MATH 275 – Section 002 – Quiz 6

You may work with other class members on this quiz, but you may not receive assistance from people not in MATH 275 (Section 002). You must show all of your work to receive full credit. Do all your work on other sheets of paper and be sure to staple all the pieces of paper together or YOU WILL GET A ‘ZERO’ ON THE QUIZ. Do not use decimal approximations unless asked to do so. Your work on this quiz must be handed in by Friday, 16 March 2007 at 1440. GOOD LUCK!

1) We have seen two equations for the plane tangent to a surface at a given point: Equation (2) in Section 14.4 and Equation (19) in Section 14.6. Prove that the former is a special case of the latter.

2) Find an equation of the plane tangent to the surface

\[ x^2 - y^2 + z^2 = \sin(xy) \]

at the origin. Then use Maple (or the equivalent) to plot the surface and the tangent plane on the same set of axes.

3) The temperature in a room is given by the function

\[ T(x, y, z) = 10\sin((2x - 3y + 4z)\pi) + 60, \]

where \( T \) is measured in degrees Fahrenheit and \( x, y, \) and \( z \) are measured in inches.

a) An insect is hovering at the point \( \left( \frac{1}{8}, \frac{1}{12}, \frac{1}{24} \right) \) and wishes to fly in the direction of maximum temperature decrease. In what direction should the insect fly?

b) What is the rate of temperature decrease when the insect leaves the point \( \left( \frac{1}{8}, \frac{1}{12}, \frac{1}{24} \right) \)?

c) If the insect instead flies in the direction of the vector \( \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix} \), what is the rate of temperature change the moment it leaves the point \( \left( \frac{1}{8}, \frac{1}{12}, \frac{1}{24} \right) \)? Is this an increase or decrease in temperature?