

Name\_\_\_\_\_

Date\_\_\_\_\_

## Vector Calculus Independent Study

### Unit 5 Sample Test

1. [25 points] Graph the vector field  $\vec{F}(x, y) = (y, x^2)$ . Be sure to include multiple points in each quadrant of the graph, and to sketch a few flow lines (assume  $\vec{F}$  is a velocity vector field).
2. [15 points] Why **isn't**  $\vec{F}(x, y, z) = (-y, -x, x)$  a conservative field?
3. [20 points] Find a scalar potential for the gradient field  $\vec{F}(x, y, z) = (z^3 + 2xy, x^2 + 2xy, 3xz^2)$ .
4. [20 points] Calculate the divergence and curl of the vector field  $\vec{F}(x, y, z) = (4xy, -x^2, 4z)$ .
5. [20 points] Verify that the path  $\vec{\sigma}(t) = (\sin(t), \cos(t), e^t)$  is a flow line of the velocity vector field  $\vec{F}(x, y, z) = (y, -x, z)$ .