000 N, L=7 m, I = 0.0001 (m4) and E = 200e9 (N/m2).
c) Plot the deflections along the beam and label accordingly.

Sol:

a) Function to calculate deflection in VBA



There needs to be a space between the '^' (power) symbol otherwise you may get a 'Compile Error'

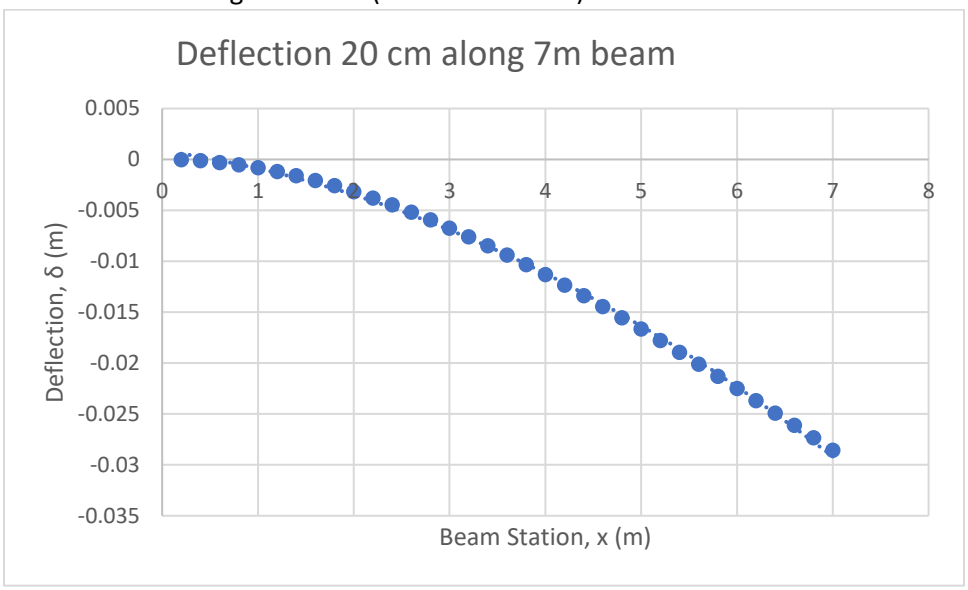


b) Deflections along the seven-meter beam every 20 centimeters. Deflections and beam stations in meters.

Problem to find the deflection of the 7 meter beam			
Programmer		A.Antonis	
Date		2/1/2022	
Forrmula	δ = -((Fx^2)*(3L-x)/(6EI))		
Inputs			
Parameter		Unit	
E	2E+11	N/m2	(E=200*10^9 for steel)
I	0.0001	m4	
F	5000	N	
L	7	m	
x	δ		
0.2	-3.5E-05		
0.4	-0.00014		
0.6	-0.00031		
0.8	-0.00054		
1	-0.00083		
1.2	-0.00119		
1.4	-0.0016		

x	δ
0.2	-3E-05
0.4	-0.0001
0.6	-0.0003
0.8	-0.0005
1	-0.0008
1.2	-0.0012
1.4	-0.0016
1.6	-0.0021
1.8	-0.0026
2	-0.0032
2.2	-0.0038
2.4	-0.0045
2.6	-0.0052
2.8	-0.0059
3	-0.0068
3.2	-0.0076
3.4	-0.0085
3.6	-0.0094
3.8	-0.0103
4	-0.0113
4.2	-0.0123
4.4	-0.0134
4.6	-0.0145
4.8	-0.0156
5	-0.0167
5.2	-0.0178
5.4	-0.019
5.6	-0.0201
5.8	-0.0213
6	-0.0225
6.2	-0.0237
6.4	-0.0249
6.6	-0.0261
6.8	-0.0274
7	-0.0286

c) Plot of the deflections along the beam (units are meters)



Problem 2

Read the car data file provided in class (week 1). The car weights are in pounds and horsepower in HP. Auto data for several vehicles is contained in the file Car data.txt. The data file contains various characteristics for automobiles produced in various countries. Show all your work and provide screen captures of your work and include the actual database commands used to make each query.

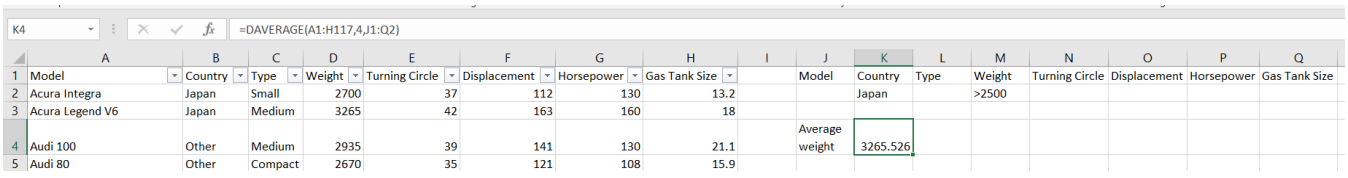
a) Calculate the average weight for cars produced in Japan with weight >2500 lb.

b) Calculate the average weight for American-made cars whose tank size > 18.5 gallons

c) Count the number of cars with horsepower > 190 HP and tank size > 17 gallons

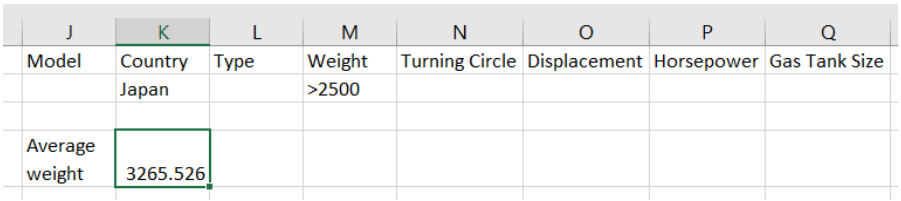
Sol:

a) Weight of cars produced in Japan with weight >2500 lb



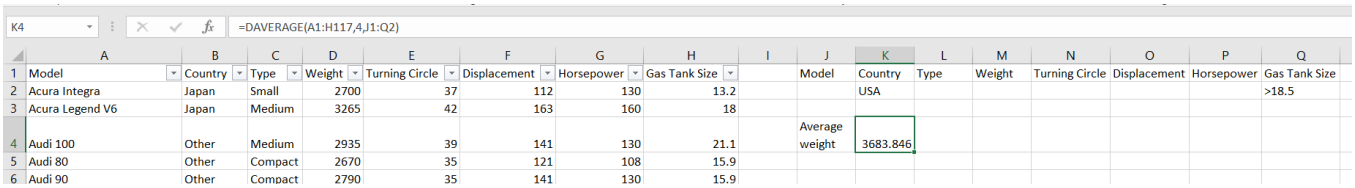
K4 =DAVERAGE(A1:H117,4,J1:Q2)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size		Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
2	Acura Integra	Japan	Small	2700	37	112	130	13.2			Japan		>2500				
3	Acura Legend V6	Japan	Medium	3265	42	163	160	18									
4	Audi 100	Other	Medium	2935	39	141	130	21.1		Average weight	3265.526						
5	Audi 80	Other	Compact	2670	35	121	108	15.9									



J	K	L	M	N	O	P	Q
Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
	Japan		>2500				
Average weight	3265.526						

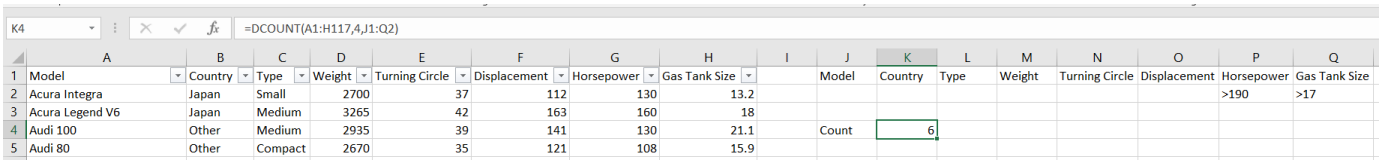
b) Average weight of American-made cars whose tank size > 18.5 gallons



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size		Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
2	Acura Integra	Japan	Small	2700	37	112	130	13.2			USA						>18.5
3	Acura Legend V6	Japan	Medium	3265	42	163	160	18									
4	Audi 100	Other	Medium	2935	39	141	130	21.1		Average weight	3683.846						
5	Audi 80	Other	Compact	2670	35	121	108	15.9									
6	Audi 90	Other	Compact	2790	35	141	130	15.9									

J	K	L	M	N	O	P	Q
Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
	USA						>18.5
Average weight	3683.846						

c) Count of the number of cars with horsepower > 190 HP and tank size > 17 gallons



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size		Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
2	Acura Integra	Japan	Small	2700	37	112	130	13.2								>190	>17
3	Acura Legend V6	Japan	Medium	3265	42	163	160	18									
4	Audi 100	Other	Medium	2935	39	141	130	21.1		Count	6						
5	Audi 80	Other	Compact	2670	35	121	108	15.9									

J	K	L	M	N	O	P	Q
Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size
						>190	>17
Count	6						

Problem 3

Use the file contructionEquipmentAssets.xlsx that contains information about a company construction equipment.

a) Create a pivot table to summarize the different types of construction equipment by for the company. The pivot table should report the average odometer miles of each construction equipment.

b) Create a pivot chart to summarize the different types of construction equipment by city for the company. The pivot chart should report (graphically) the average odometer miles of each construction equipment.

c) Modify the solution to part (a) and add a filter to the pivot table to select the status of the equipment. Show the pivot table showing the solution for the number of Excavators in Maintenance.

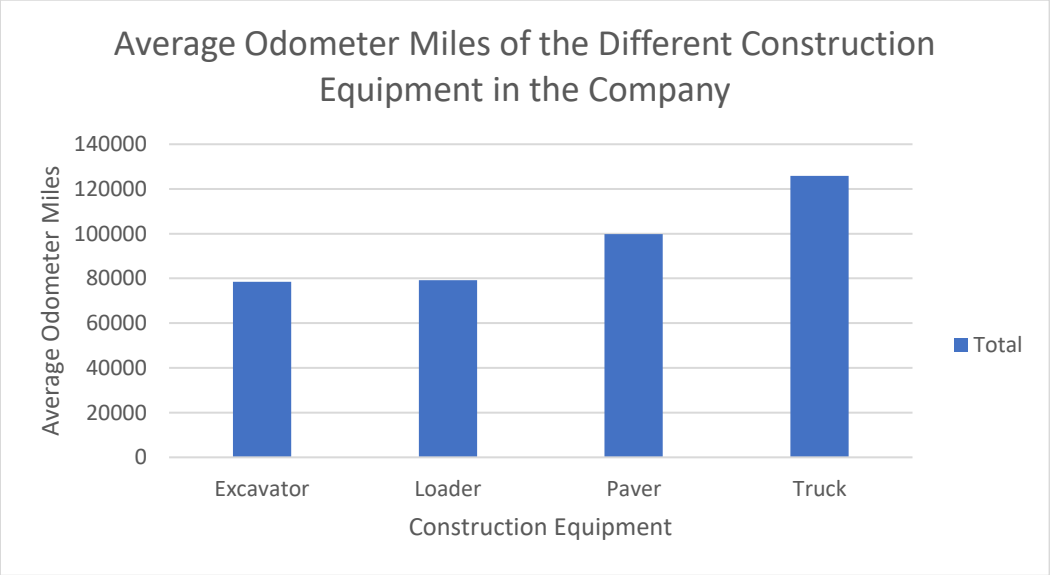
Sol:

a) Pivot table summarizing the average odometer miles of the different construction equipment in the company

Row Labels	Average of Odometer_Miles
Excavator	78461.27983
Loader	79228.56561
Paver	99841.27522
Truck	125863.9444
Grand Total	**94288.94391**

You are expected to control the number of significant figures to a realistic value (probably to the closest mile is fine)

b) Pivot chart summarizing the average odometer miles of the different construction equipment in the company



c) Pivot table showing the average odometer miles of the excavator in maintenance

Status	In Maintenance

Row Labels	Average of Odometer_Miles
Excavator	78820.84654
Grand Total	**78820.84654**

Problem 4

Use the file contructionEquipmentAssets.xlsx that contains information about a company construction equipment to answer the following questions. Here we use the Excel database functions. Show your database commands in the solution (i.e., the formula bar).

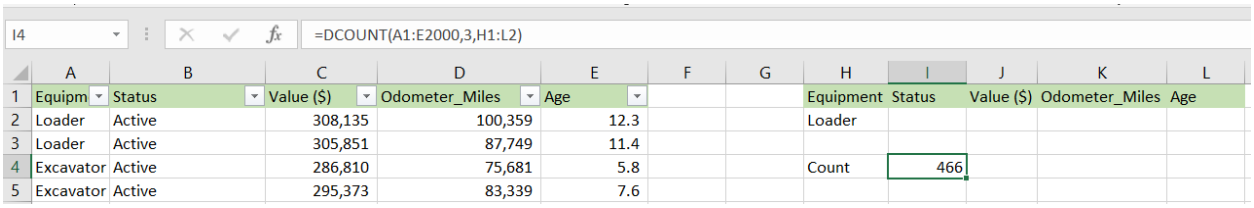
a) Use Excel database functions to count the number of loaders in the company.

b) Use Excel database functions to estimate the average value of trucks in the company with more than 8 years of age and less than 12 years of age.

c) Use Excel database functions to count the number of trucks in part (c)

Sol:

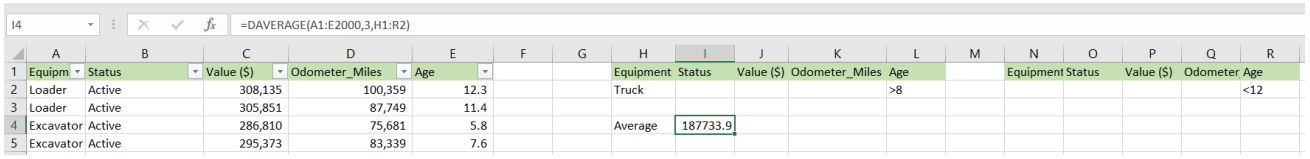
a) Count of the number of loaders in the company



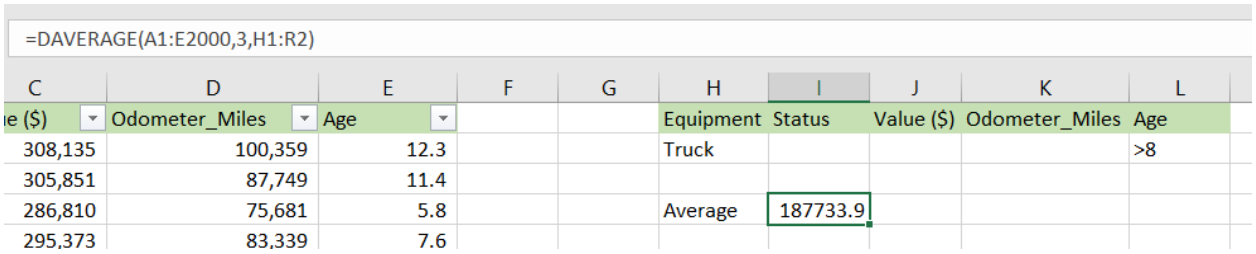
	A	B	C	D	E	F	G	H	I	J	K	L
1	Equipm	Status	Value ($)	Odometer_Miles	Age			Equipment	Status	Value ($)	Odometer_Miles	Age
2	Loader	Active	308,135	100,359	12.3			Loader				
3	Loader	Active	305,851	87,749	11.4							
4	Excavator	Active	286,810	75,681	5.8			Count	466			
5	Excavator	Active	295,373	83,339	7.6							

*note that 'field' in DCOUNT(database,field,criteria) should be a column with numerical values

b) Average value of trucks of age greater than 8 and less than 12



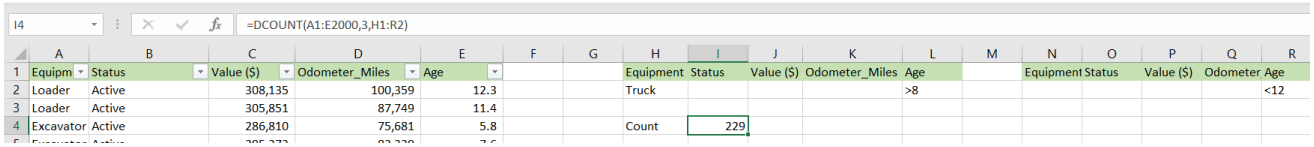
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Equipm	Status	Value ($)	Odometer_Miles	Age			Equipment	Status	Value ($)	Odometer_Miles	Age		Equipment	Status	Value ($)	Odometer	Age
2	Loader	Active	308,135	100,359	12.3			Truck				>8						<12
3	Loader	Active	305,851	87,749	11.4													
4	Excavator	Active	286,810	75,681	5.8			Average	187733.9									
5	Excavator	Active	295,373	83,339	7.6													



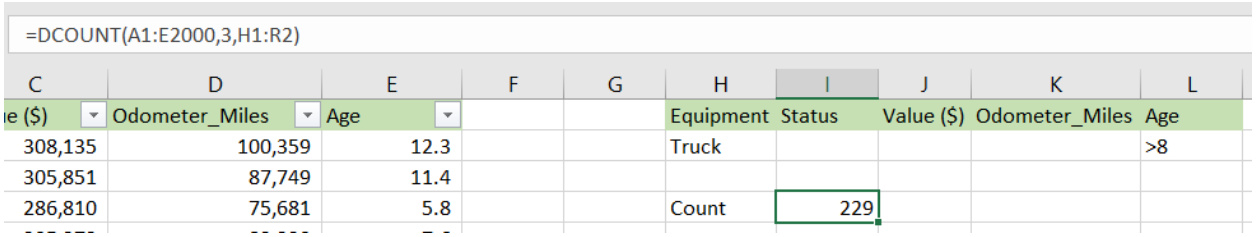
=DAVERAGE(A1:E2000,3,H1:R2)

C	D	E	F	G	H	I	J	K	L
e ($)	Odometer_Miles	Age			Equipment	Status	Value ($)	Odometer_Miles	Age
308,135	100,359	12.3			Truck				>8
305,851	87,749	11.4							
286,810	75,681	5.8			Average	187733.9			
295,373	83,339	7.6							

c) Count of trucks of age greater than 8 and less than 12



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Equipm	Status	Value ($)	Odometer_Miles	Age			Equipment	Status	Value ($)	Odometer_Miles	Age		Equipment	Status	Value ($)	Odometer	Age
2	Loader	Active	308,135	100,359	12.3			Truck				>8						<12
3	Loader	Active	305,851	87,749	11.4													
4	Excavator	Active	286,810	75,681	5.8			Count	229									



=DCOUNT(A1:E2000,3,H1:R2)

C	D	E	F	G	H	I	J	K	L
e ($)	Odometer_Miles	Age			Equipment	Status	Value ($)	Odometer_Miles	Age
308,135	100,359	12.3			Truck				>8
305,851	87,749	11.4							
286,810	75,681	5.8			Count	229			

Problem 5

Read the car data file provided in class (week 1).

a) Import the data into Excel.

b) Perform a simple linear regression using Excel to estimate the best model that relates vehicle engine displacement (called displacement in the data set – in cubic inches) and horsepower. Use the trend analysis function in Excel to estimate the equation of the line that fits the data best. The steps to make a trend line from a chart are:

i) Select the chart.

ii) Click the + button on the right side of the chart or select the Add Chart Element in the Chart Design Tab.

iii) Select the Trendline and make your selection of Options.

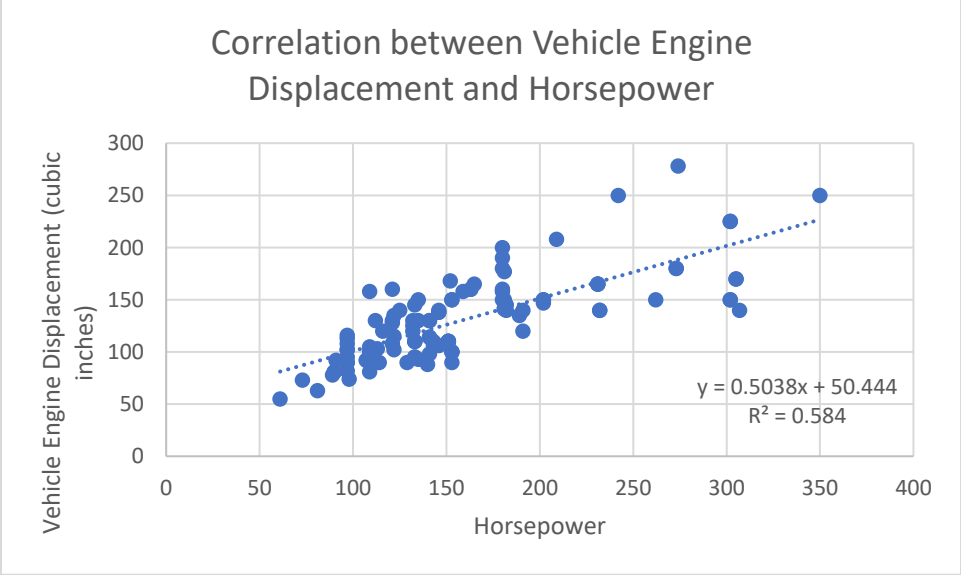
c) Create a function in Excel (using VBA) to calculate the horsepower (in units of horsepower) of a vehicle as a function of engine displacement (cubic inches).

d) Test the function created in part (c) to estimate the horsepower expected for an engine with 165, and 300 cubic inches of engine displacement.

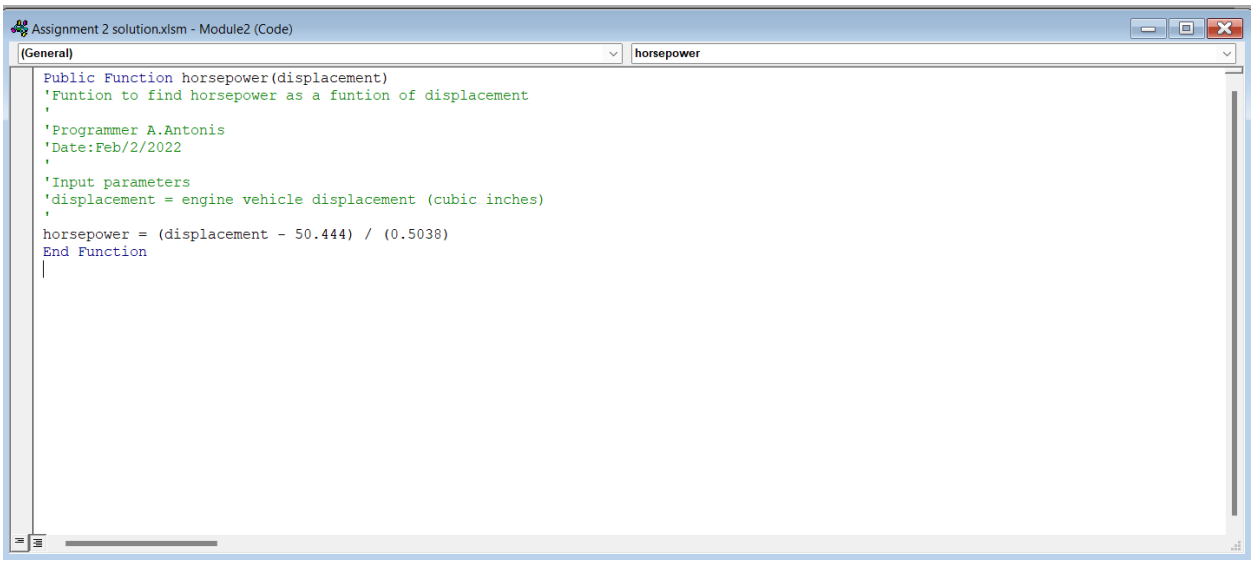
Sol:

a) Imported data
b) From the R square value, we can say that the correlation between Vehicle Engine Displacement and Horsepower isn't very strong. The equation of the line that best fits the data is

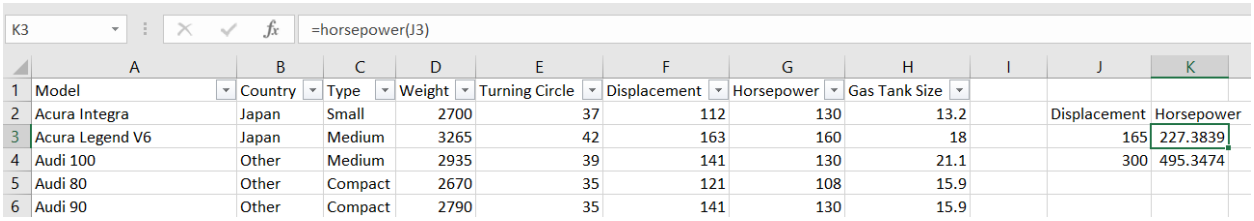
$$y = 0.5038x + 50.444$$



c) Function in excel find the horsepower as a function of displacement



d) Value of horsepower using the function created in VBA above



	A	B	C	D	E	F	G	H	I	J	K
1	Model	Country	Type	Weight	Turning Circle	Displacement	Horsepower	Gas Tank Size			
2	Acura Integra	Japan	Small	2700	37	112	130	13.2		Displacement	Horsepower
3	Acura Legend V6	Japan	Medium	3265	42	163	160	18		165	227.3839
4	Audi 100	Other	Medium	2935	39	141	130	21.1		300	495.3474
5	Audi 80	Other	Compact	2670	35	121	108	15.9			
6	Audi 90	Other	Compact	2790	35	141	130	15.9			