**MA 302: Exam 2 Review** **Name:**______________________________

(1) Green's Theorem
   (a) Know the precise statement of Green's Theorem
   (b) Be able to calculate the integrals appearing on both sides of the equality in Green's theorem (that is: "verify" Green's theorem for particular examples.)
   (c) Be able to use the integral on one side of Green's theorem to calculate the integral on the other side (that is: "use" Green's theorem for particular examples.)
   (d) Use Green's theorem to find areas enclosed by curves
   (e) Use Green's theorem to relate the line integral of a vector field around one curve to the line integral of the vector field around a different curve
   (f) Be able to explain why Green's theorem is true by identifying the important features of the proof and how they fit together.

(2) Conservative Vector Fields
   (a) Review the material on Conservative Vector Fields from before Exam 1.
   (b) Be able to apply the theory of conservative vector fields to calculate the work done in moving a particle through the electric field generated by a charged wire.
   (c) Be able to prove that a vector field is conservative if and only if its integral around any closed curve is 0.
   (d) Be able to prove that on a simply connected domain if a vector field has zero curl then it is conservative.
   (e) Use curl to determine whether or not a vector field is conservative
   (f) State Poincaré's theorem
   (g) Be able to give an example of a vector field having curl zero on its domain which is not a conservative vector field. Understand the relationship between this example and Poincaré's theorem

(3) Planar Divergence Theorem
   (a) Know and be able to explain the statement of the planar divergence theorem

   (b) Be able to both "verify" and "use" the planar divergence theorem
   (c) Understand and be able to explain the relationship between the Green's theorem and the planar divergence theorem.

(4) Curves, Vector Fields, and 2-dimensional regions
   (a) Understand ways in which the holes in a 2-dimensional region can affect the behaviour of vector fields having curl zero.

(5) Surface Integrals and Stokes' theorem
   (a) Know the definitions of "surface" in both the topological and calculus senses
   (b) Be able to find write down equations for standard parameterizations of surfaces
   (c) Be able to match a parameterization with the image of a surface.
   (d) Know what it means to "orient" a surface and know examples of non-orientable surfaces
   (e) Understand the relationship between non-orientability and 1-sided.
   (f) Know the definition of surface integral of a scalar field and vector field
   (g) Understand how the change of variables theorem can be used to show that a surface integral of a vector field is intrinsice to an (oriented) surface.
   (h) Know the statement of Stokes' theorem.