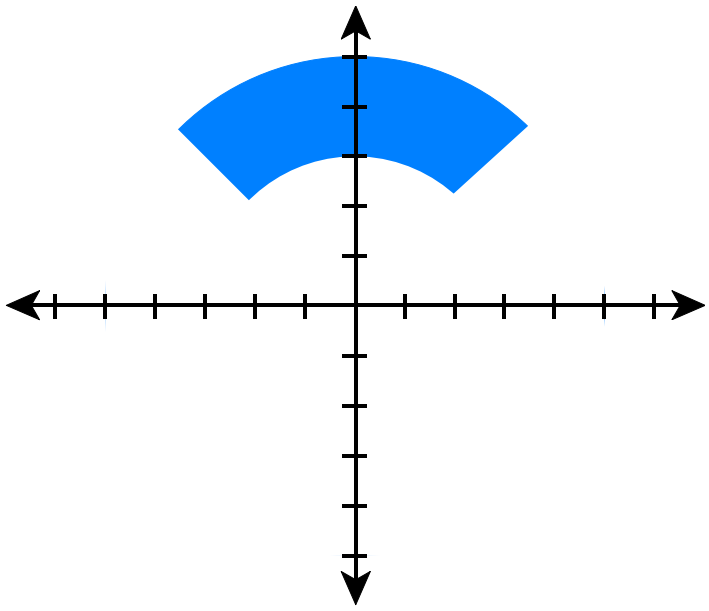
Exam 2 Calc 3 10/26/2017

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 volume below $z = f(x, y)$ and above the xy-plane on the region R, a triangle with vertices (0,0), (3,6), and (0,6).

2. Set up an iterated integral for the volume below $z = 7$ and above the xy-plane on the region R pictured below (the diagonal boundaries are the lines $y = x$ and $y = -x$):



3. Set up an iterated integral for the volume of the solid enclosed between the surface $z = x^2 + y^2$ and the surface $z = 72 - x^2 - y^2$.

4. Set up an iterated integral for the volume of the solid lying within the sphere $x^2 + y^2 + z^2 = 4$, above the *xy*-plane, and outside the cone $z = 2\sqrt{x^2 + y^2}$.

5. Evaluate $\iint_D x \cos y \, dA$, where D is bounded by $y = 0$, $y = x^2$, and $x = 2$.

6. Compute the Jacobian for the conversion from rectangular to cylindrical 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 just too much. I used to think symmetrical always made things easier, but now I'm really confused. I guess sometimes with the double integral thingies you can go from, like, – 3 to 3 both ways, or instead go from 0 to 3 and then times it by 4, right? But I think they were saying that you can't always. How do you tell when you can?

   Give Bunny examples and explain why sometimes it would be okay in a double integral to use symmetry, and which times it wouldn't (**at least one** example each way).

8. Set up iterated integrals for the z-coordinate of the centroid of the solid bounded between the xy-plane and $z = 9 - x^2 - y^2$.

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9. Evaluate $\iint_R xy\,dA$, where R is the region in the first quadrant bounded by the lines $y = x$ and $y = 3x$ and the hyperbolas $xy = 1$, $xy = 5$ by using the transformation $x = u/v$, $y = v$.

10. Consider the region under the surface $z = 18 - 2x^2 - 2y^2$, above the xy-plane, and with $x \leq 2$. Set up an iterated integral for the volume of this solid.

Extra Credit (5 points possible):

Evaluate $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\sqrt{x^2+y^2+z^2}\,e^{-\left(x^2+y^2+z^2\right)}\,dxdydz$.