Math 4530
Solutions to hw due January 28

Chapter 1: 6.2-6.6, 6.9 (kappa3,kappa4), 6.10 (kappa3d1, tau3d1).
Chapter 2: 1.6-1.7, 5.1-5.5

I have decided to break the solutions into two files. This file contains the chapter 1 portion. the file hwsolsjan28b.mws will contain solutions to the chapter 2 problems.

6.2: I have loaded the procedures from the posted file curtor.mws. These compute curvature and torsion.

```
> hel:=[a*cos(t),a*sin(t),b*t]:
  hel1:=subs({a=4,b=2},hel):
  curv(hel1);
  tor(hel1);
```

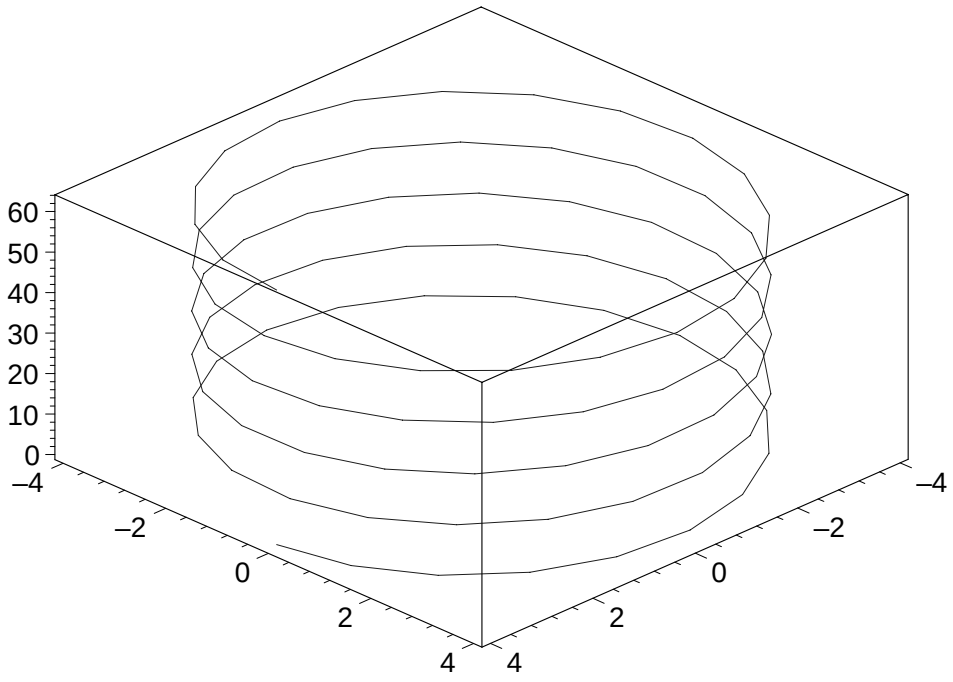
$$\kappa = \frac{1}{5}$$

$$\tau = \frac{1}{10}$$

6.3:

```
> with(plots):
Warning, the name changecoords has been redefined
```

```
> spacecurve(hel1,t=0..10*Pi,scaling=unconstrained,
  thickness=1,color=blue,axes=boxed,numpoints=100);
  #I increased numpoints to get a smoother picture
```



6.4, 6.5, 6.6 have a lot of work that is easier to do by hand, and I intend to minimize my work.

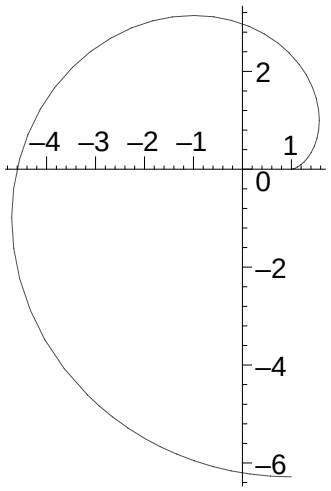
6.4) Using the formula for involute (exercise 2.4 page 17), and noting that for us, s(t)=sqrt(2)*t, one deduces that the involute of the given helix is a curve in the x-y plane, with formula

```
> Invo:=[cos(t)+t*sin(t),sin(t)-t*cos(t)];
```

$$Invo := [\cos(t) + t\sin(t), \sin(t) - t\cos(t)]$$

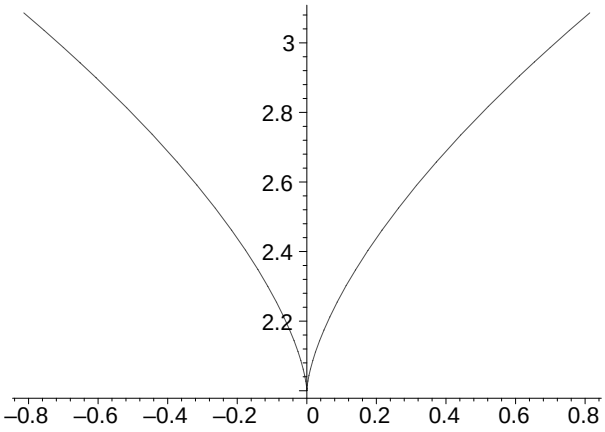
We recognize that this is actually the involute of a unit circle as well. Here's a picture:

```
> plot([cos(t)+t*sin(t),sin(t)-t*cos(t),t=0..2*Pi]);
```



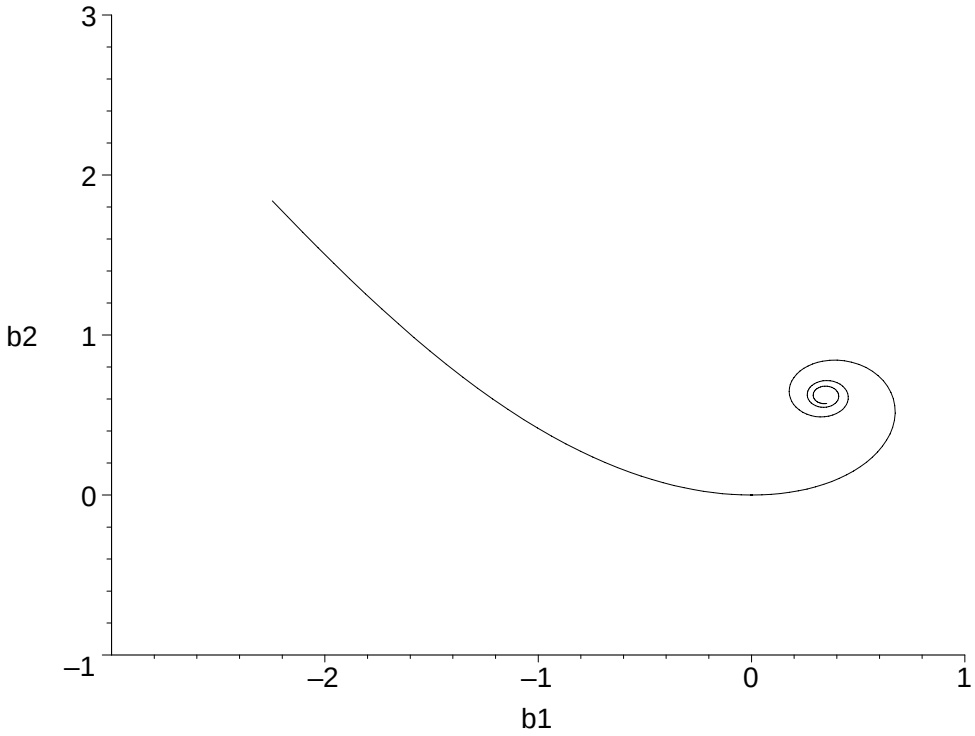
6.5-6.6) See hand-worked notes, for the formula derivations. Here's a picture of the evolute:

```
> plot([t-cosh(t)*sinh(t),2*cosh(t),t=-1..1]);
```

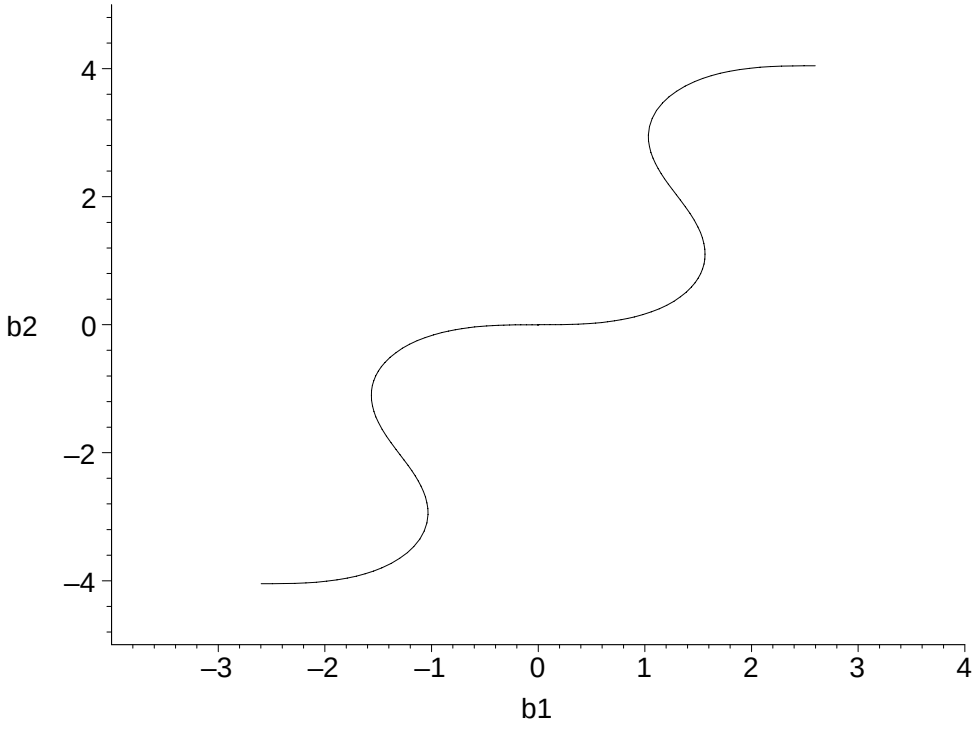


6.9: I have loaded the procedures from the posted document planecurve.mws. I adjust the parameter ranges to make nice pictures:

```
> kap3:=t->exp(t):
  kap4:=t->sin(t):
> recreate(kap3,-3,3,-3,1,-1,3);
```



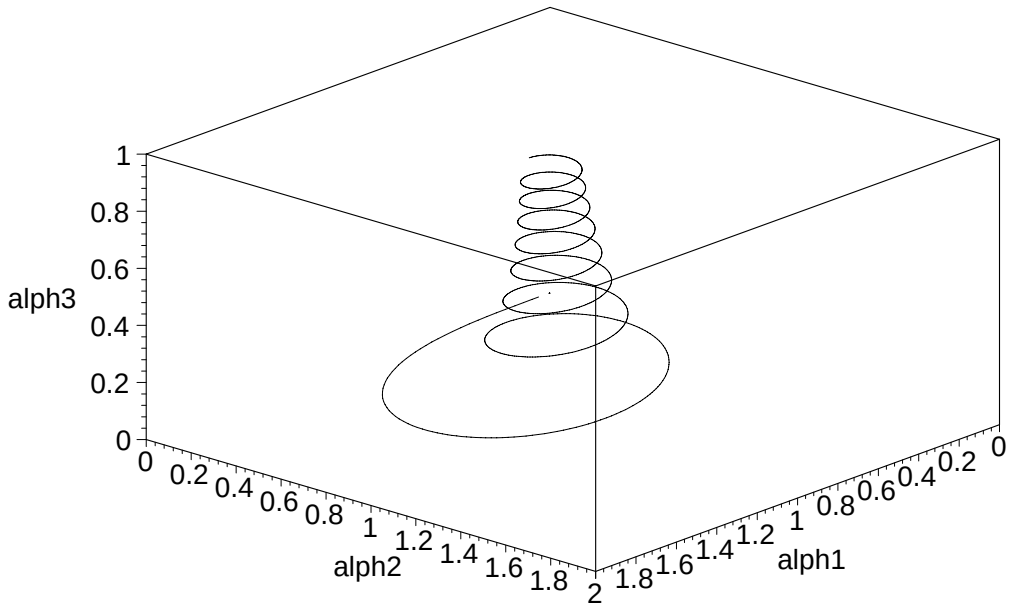

```
> recreate(kap4,-2*Pi,2*Pi,-4,4,-5,5);
```



6.10: I have loaded the procedures from the posted file frenet.mws:

```
> kap3d1:=t->t:
```

```
tau3d1:=t->t/10:
recreate3dview(kap3d1,tau3d1,0,10,0,2,0,2,0,1);
```




```
>
```