Name:

Points: /25

1. Examine local extremes of
$$f(x, y) = x^2 - 4x + y^2 + 2y + 5.$$

Points: /4

2. Find the global maximum and minimum of
$$f(x, y) = x^2 - y^2$$
   on a set
$$M = \{(x, y) \in \mathbb{R}^2, \ |x| \le 1, \ |y| \le 1\}.$$

Points: /6

3. Rewrite the system
$$x'(t) = 2x(t) - 4y(t) + t^2 + 1$$
$$y'(t) = -x(t) - y(t) + \sin t$$
   into the matrix form.

Points: /4

4. Find the fundamental system for
$$x' = \begin{pmatrix} 1 & 1 & -1 \\ 4 & 1 & -2 \\ 5 & 2 & -3 \end{pmatrix} x.$$

Points: /6

5. Find the critical points of
$$x' = (x - 1)y$$
$$y' = x(x - 1)$$

   Sketch several representative trajectories into the phase plane.

Points: /5