Matlab Notes for HW #9

Find and classify the critical points.

```
syms f(x,y)
f(x,y)=x*y^3+5*x*y^2+6*x*y;  g=gradient(f);  cp = solve(g==0);
```

By double clicking on the cp structure in the workspace, I see that I have three roots, so I do the following:

```
a=[cp.x(1), cp.y(1)]; b=[cp.x(2), cp.y(2)]; c = [cp.x(3), cp.y(3)];
disp(a), disp(b), disp(c)
```

$$\begin{pmatrix} 0 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & -2 \end{pmatrix}$$

$$\begin{pmatrix} 0 & -3 \end{pmatrix}$$

The discriminant and f_xx for each critical point are below; the determinant of the hessian gives the discriminant and is listed first.

(0,0):

```
H(x,y)=hessian(f,[x,y]); df2(x,y)=diff(f,x,2);
det(H(cp.x(1), cp.y(1))), df2(cp.x(1), cp.y(1))
```

$$\text{ans} = -36$$

$$\text{ans} = 0$$

(0,-2):

```
H(x,y)=hessian(f,[x,y]); df2(x,y)=diff(f,x,2);
det(H(cp.x(2), cp.y(2))), df2(cp.x(2), cp.y(2))
```

$$\text{ans} = -4$$

$$\text{ans} = 0$$

(0,-3):

```
H(x,y)=hessian(f,[x,y]); df2(x,y)=diff(f,x,2);
det(H(cp.x(3), cp.y(3))), df2(cp.x(3), cp.y(3))
```

$$\text{ans} = -9$$

$$\text{ans} = 0$$

So the second partials test tells us all three critical points are saddle points.