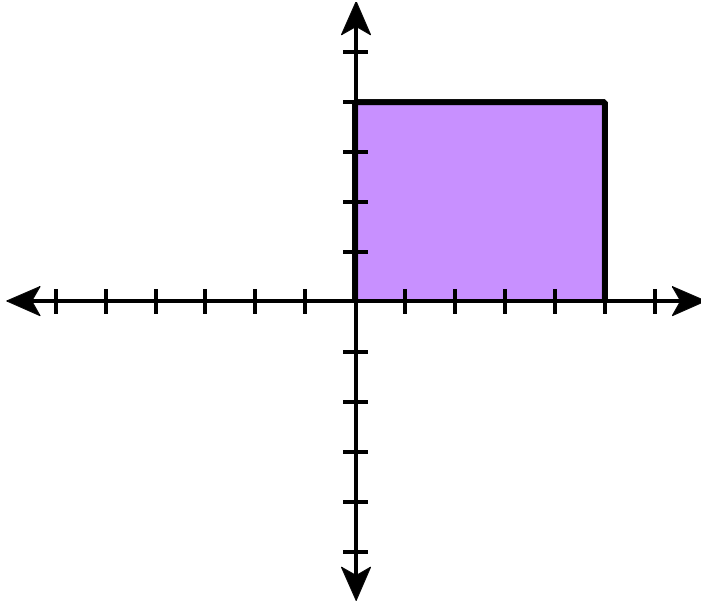Each problem is worth 10 points. For full credit provide complete justification for your answers. All integrals should be set up in terms of a single coordinate system, i.e., if you use cylindrical your integral should involve no x or y, etc.

1. Set up an iterated integral for the area of the rectangle shown (assuming tick marks are at unit intervals)

2. Set up an iterated integral for the volume under $z = 10 + x$ inside the circle $x^2 + y^2 = 4$.

3. Set up an iterated integral for the volume below $z = 10 - 2x$, above the region shown below.
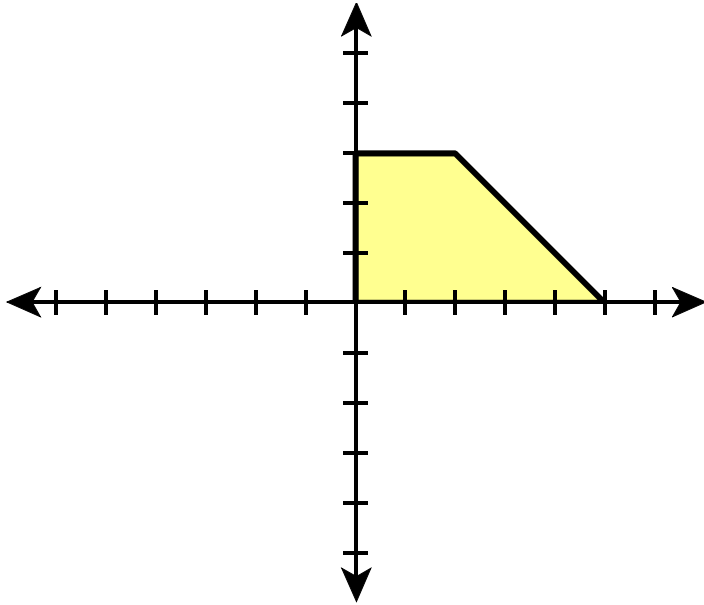
4. Set up an iterated integral for the volume of the region beneath the surface $z = xy + 10$ and above the annular region outside $x^2 + y^2 = 4$ but inside $x^2 + y^2 = 16$.

5. Reverse the order of integration in $\int_0^2 \int_{x^2}^{2x} f(x,y)\,dy\,dx$.

6. Find the Jacobian for converting from rectangular to polar coordinates.

7. Bunny is a calculus student at Enormous State University, and she's having some trouble. Bunny says "Ohmygod, this Calc 3 stuff is soooo confusing! Like, our exam review sheet has a bunch of multiple guess questions, right? And one of them was, like, if you know a function has an average value of 2 for some region, then what's the max it could be someplace on that. How can I do that without a formula or anything?"

Explain clearly to Bunny what can be said about this, and why.

8. Set up iterated integrals for the z coordinate of the centroid of the paraboloid below $z = 25 - x^2 - y^2$ but above $z = 0$.

9. Evaluate the integral $\iint_R xy\, dA$ on the region R with vertices $(0,0)$, $(2,2)$, $(4,0)$, and $(2,-2)$ by using the Jacobian to convert using the transformation $x = u + v$, $y = u - v$.

10. Set up an iterated integral (or integrals) for the volume of the region under **both** $z = \cos x$ and $z = \cos y$, but above the plane $z = 0$, and within 3 units of the origin.

Extra Credit (5 points possible):
If a function $f(x, y)$ has the property that its integral is 0 on every circle centered at the origin, can you conclude that the function is 0 everywhere? Why or why not?