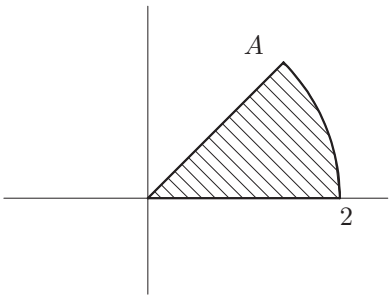
MAC 2313 Calculus 3 **Test 4** 20 Oct 2004

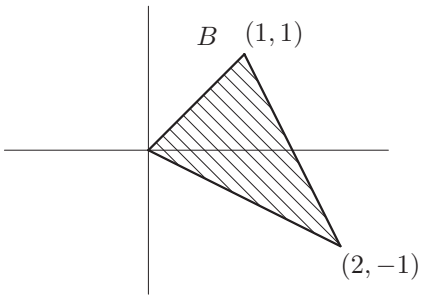
Directions: Show **ALL** work for credit; Give **EXACT** answers when possible; Start each problem on a **SEPARATE** page; Use only **ONE** side of each page; Be neat; Leave margins on the left and top for the **STAPLE**; Calculators can be used for graphing and calculating only; Nothing written on this page will be graded;

1. Write (but do NOT evaluate) a double integral in polar coordinates which will give the volume inside the sphere $x^2 + y^2 + z^2 = 9$ and outside the cylinder $x^2 + y^2 = 4$. (Sketching is good.)

2. Find the point (or points) on the surface $z^2 = xy$ closest to the point $(1, 2, 0)$.

3. Write (but do NOT evaluate) a double integral in polar co-ordinates that will give the area of the region A (below left). Write (but do NOT evaluate) a sum of two double integrals in rectangular co-ordinates that will give the area of the region B (below right).





4. Use Lagrange multipliers to find the minimum and maximum **VALUES** of $f(x, y) = 4x + 9y$ subject to the constraint $x^2 + 9y^2 = 25$.

5. Sketch the region of integration and then change the order of integration to evaluate

$$\int_0^3 \int_{y^2}^9 y \cos(x^2)\, dx\, dy$$