MAC 2313, Section 04 with Dr. Hurdal
Fall 2011 – Test 2

Name: _____

As stated in class, you are allowed to bring to the test one 8.5x11 inch page, written on both sides. Calculators are allowed. Notebooks and textbooks are NOT allowed. Marks will be allocated for clear and well written mathematics solutions. This test will be graded out of 100.

1. (15 marks) Consider the function $f(x,y) = \dfrac{y^2}{x^2+y^2}$.

a) What is the domain and range of $f(x,y)$?
b) Where is $f(x,y)$ continuous?
c) Find $\lim\limits_{(x,y)\to(0,0)} f(x,y)$.
d) Compute $f_x(x,y)$.

2. (15 marks) Given the surface $z = \sqrt{y - x}$,
a) sketch 4 level curves of the surface,
b) find the equation of the plane that is tangent to the surface at $(x, y) = (1, 2)$.

3. (25 marks) For the curve $\mathbf{r}(t) = \langle 2\cos t, t, 2\sin t \rangle$,
a) sketch the curve (make sure you indicate the direction and label a few points),
b) find the arc length of the curve for $0 \leq t \leq \pi/4$,
c) find the tangential and normal components of acceleration for the curve,
d) find the equation of the tangent line to the curve at $(2, 0, 0)$,
e) find the equation of the osculating plane of the curve at $(2, 0, 0)$.

4. (15 marks) A javelin leaves the thrower's hand 2 m above the ground at a 40° angle and at 30 m/s. How high and how far does the javelin go?

5. (15 marks) (a) Find the linearization of the function $f(x, y) = e^x \cos y$ at $(0, \pi)$.
(b) Use your result to estimate the value of $f(x, y)$ at $(0.1, 3.2)$.

6. (15 marks) The wave heights (h, in feet) in the open sea depend on the speed of the wind (v, in knots) and the length of time (t, in hours) the wind has been blowing at that speed. Values of the function $h = f(v, t)$ are given in the following table.

		Duration in hours (t)		
		15	20	25
Wind Speed in knots (v)	20	17	18	19
	30	28	31	33
	40	40	45	48

(a) Estimate the values of $f_v(30, 20)$ and $f_t(30, 20)$. NOTE: you only need to estimate the derivative from one side.
(b) Interpret the meaning of your answers from part (a).

Bonus (10 marks): At what point on the curve $x = t^3$, $y = 3t$, $z = t^4$ is the normal plane parallel to the plane $6x + 6y - 8z = 1$?