Fall 2025 **Math 53, Sections 104/106**

Discussion #19/21

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1. Evaluate $\iint_D x^2 y \, \mathrm{d}A$ where D is the top half of the disk with center the origin and radius 5.
2. Evaluate $\iint_D e^{-x^2-y^2} \, \mathrm{d}A$ where D is the region bounded by the semicircle $x = \sqrt{4-y^2}$ and the y-axis.
3. Evaluate $\displaystyle\iint_D (y^2 + 3x) \, \mathrm{d}A$, where D is the region in the fourth quadrant between $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.
4. Evaluate the following integral:

$$\int_0^3 \int_{-\sqrt{9-x^2}}^0 e^{x^2+y^2} \, \mathrm{d}y \, \mathrm{d}x$$

5. Parameterize the following surfaces in an appropriate way (if they are not already parametrized) and compute their normal vectors and area.

   (a) The portion of the elliptic paraboloid $z = x^2 + y^2$ lying over the unit disk.

   (b) The part of the surface $z = xy$ that lies within the cylinder $x^2 + y^2 = 1$.

   (c) The portion of $z = 2x^2 + 2y^2 - 7$ that lies inside the cylinder $x^2 + y^2 = 4$.

   (d) The surface area of the portion of $z = 2 - \sqrt{x^2 + y^2}$ above $z = 0$.

6. Rewrite the integral

$$\int_0^1 \int_{\sqrt{x}}^1 \int_0^{1-y} f(x, y, z)\, \mathrm{d}z dy\, \mathrm{d}x$$

   as the equivalent iterated integral in the five other orders.