ENG103 – Computer Aided Design
Lecture Set V

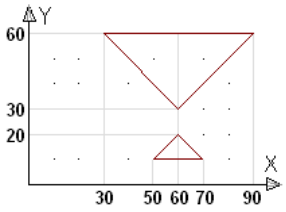
ARC Tool Command

The command for arc is '**ARC**'. It is possible to draw an arc with one of the 10 methods. These are,

1.	3 Point	
2.	Start-Center-End	Group I
3.	Start-Center-Angle	
4.	Start-Center-Length	
5.	Start-End-Angle	Group II
6.	Start-End-Direction	
7.	Start-End-Radius	
8.	Center-Start-End	Group III
9.	Center-Start-Angle	
10.	Center-Start-Length	

Group I and Group III are exactly the same except Start & Center priority. In both groups the distance between 'Start' and 'Center' determines '**Radius**' of the arc that will be drawn. There'll be no need to discuss Group III after discussing Group I.

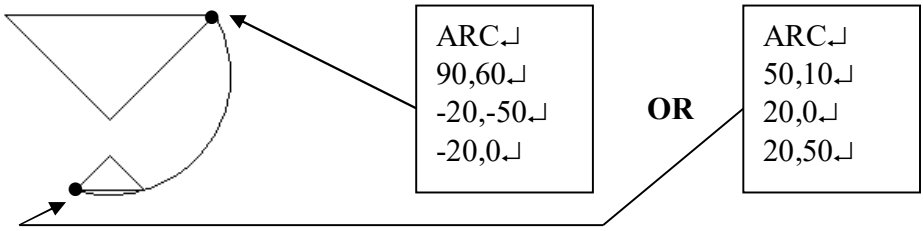
While exercising arcs, given triangles (on right) will be used (with given coordinates) so, let's draw them first.



L↵	L↵
60,30↵	60,20↵
30,30↵	10,-10↵
-60,0↵	-20,0↵
C↵	C↵

Note: *Center* will be indicated with (❁)
Start will be indicated with (●)

1. 3 Point: Draws an arc which starts from first point and stops with last point. It is possible to draw an arc (or a circle) using three poins if they are not on a straight line.

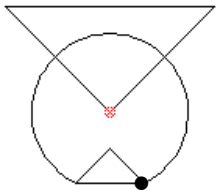


```
ARC↵
90,60↵
-20,-50↵
-20,0↵
```

OR

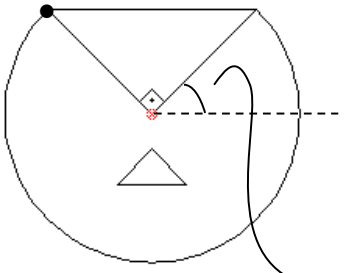
```
ARC↵
50,10↵
20,0↵
20,50↵
```

2. Start-Center-End: First point will be the starting point of arc. Second point will be the center of arc and also will determine radius of arc. Arc will be drawn counter-clockwise (anti-clockwise). Line which passes through last point and center will be the end of arc.



```
ARC↵
70,10↵
C↵
-10,20↵
-10,-20↵
```

3. Start-Center-Angle: First point will be the starting point of arc. Second point will be the center of arc and also will determine radius of arc. Arc will be drawn counter-clockwise (anti-clockwise). Third value will be the angle of arc.



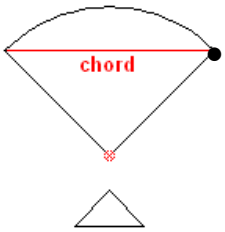
```
ARC↵
30,60↵
C↵
30,-30↵
A↵
270↵
```

It is possible to draw exactly same figure as,

```
ARC↵
30,60↵
C↵
30,-30↵
45↵
```

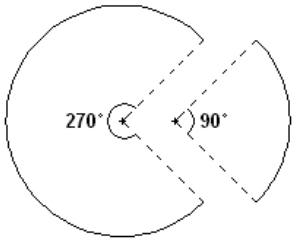
If parameter 'A' is NOT used, angle is determined from horizontal

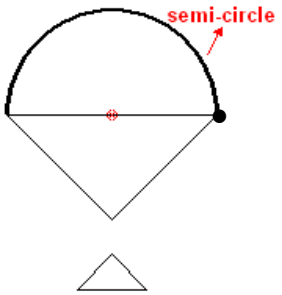
4. Start-Center-Length: First point will be the starting point of arc. Second point will be the center of arc and also will determine radius of arc. Arc will be drawn counter-clockwise (anti-clockwise). Third value will be the length of chord.




```
ARC↵
90,60↵
C↵
-30,-30↵
L↵
60↵
```

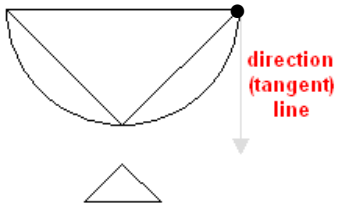
5. Start-End-Angle: First point and second point is the starting and end point of arc. Arc will be drawn counter-clockwise (anti-clockwise). Last value is the ***angle*** of arc. *Last value also determines the center of arc. If angle is greater than 180, center of arc will be inside of enclosed area of arc. If angle is less then 180, center of arc will be outside of enclosed area of arc.*






```
ARC↵
90,60↵
E↵
-60,0↵
A↵
180↵
```

6. Start-End-Direction: First point and second point is the starting and end point of arc. Third point is the coordinate of direction line. Direction line is drawn between starting point and last coordinate. Direction line is tangent line of arc.

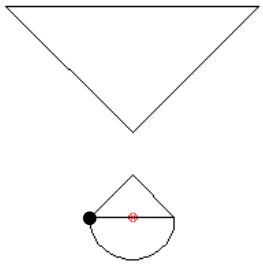



```
ARC↵
90,60↵
E↵
-60,0↵
D↵
0,-10↵
```

This coordinate is given relative to starting point. Line that will be drawn between starting coordinate and this point will be direction (tangent) line for arc. If this line modified as '0,-500↵', result does not change.

If this line is modified as '0,10↵', the result will be exactly same as previous example.

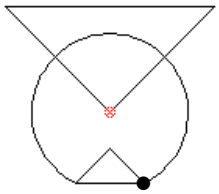
7. Start-End-Radius: First point and second point is the starting and end point of arc. Arc will be drawn <u>counter-clockwise</u> (anti-clockwise). Last value is the radius of arc. Note that, radius of arc must NOT be smaller than the half of distance between starting and end point.



```
ARC↵
50,10↵
E↵
20,0↵
R↵
10↵
```

<u>NOTICE:</u>
Arc drawing method 8, 9 and 10 are exactly the same as 2, 3 and 4. The only difference is that, in 2, 3 and 4 First *start point* then *center point* is given but in 8, 9, 10 First *center point* then *start point* must be determined. Repeat following examples with methods 8, 9 and 10.

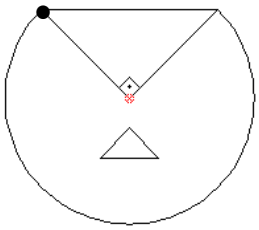
8. Center-Start-End



```
ARC↵
C↵
60,30↵
10,-20↵
-10,-20↵
```

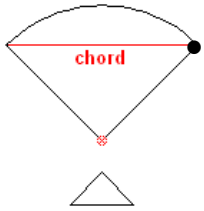
Both of them are relative to center of arc

9. Center-Start-Angle



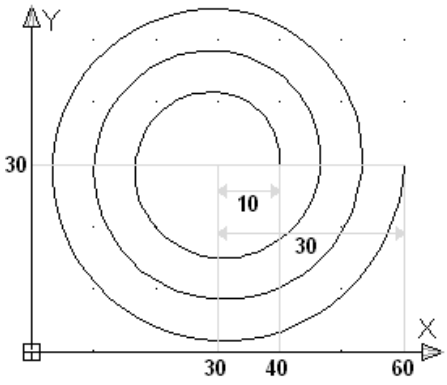
```
ARC↵
C↵
60,30↵
-30,30↵
A↵
270↵
```

10. Center-Start-Length



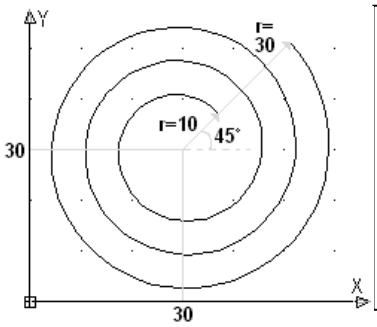

```
ARC↵
C↵
60,30↵
30,30↵
L↵
60↵
```

HELIX Tool Command

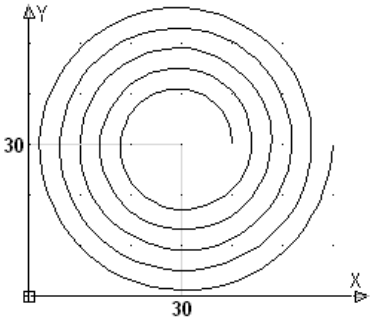


The command for helix is 'HELIX'. Helix command creates a spiral in 2D or a spring in 3D drawing. As default, drawing direction is counter (anti) clockwise.

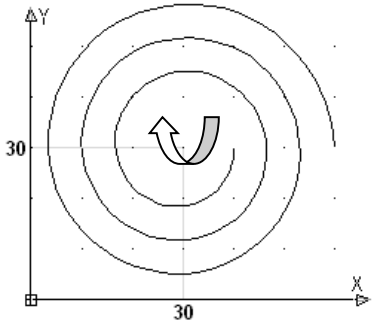
HELIX↵
30,30↵ ← Center for spiral
10↵ ← Base (starting) radius (or diameter with 'D')
Note that, in base radius it is possible to give angle or coordinate also.
30↵ ← Top (finishing) radius (or diameter with 'D')
0↵ ← It is used in 3D for the height of spring so, in 2D any value can be given.
Also, it is possible to change, i) Number of '**T**'urns,
ii) T'**W**'ist Direction or
iii) '**A**'xis Endpoint



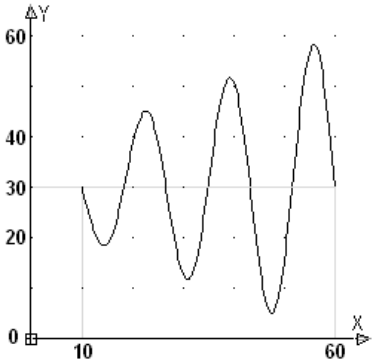
HELIX↵
30,30↵
10<45↵
30↵
0↵



HELIX↵
30,30↵
10↵
30↵
T↵
5↵
0↵



HELIX↵
30,30↵
10↵
30↵
W↵
CW↵
0↵



HELIX↵
10,30↵
10↵
30↵
A↵
50↵

Axis Endpoint mainly used in 3D but when we use it in 2D it helps us to see the section of spring.

After entering 'A', the length of spring must be determined.