

## MAT 275

September 28, 2007

Please answer the following questions Maple and hand in your Maple worksheet. Type your name(s) at the top of the page and number each of the problems.

Use the following Maple commands for this worksheet:

**with(plots);**

```
implicitplot3d(F,x=x1..x2,y=y1..y2,z=z1..z2);  
plot3d(f,x=x1..x2,y=y1..y2);  
contourplot(f,x=x1..x2,y=y1..y2);  
gradplot(f,x=x1..x2,y=y1..y2);  
spacecurve([x(t),y(t),z(t)],t=t1..t2,thickness=4);  
display({p1,p2,p3});
```

where  $p1:=\text{contourplot}(\dots)$ ;  $p2:=\text{gradplot}(\dots)$ ; etc.

### 1. Gradient vectors

- Use *plot3d* to plot  $f(x, y) = (x^2 + 3y^2)e^{1-x^2-y^2}$  for  $-2 \leq x \leq 2$  and  $-2 \leq y \leq 2$ .
- Plot the level curves of  $f$  using *contourplot* in the same domain.
- Plot the gradient vectors of  $f$  using *gradplot* in the same domain.
- Plot the level curves and gradient vectors together using *display*. What insight can you gain by graphing them together?

### 2. Tangent planes and normal vectors

Consider the surface  $xy + yz + zx = 3$ .

- Use *implicitplot3d* to plot it for  $-1 \leq x \leq 3$ ,  $-1 \leq y \leq 3$ ,  $-1 \leq z \leq 3$ .
- Find the equation of the tangent plane at the point  $(1, 1, 1)$  and plot it with *implicitplot3d* for  $0 \leq x \leq 2$ ,  $0 \leq y \leq 2$ .
- Find the normal line at  $(1, 1, 1)$  and plot it with *spacecurve* for  $-\frac{1}{2} \leq t \leq \frac{1}{2}$ .
- Plot the function, tangent plane and normal line on the same graph using *display*. Rotate until you get good view.