1. (a) Find the equation of the plane through \((1, 3, 2), (0, 3, 0),\) and \((2, 4, 3)\). (b) What is the area of the triangle spanned by these three points.

2. Let \(P\) be a point on a plane with normal \(\mathbf{n}\) and \(Q\) be a point off the plane. (a) Show the distance \(d\) from \(Q\) to the plane is given by \(d = \frac{\mathbf{PQ} \cdot \mathbf{n}}{||\mathbf{n}||}\). (b) Use this result to find the distance between \((3, 0, 4)\) and the plane \(x + y + z = 0\).

3. The motion of a particle is given by \(r(t) = (\cos t, \sin t, -t^2 + t - 1)\). (a) What is the highest altitude reached by the particle? (b) Does the particle ever stop moving? (c) If the particle leaves the curve at \(t = 0\), where will it be 5 seconds later?

4. (a) Sketch the surface given by \(5x^2 + 5y^2 - 4z = 0\). (b) What is the equation of this surface in cylindrical coordinates?

5. Suppose that the temperature of a plate is given by \(T(x, y) = xy\). (a) Sketch the isothermal curves corresponding to \(T = -1, 0,\) and \(1\). (b) What is the rate of change in temperature as experienced by an ant at point \((1, 1)\) moving parallel to the positive direction of the \(x\)-axis? (c) In which direction should the ant move in order to experience the greatest decrease in temperature?

Each problem is worth 20 points