

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Problems 1 and 4 are worth 15 points each. Problems 2 and 3 are worth 10 points each. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

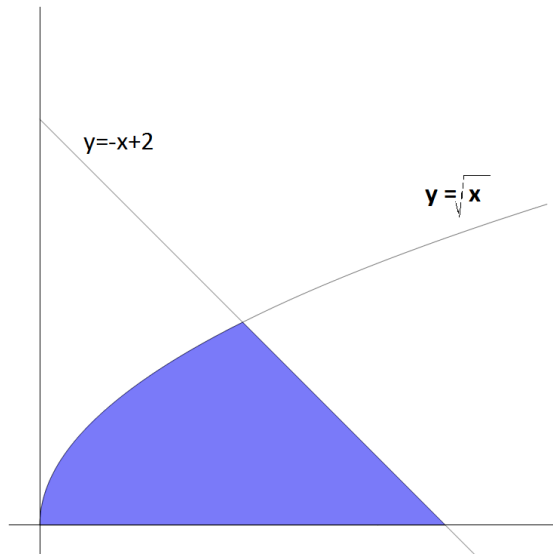
1. (Modified Version) Find the global extrema of $f(x, y) = xy$ on the domain

$$\mathcal{D} = \{(x, y) : y \leq 3, y \geq x^2 - 1\}.$$

- Use Lagrange multipliers to find the min and max values of $f(x, y, z) = x^2 - y - z$ subject to the constraint $x^2 - y^2 + z = 0$.

3. Consider the integral $\iint_{\mathcal{D}} (x + y) dA$, where \mathcal{D} is the shaded region.

(a) Express the region \mathcal{D} **formally** as a Type II (or horizontally simple) region.



$$\mathcal{D} = \{(x, y) : \quad \quad \quad \}$$

(b) Compute the given double integral as a Type II iterated integral.

4. Sketch the region of integration and evaluate by changing into polar coordinates

$$\int_0^2 \int_x^{\sqrt{3}x} y \, dy \, dx.$$