Calc 3, Assignment 30

1. Please state:
   a) What is Green's Theorem?
   b) What is Gauss' Theorem?
   c) For what type of surface can you apply the Divergence theorem?

2. Find the following surface areas:
   a) of the plane $z = 2 - x - y$ above the rectangle $0 \le x \le 2$ and $0 \le y \le 3$
   b) of the cylinder $z = 9 - y^2$ above the triangle bounded by $y = x$, $y = -x$, and $y = 3$
   c) of the surface $z = 16 - x^2 - y^2$ above the circle $x^2 + y^2 \le 9$

5. Find the following line integrals. You may use Maple to help you out.
   a) $\int_C x + y^2 ds$ where C is a line segment given by $r(t) = < 3t, 4t >$, $0 \le t \le 1$
   b) $\int_C F \cdot dr$ where $F(x, y) = < 2xy^3 - 2xy + 1, 3x^2y^2 - x^2 >$ and C is the lower half of the unit circle, from (-1,0) to (1,0).
   c) $\iint_R dS$, where S is the portion of the hemisphere $f(x, y) = \sqrt{25 - x^2 - y^2}$ that lies above the circle $x^2 + y^2 \le 9$
   d) Find the surface integral $\iint_S x - 2y + zdS$, where S is the surface $z = 10 - 2x + 2y$ such that x is between 0 and 2 and y is between 0 and 4.
   e) $\iint_S (x + z)dS$ where S is the first-octant portion of the cylinder $y^2 + z^2 = 9$ between x = 0 and x = 4
   f) The flux of the vector field $\vec{F}(x, y, z) = < x, y, z >$, where S is the portion of the surface $z = 10 - 2x - 2y$ between the coordinate planes.
   g) Find the flux of the vector field $F(x, y, z) = < x, y, z >$ through the surface given by potion of the paraboloid $z = 4 - x^2 - y^2$ that lies above the xy-plane. Note that this surface is *not* closed.
   h) Evaluate the flux integral $\iint_S \vec{F} \cdot \vec{n}\, dS$ where $F(x, y, z) = < x, y, z >$ and S is $x^2 + y^2 + z^2 = 4$