# MAT 331
# Exercise 5

animations of hypo- and epicycloids

```
> restart; with(plots): with(plottools):
```

## 1. Epicycloid.

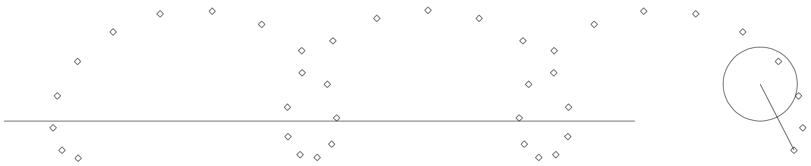
Using the code to produce an animation of the cycloid (below) as a guide, produce an animation of the epicycloid (a circle of radius r  rolling on the outside a circle of radius R) This should be a procedure which allows the user to vary the inner and outer radius.

### sample cycloid code

```
> cycloid := proc(len, spoke_len, num_frames)
    local cyc, baseline, pict, dots, picts, t, r ;
    r := spoke_len;
    cyc := (t, r)->[t-r*sin(t), 1-r*cos(t)]:
    baseline := line([-2,0], [15,0]):
    pict := []:
    dots := []:
    picts := []:

    for t from 0 by evalf(len)/num_frames to evalf(len)
   do
    dots := [op(dots), cyc(t,r)];
    pict := [ baseline, curve(dots, style = POINT),
              disk([t,1],1, color = white),
              line([t,1], cyc(t, r),color = black, thickness = 2)];
    picts := [op(picts),display(pict)];
   od:
    display(picts, scaling = constrained, insequence = true, axes =
  none);
  end:

> cycloid(6*Pi,2, 40);
```



### the guts of the epicycloid animation

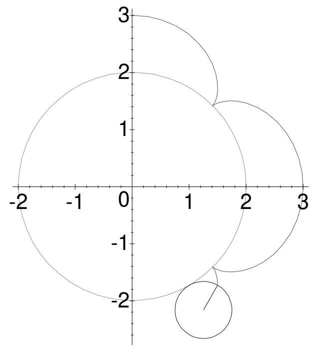
Here are some lines that make up the "guts" of your animation.  Adjust to suit your taste.  Note that this parameterization starts the point at $[0, r+R]$ when $t = 0$.

```
> R:=2:  r:=.5: t:=5*Pi/6:

> epi := (R,r,t) ->
```

```
          [(R+r)*sin(t)+r*sin((R+r)*t/r),
           (R+r)*cos(t)+r*cos((R+r)*t/r)]:
> cR :=circle([0,0],R,color=green,thickness=2):
  cr := circle([(R+r)*sin(t),(R+r)*cos(t)],r,
             color=blue,thickness=2):
  l := line([(R+r)*sin(t),(R+r)*cos(t)],epi(R,r,t),color=purple):
  g:=plot([op(epi(R,r,s)),s=0..t],color=red):

> display(cR,cr,l,g,scaling=constrained);
```

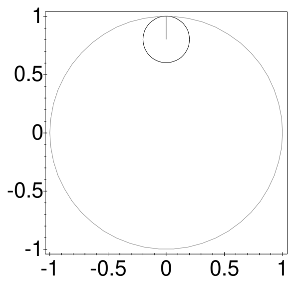



## 2. Hypocycloid.

Modify your answer in (1) to produce the hypocycloid, where the disk rolls on the inside. You will have to rederive the parametric equation. Take care to note which way the rolling wheel turns (clockwise or counter-clockwise).

What happens when $r = \frac{R}{2}$? This should give a rather special hypocycloid.

### See the maple worksheet /home/mat331/exercise5.mws for a sample Hypocycloid animation




To turn in your project, save it as a maple worksheet, then send email to your instructor containing the full path name of the worksheet. For example, if your login is `foofoo` and the file is called `ex5.mws` in your home directory, you should send the name `/home/foofoo/ex5.mws` to us. Make sure the file is publically readable.

Our email addresses are:


S. Sutherland -- `scott@math.sunysb.edu`

S. Mandell -- `mandell@math.sunysb.edu`