

# Wolfram *Mathematica* 10

---

## setup

overhead

tag

```
In[85]:= (* project directory *)
home = "PETTT/RA/jeff/rotation/";
(* common variable definitions *)
Get["utility modules.m", Path -> dirPack];
stamp1; (* time, date, system user *)

maximum memory: 0.0551045 GB

user: rditldmt, CPU: ITL-DTOPA-MP, MM v. 10.4.1 for Mac OS X x86

ip: 10.10.0.2, domain: erdc.dren.mil, location: GeoPosition[{32.44, -90.74}]

date: Aug 9, 2016, time: 16:04:55

nb: /Users/rditldmt/Dropbox/ nb/PETTT/RA/jeff/rotation/rotate points 02.nb
```

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## modules et al.

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## create solid

```
In[93]:= numPoints = 7;
phi =  $\frac{2 \pi}{\text{numPoints}}$ ; (* angular separation of points *)
Vertices of the n - gon

In[95]:= unitCircle = {Cos[#], Sin[#]} & /@ Range[0, 2  $\pi$  - phi, phi];

In[96]:= shift = {1, 2}; (* translation vector: polygon origin *)

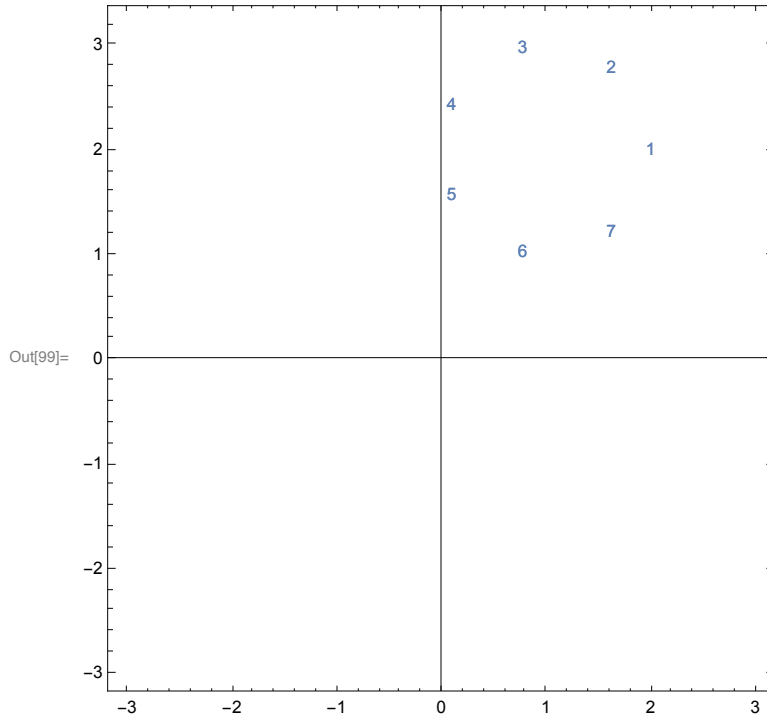
In[97]:= vertices = (# + shift) & /@ unitCircle; (* input mesh *)

Diagnostic plot
```

```

In[98]:= tbl = Table[
  ListPlot[{vertices[[k]]}, PlotMarkers -> {k}]
  , {k, numPoints}];
g002 = Show[tbl, AspectRatio -> Automatic,
  Frame -> True, PlotRange -> 3.05 {{-1, 1}, {-1, 1}}]

```



## rotate points about p

```

In[100]:=  $\theta = \frac{4}{3}\pi$ ; (* rotation angle for mesh *)
Clear[R]; (* rotation matrix *)
R[ $\theta$ _] := {{Cos[ $\theta$ ], -Sin[ $\theta$ ]}, {Sin[ $\theta$ ], Cos[ $\theta$ ]}};

In[103]:=  $p = \frac{1}{2}\{-1, 1\}$ ;
g200 = ListPlot[{p}, PlotStyle -> {Red}];

In[105]:= newVertices = (R[ $\theta$ ].(# - p) + p) & /@ vertices; (* rotated points *)

In[106]:= tbl = Table[
  ListPlot[{newVertices[[k]]}, PlotMarkers -> {k}]
  , {k, numPoints}];
g003 = Show[tbl, AspectRatio -> Automatic, Frame -> True];

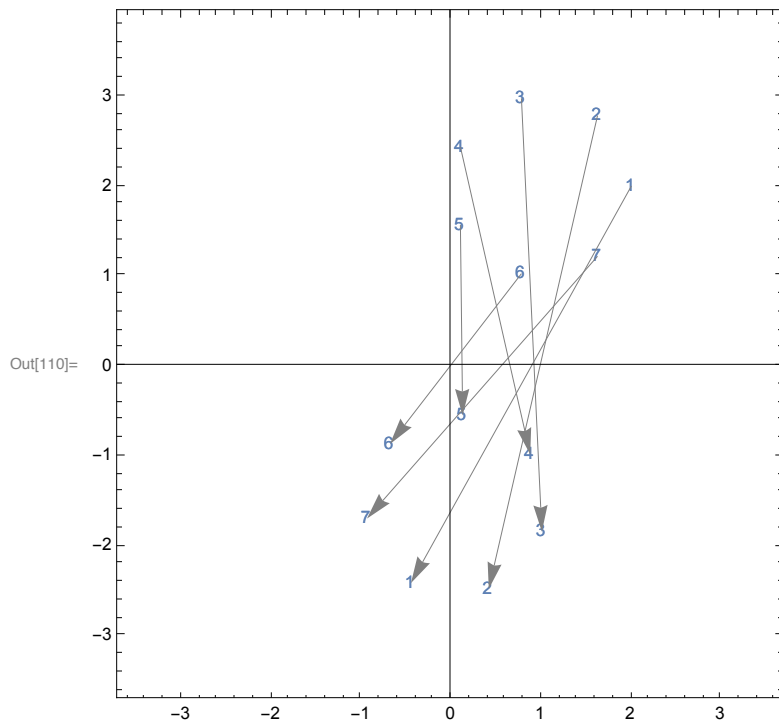
```

## connect dots: chord

```

In[108]:= tbl = Table[
  Arrow[{vertices[[k]], newVertices[[k]]}],
  {k, numPoints}];
g100 = Graphics[{Gray, tbl}];
g004 = Show[{g002, g003, g100}, PlotRange -> 3.55 {{-1, 1}, {-1, 1}}]

```

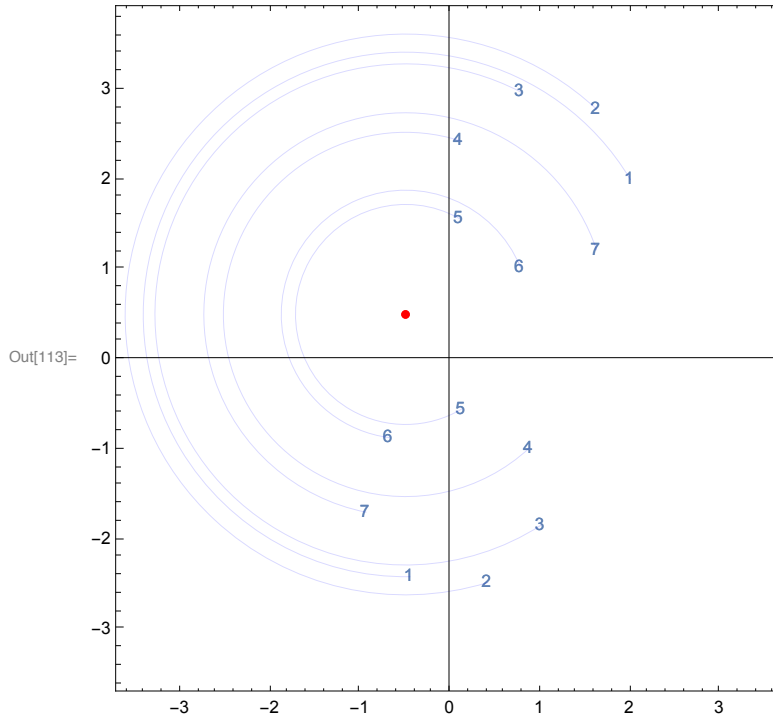


## connect dots: arc

```

In[111]:= tbl = Table[
  q = vertices[[k]];
  radius = Norm[p - q];
  φ = ArcTan[q[[1]] - p[[1]], q[[2]] - p[[2]]];
  Circle[p, radius, {φ, φ + θ}]
, {k, numPoints}];
g101 = Graphics[{Blue, Opacity[0.15], tbl}];
g005 = Show[{g002, g003, g101, g200}, PlotRange → 3.55 {{-1, 1}, {-1, 1}}]

```



## validate rotation does not change radius

```

In[114]:= tvertices = (# - p) & /@ vertices; (* original points, translated *)
In[115]:= nrmtvertices = {#[[1]], #[[2]], Norm[#]} & /@ tvertices;
In[116]:= TableForm[nrmtvertices // N, TableHeadings → {Automatic, {"x", "y", "radius"}}]

```

Out[116]//TableForm=

	x	y	radius
1	2.5	1.5	2.91548
2	2.12349	2.28183	3.11704
3	1.27748	2.47493	2.78518
4	0.599031	1.93388	2.02454
5	0.599031	1.06612	1.22288
6	1.27748	0.525072	1.38118
7	2.12349	0.718169	2.24165

```

In[117]:= tnewVertices = (# - p) & /@ newVertices; (* rotated points, translated *)
nrmtnewVertices = {#[[1]], #[[2]], Norm[#]} & /@ tnewVertices;

```

```
In[119]:= TableForm[nrmtnewVertices // N, TableHeadings → {Automatic, {"x", "y", "radius"}}]
```

```
Out[119]//TableForm=
```

	x	y	radius
1	0.0490381	-2.91506	2.91548
2	0.914379	-2.97991	3.11704
3	1.50461	-2.34379	2.78518
4	1.37528	-1.48572	2.02454
5	0.623768	-1.05183	1.22288
6	-0.184014	-1.36887	1.38118
7	-0.439793	-2.19808	2.24165

## check rotation

Verify that the radius is unchanged. Vector should be all 0s.

```
In[120]:= Table[
  nrmtvertices[[k, 3]] - nrmtnewVertices[[k, 3]]
, {k, numPoints}] // N
```

```
Out[120]= {4.44089 × 10-16, 0., 4.44089 × 10-16, 0., 2.22045 × 10-16, 0., 4.44089 × 10-16}
```

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fin