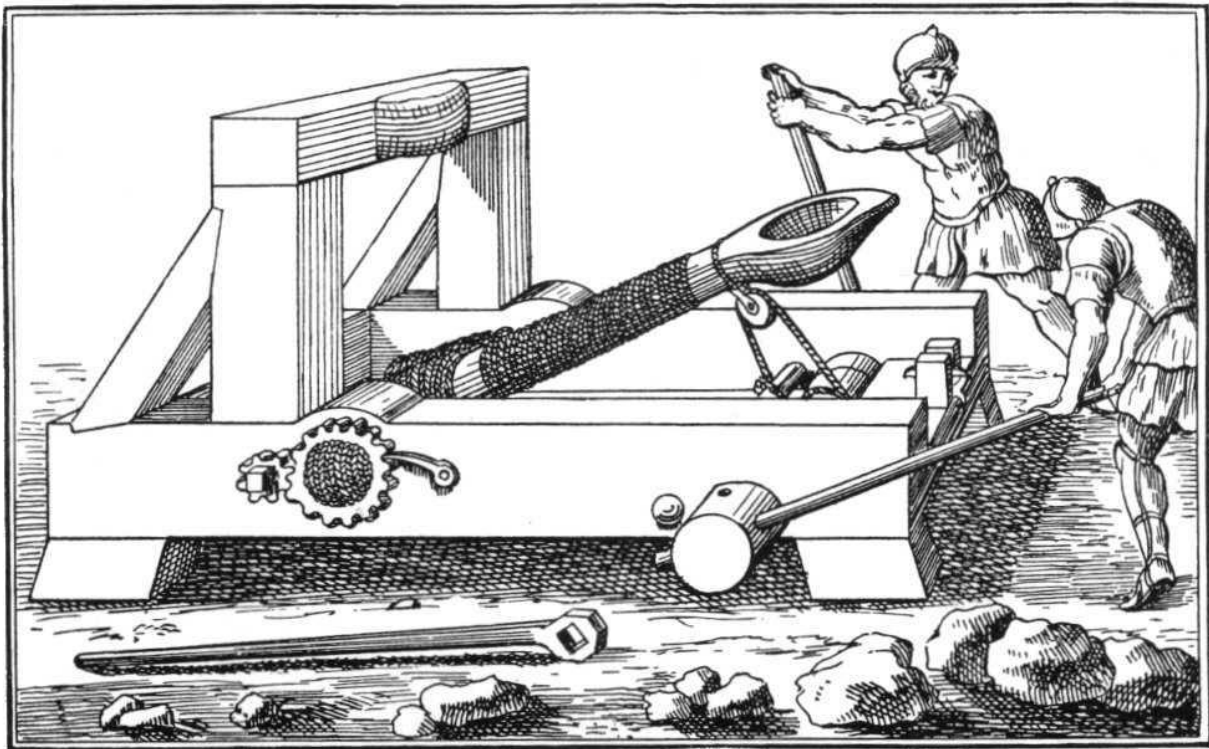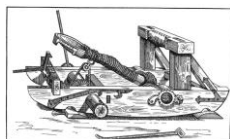**MECHANICAL ENGINEERING DEPARTMENT**

Assignment - 0.
Working on a spreadsheet (e.g. MS Excel /OO Calc)

UTA013
Engineering Design Project-II
(Mangonel)

Assignment - 0.
Working on a spreadsheet (e.g. MS Excel /OO Calc)

The following tasks have been designed to give practice in using a spreadsheet for tutorial assignments in the coming weeks in MED. The basic demonstration of these are given by the teacher and the task has to be done by the student in the class as far as possible and completed as a home assignment. There is no evaluation of this assignment, while the completion of it would enable the student to attempt further assignments which will be evaluated in class and by submission.

1. Generate a circle using the basic definition of 'locus of a point at a fixed distance from another point'.
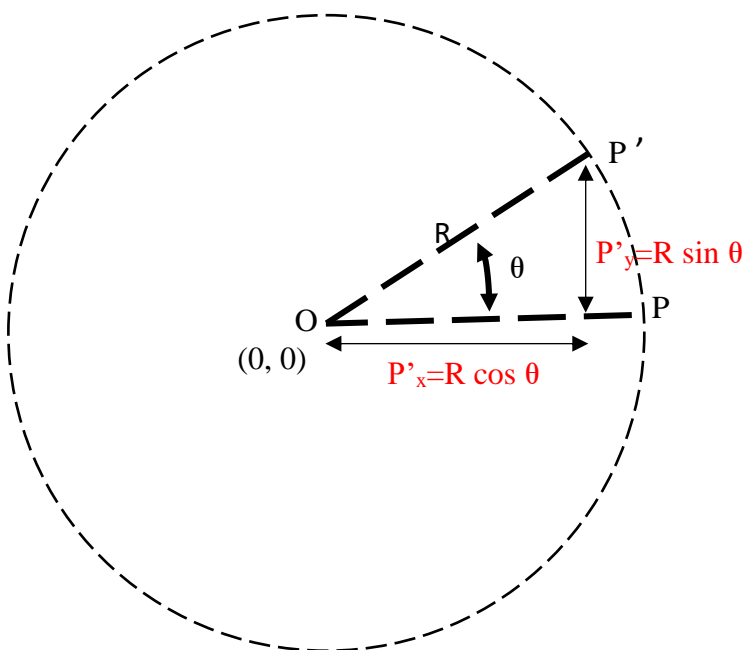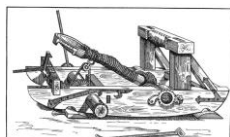

Step1: Type Radius 'R' and number of sides of 'Polygon' N as in

	A	B
1	R	20
2	N	360
3		

figure ->

These will be user input in future so maybe highlighted and comment added.

Step2: **Calculate Angle in degree Thd from N in B2 by equation as in the**

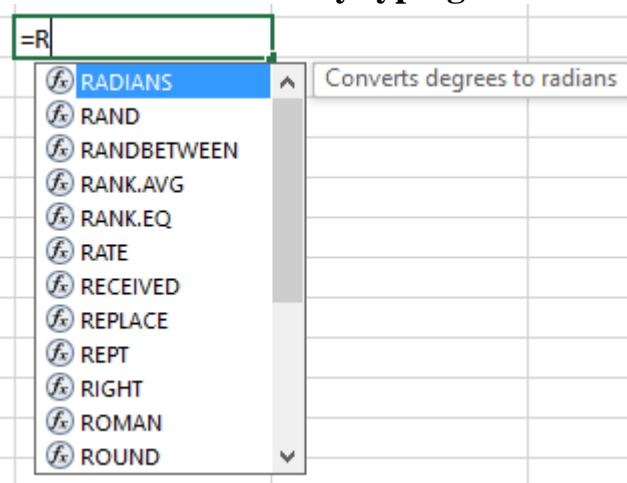|	A	B	C
1	R	20	radius
2	N	360	sides of Polygon
3			
4	Thd	=360/B2	degree

figure -> **by typing '=' and then selecting cell B2, then 'enter'. Check Thd changes if N is modified.**

Step3: **Make a column for Serial number 'Sr' and angle in radians 'Thr (rad)'**

F13   ▼   ⋮   ✕ ✓ f_x

	A	B	C	D	E
1	R	20	radius	Sr	Thr (rad)
2	N	360	sides of Polygon	0	0
3				1	=RADIANS($B$4)
4	Thd	=360/B2	degree		

as in figure ->
Calculate Angle in radians Thr from Thd by typing =R and selecting

=R

f_x RADIANS	∧	Converts degrees to radians
f_x RAND		
f_x RANDBETWEEN		
f_x RANK.AVG		
f_x RANK.EQ		
f_x RATE		
f_x RECEIVED		
f_x REPLACE		
f_x REPT		
f_x RIGHT		
f_x ROMAN		
f_x ROUND	∨	

RADIANS as in fig ->

OR =(click) on f_x **and select the RADIANS function from 'Math & Trig'. When selecting cell B4 use the F4 function key to make 'B4' as a fixed reference '$B$4' in the equation. i.e. this cell reference will remain unchanged even if the equation is copied, dragged copied, etc.**
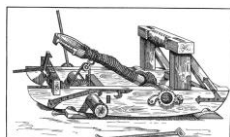
Step 4: Define columns for P point on the circle (Px and Py coordinates) Px=Rsin(Thr) and similarly Py. Thr is referenced from the column 'E'. The equations are shown in figure ->

	A	B	C	D	E	F	G
1	R	20	radius	Sr	Thr (rad)	Px	Py
2	N	360	sides of Polygon	0	0	=B1	0
3				=D2+1	=E2+RADIANS($B$4)	=$B$1*COS(E3)	=$B$1*SIN(E3)
4	Thd	=360/B2	degree				

Step 5: Select cell D3 to G3 as shown below and take the mouse pointer to the lower right corner of selection till a '+' sign comes. Left-click mouse and drag the row down to form 360 rows as shown in next figure.

	A	B	C	D	E	F	G
1	R	20	radius	Sr	Thr (rad)	Px	Py
2	N	360	sides of Polygon	0	0	20	0
3				1	0.017453293	19.9969539	0.349048129
4	Thd	1	degree				

	A	B	C	D	E	F	G
1	R	20	radius	Sr	Thr (rad)	Px	Py
2	N	360	sides of Polygon	0	0	20	0
3				1	0.017453293	19.9969539	0.349048129
4	Thd	1	degree	2	0.034906585	19.98781654	0.697989934
5				3	0.052359878	19.9725907	1.046719125
6				4	0.06981317	19.95128101	1.395129475
7				5	0.087266463	19.92389396	1.743114855
8				6	0.104719755	19.89043791	2.090569265
9				7	0.122173048	19.85092303	2.437386868

Step 6: Select Px and Py columns as shown with Ctrl+Shift+down arrow key OR with the mouse.

	A	B	C	D	E	F	G
1	R	20	radius	Sr	Thr (rad)	Px	Py
2	N	360	sides of Polygon	0	0	20	0
3				1	0.017453293	19.9969539	0.349048129
4	Thd	1	degree	2	0.034906585	19.98781654	0.697989934
5				3	0.052359878	19.9725907	1.046719125
6				4	0.06981317	19.95128101	1.395129475
7				5	0.087266463	19.92389396	1.743114855

Generate Scatter with straight lines graph as shown below.
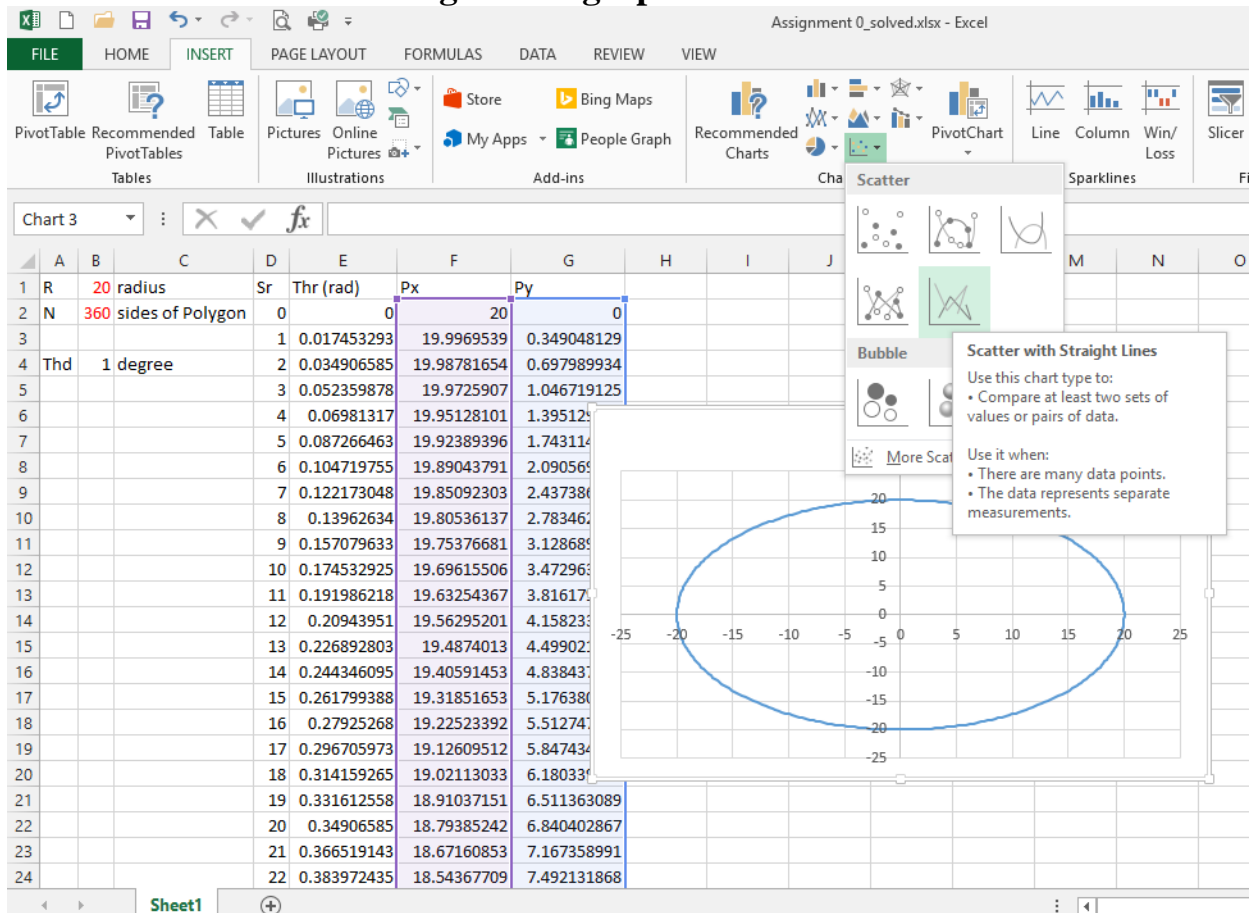
Drag the graph boundary to make it into a circle.

©A.S.Jawanda, Assoc. Prof. MED (Reference: TCD course 1E10)   Page **5** of **13**
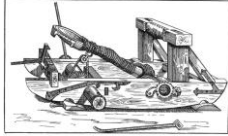
Step 7:

Right-click on Sheet1 tab on the lower left of the screen.
Copy the sheet to make a new one

| | 7 | 0.122173048 | 19.850923 |

Move or Copy ? ✕

Move selected sheets
To book:

Assignment 0_solved.xlsx ⌄

Before sheet:

Sheet1
(move to end)

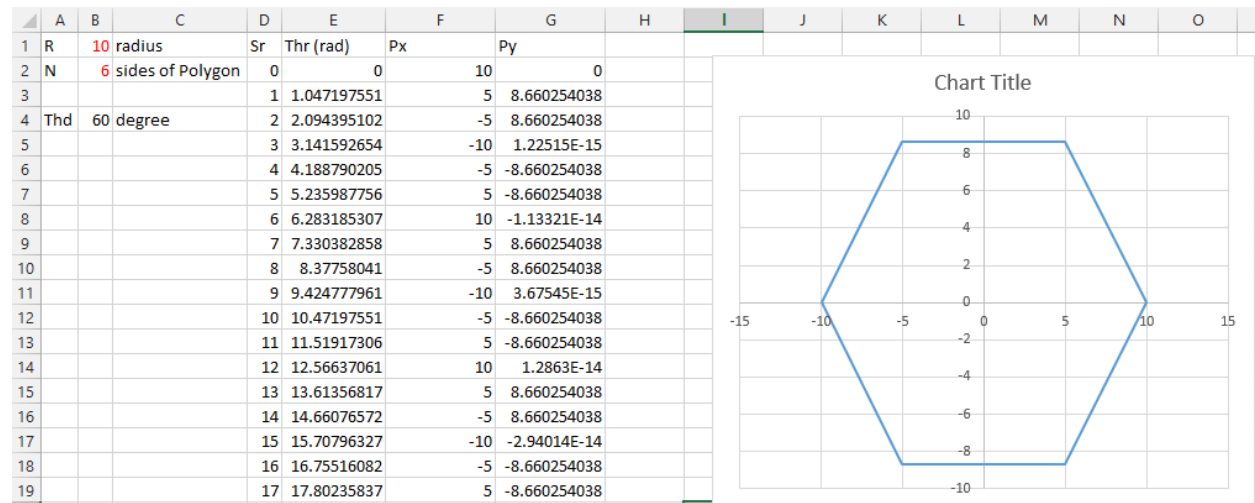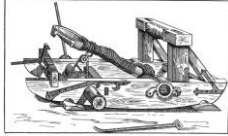☑ Create a copy

OK   Cancel

| | 22 | 0.383972435 | 18.543677 |
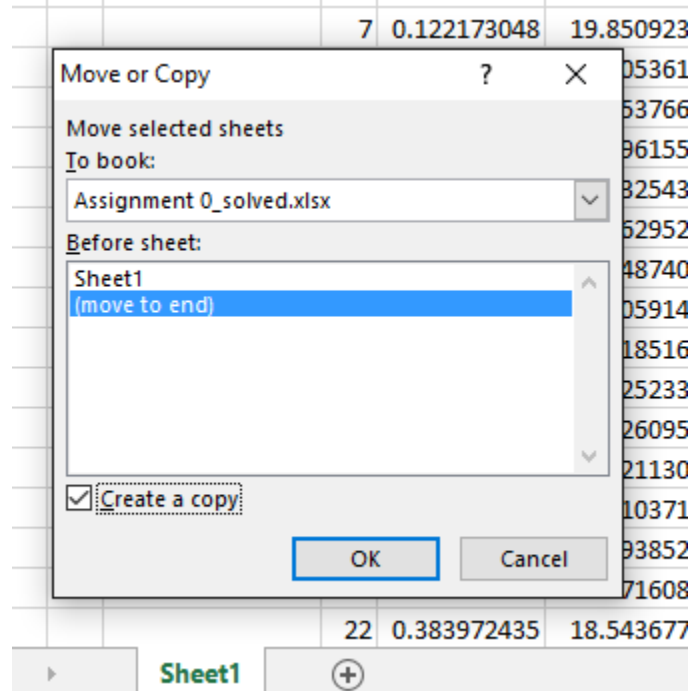
Sheet1   ⊕

In this sheet set R=10 and N=6
Get

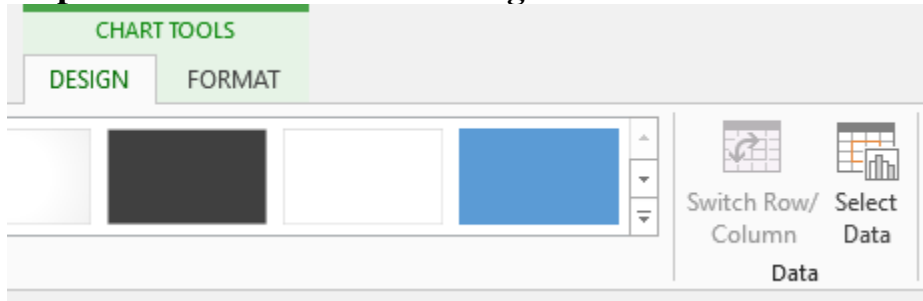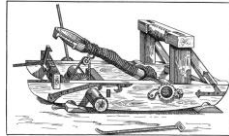|	A	B	C	D	E	F	G	H
1	R	10	radius	Sr	Thr (rad)	Px	Py	
2	N	6	sides of Polygon	0	0	10	0	
3				1	1.047197551	5	8.660254038	
4	Thd	60	degree	2	2.094395102	-5	8.660254038	
5				3	3.141592654	-10	1.22515E-15	
6				4	4.188790205	-5	-8.660254038	
7				5	5.235987756	5	-8.660254038	
8				6	6.283185307	10	-1.13321E-14	
9				7	7.330382858	5	8.660254038	
10				8	8.37758041	-5	8.660254038	
11				9	9.424777961	-10	3.67545E-15	
12				10	10.47197551	-5	-8.660254038	
13				11	11.51917306	5	-8.660254038	
14				12	12.56637061	10	1.2863E-14	
15				13	13.61356817	5	8.660254038	
16				14	14.66076572	-5	8.660254038	
17				15	15.70796327	-10	-2.94014E-14	
18				16	16.75516082	-5	-8.660254038	
19				17	17.80235837	5	-8.660254038	

Step 8: Make another new sheet as the first one. "Graph". Rename the other two as "Circle" and "HEX". Insert a blank 'Scatter with straight lines' graph as shown
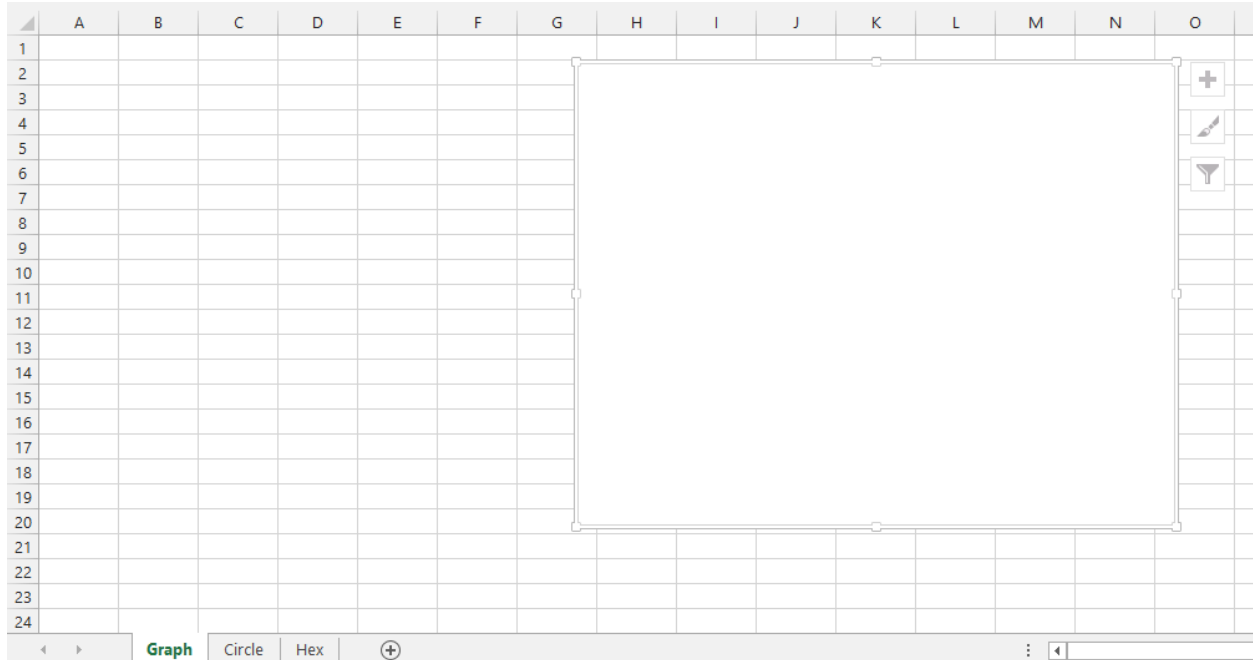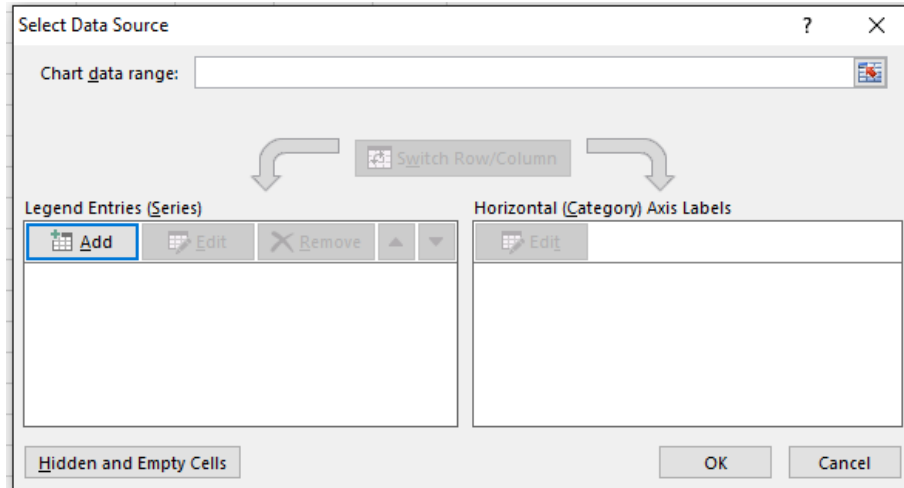
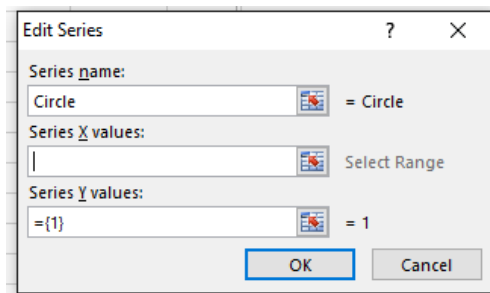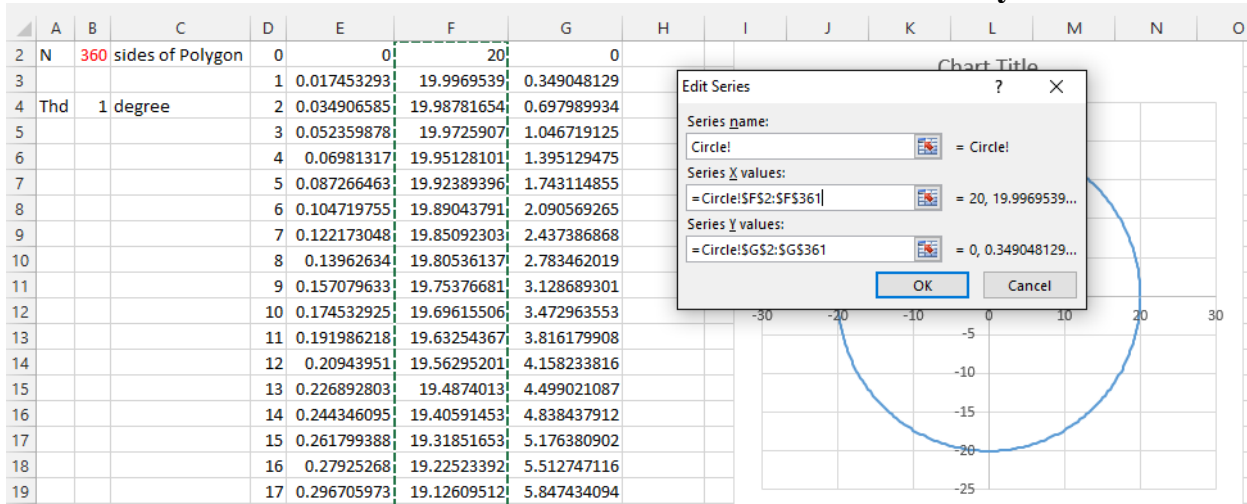**Step 9: Under chart tools> Design tab select "Select Data".**

'Add' series.

Select Data Source

Chart data range:

Switch Row/Column

Legend Entries (Series)   Horizontal (Category) Axis Labels

Add   Edit   Remove   Edit

Hidden and Empty Cells   OK   Cancel

Enter Series name 'click on sheet name "circle", click on red arrow for X values.

Edit Series

Series name:
Circle   = Circle

Series X values:
    Select Range

Series Y values:
={1}   = 1

OK   Cancel

Select the column values of 'Px' from Circle sheet and similarly for Y values.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	N	360	sides of Polygon	0	0	20	0					Chart Title			
3				1	0.017453293	19.9969539	0.349048129								
4	Thd	1	degree	2	0.034906585	19.98781654	0.697989934								
5				3	0.052359878	19.9725907	1.046719125								
6				4	0.06981317	19.95128101	1.395129475								
7				5	0.087266463	19.92389396	1.743114855								
8				6	0.104719755	19.89043791	2.090569265								
9				7	0.122173048	19.85092303	2.437386868								
10				8	0.13962634	19.80536137	2.783462019								
11				9	0.157079633	19.75376681	3.128689301								
12				10	0.174532925	19.69615506	3.472963553			-30	-20	-10	0	10	
13				11	0.191986218	19.63254367	3.816179908						-5		
14				12	0.20943951	19.56295201	4.158233816						-10		
15				13	0.226892803	19.4874013	4.499021087								
16				14	0.244346095	19.40591453	4.838437912						-15		
17				15	0.261799388	19.31851653	5.176380902								
18				16	0.27925268	19.22523392	5.512747116						-20		
19				17	0.296705973	19.12609512	5.847434094						-25		

Edit Series

Series name:
Circle!   = Circle!

Series X values:
=Circle!$F$2:$F$361   = 20, 19.9969539...

Series Y values:
=Circle!$G$2:$G$361   = 0, 0.349048129...

OK   Cancel

Similarly "Add" another series for the "Hex" as shown below (6 vertex only).

Sr	Thr (rad)	Px	Py
0	0	10	0
1	1.047197551	5	8.660254038
2	2.094395102	-5	8.660254038
3	3.141592654	-10	1.22515E-15
4	4.188790205	-5	-8.660254038
5	5.235987756	5	-8.660254038
6	6.283185307	10	-1.13321E-14
7	7.330382858	5	8.660254038
8	8.37758041	-5	8.660254038
9	9.424777961	-10	3.67545E-15
10	10.47197551	-5	-8.660254038
11	11.51917306	5	-8.660254038
12	12.56637061	10	1.2863E-14
13	13.61356817	5	8.660254038
14	14.66076572	-5	8.660254038
15	15.70796327	-10	-2.94014E-14
16	16.75516082	-5	-8.660254038
17	17.80235837	5	-8.660254038

Edit Series   ?   ✕

=Hex!$F$2:$F$7

ALTERNATELY (Works in MS Excel): After making the sheet "Graph".
- Copy and paste the Circle graph to the "Graph" sheet.
- Copy and paste the Hex graph on to the Circle graph in "Graph" sheet.
- Copy and paste special as 'link' the cells from A1 to C2 from circle sheet and Hex sheet to the "Graph" sheet label them appropriately to differentiate.
- Vary the values of the R and N and observe graphs.

The resultant combined graph should appear as below:
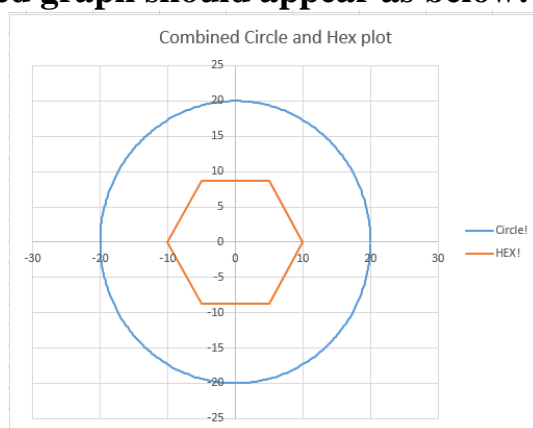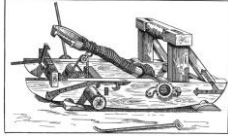
EXTRA PRACTICE FOR THOSE WHO LIKE A CHALLENGE:

1. Plot a SIN / COS curve for amplitude-A and number of cycles-C.
2. Plot the SIN variation of the radius of a circle. Hint: divide no of cycles in 360 degrees, vary the R=r+A.
3. Plot polynomial curves like Parabola. Hyperbola etc.
4. Plot Cycloidal curves – epi cyclic / hypo cyclic.

Notes:

1. It is advisable to use your own PC to do this assignment as future assignments will be individual submissions only. MSExcel or OpenOffice Calc or similar spreadsheet package can be used.
2. Do not leave this assignment until the last minute to find you have some IT issue.

Enjoy the assignment and try to think around the subject as much as possible to try variations of it for practice.
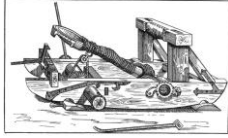
Submission: Generate only a PDF file for submission as follows:
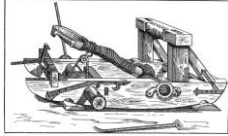
UTA013
Engineering Design Project-II (Mangonel)

Assignment - 0.
Working on a spreadsheet (e.g. MS Excel /OO Calc)

NAME:_____ Roll No:_____ Group:_____

This submission is original work and no part is plagiarized
(Signed-Type your name) _____(Date)_____

(Paste your graph(s) below this. They should be formatted to look as shown in the next page.)
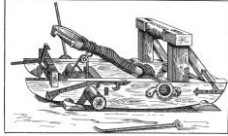
Note: Format all the elements of the graph as shown below. Take special care of the aspect ratio of the scale of the x-axis and y-axis. A circle should 'appear' like a circle and not an oval.
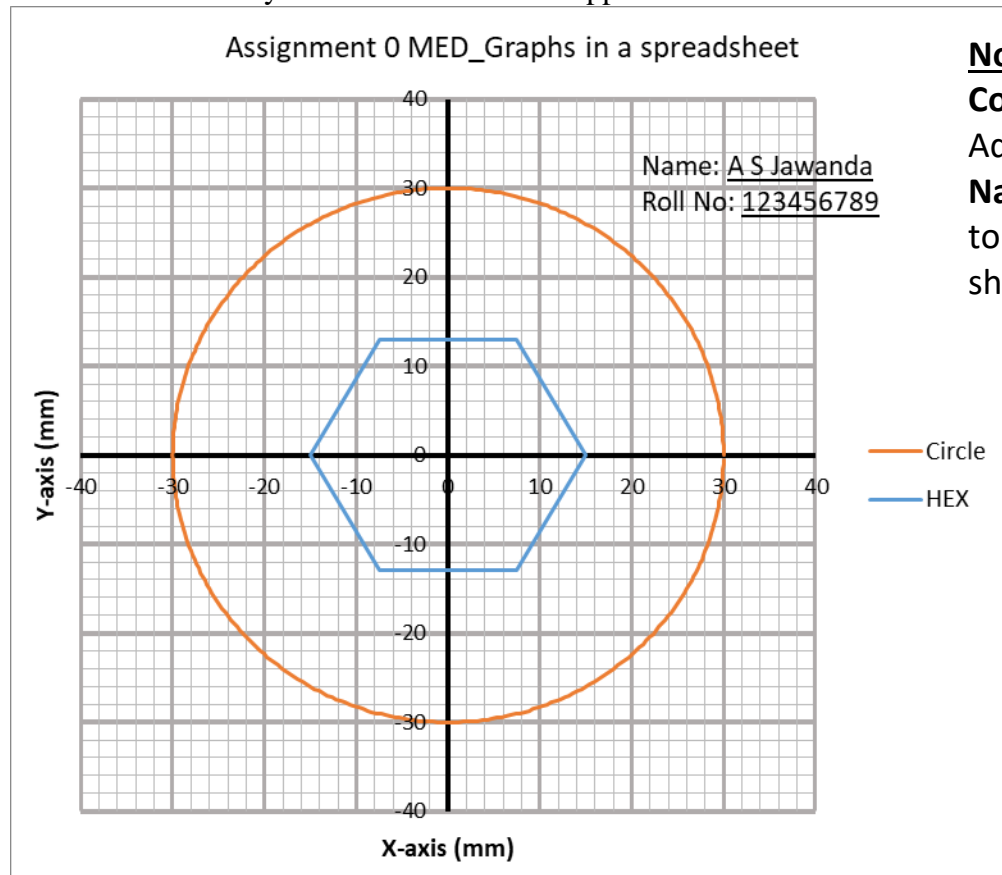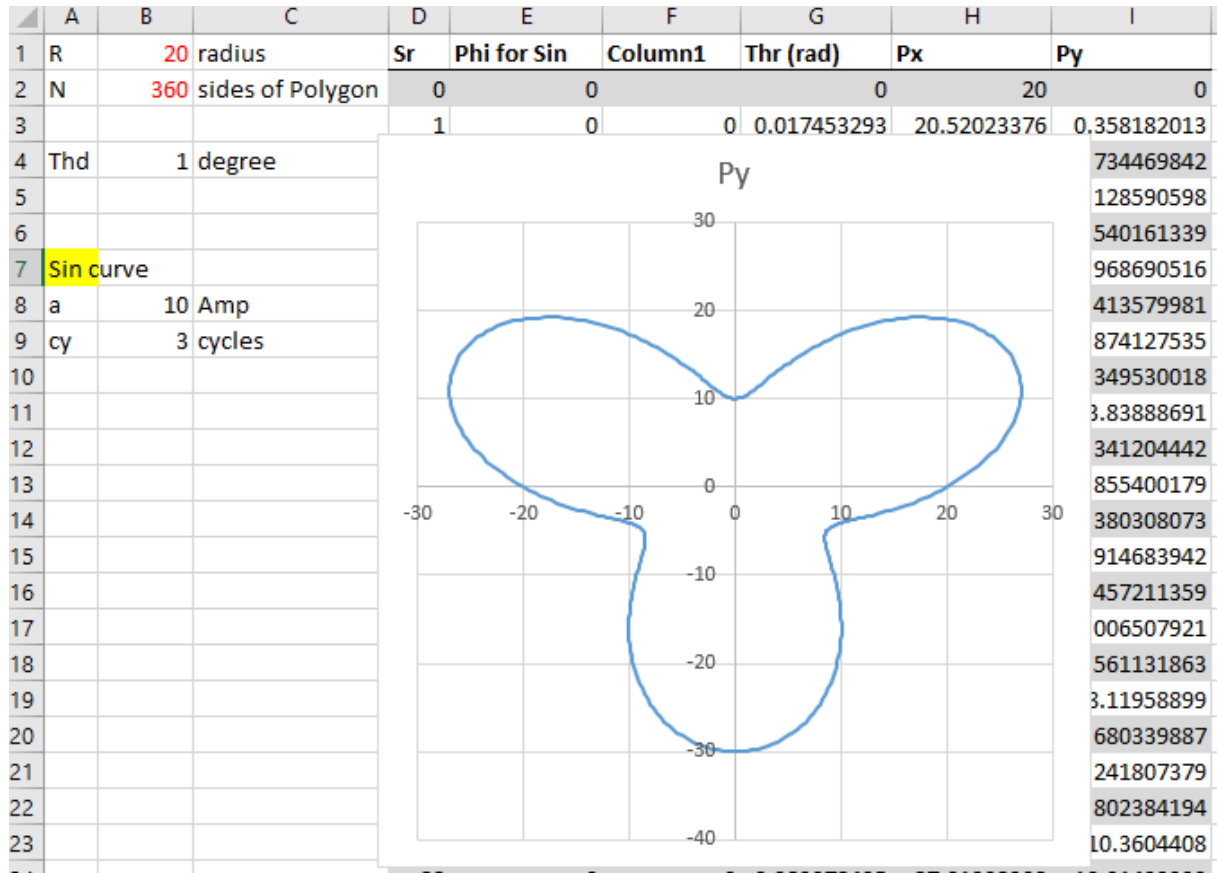

Note:
Compulsory to Add Text box of **Name and Roll No** to every graph as shown.

and

If you have taken the challenge it would look like this for the shown values:

	A	B	C	D	E	F	G	H	I
1	R	20	radius	Sr	Phi for Sin	Column1	Thr (rad)	Px	Py
2	N	360	sides of Polygon	0	0		0	20	0
3				1	0	0	0.017453293	20.52023376	0.358182013
4	Thd	1	degree						734469842
5									128590598
6									540161339
7	Sin curve								968690516
8	a	10	Amp						413579981
9	cy	3	cycles						874127535
10									349530018
11									3.83888691
12									341204442
13									855400179
14									380308073
15									914683942
16									457211359
17									006507921
18									561131863
19									3.11958899
20									680339887
21									241807379
22									802384194
23									10.3604408

THE END