(12) 1. Find and classify using the Second Derivative Test all critical points of $f(x,y) = x^3 + 2xy - 2y^2 - 10x$.

Problem 8 in section 14.7

(12) 2. Use the Lagrange multiplier method to find the maximum and minimum values of $f(x,y) = 3x^4 + 5y^4$ subject to the constraint $x^2 + y^2 = 1$.

Be sure to check *all* solutions to the Lagrange multiplier equations!

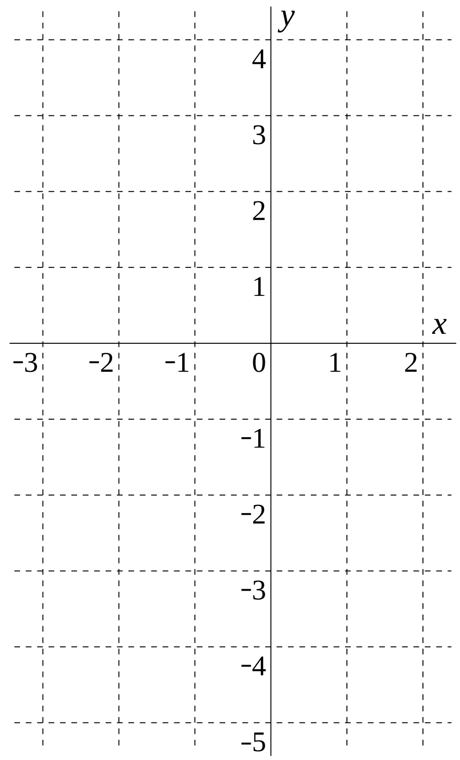
(16) 3. This problem investigates the iterated integral

$$I = \int_{-3}^{2} \int_{x-2}^{4-x^2} x\, dy\, dx.$$

a) Compute I.

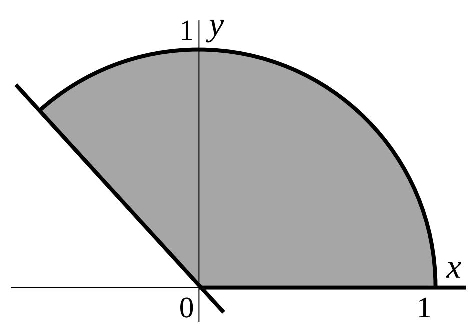
b) Use the axes to the right to sketch the region of integration for I.

c) Write I as a sum of one or more $dx\,dy$ integrals. You do not need to compute the result!



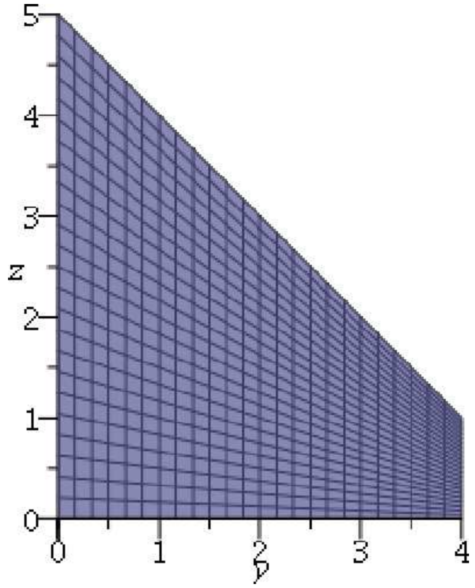
(12) 4. The average value of a function f defined in a region R of $\mathbb{R}^2$ is $\dfrac{\int\int_R f\,dA}{\int\int_R dA}$.

Suppose the region R is bounded by an arc of the unit circle, $x^2 + y^2 = 1$, a part of $y = -x$, and a part of $y = 0$ as shown. Compute the average value of <u>the distance to the origin</u> over this region.

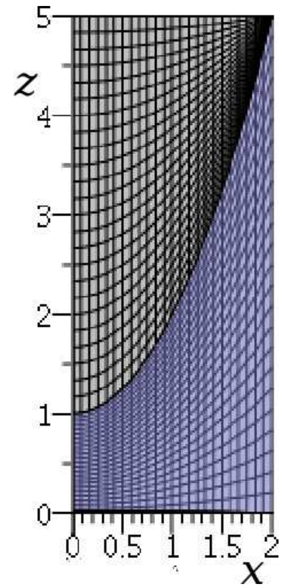


(16) 5. A bounded solid object A in $\mathbb{R}^3$ is located in the first octant, where $x \geq 0$, $y \geq 0$, and $z \geq 0$. One side of the object is given by $y = 4 - x^2$ and another side by $z = 5 - y$. Compute the triple integral of $2x$ over the object A by writing a triple iterated integral for $2x$ over the object A and then computing the value of this integral.

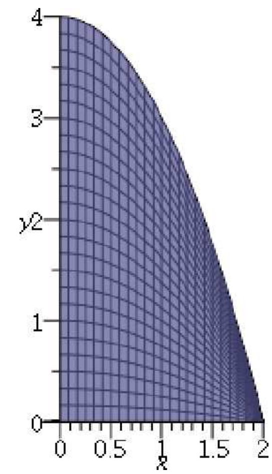
Below are some pictures of the object which may be helpful.



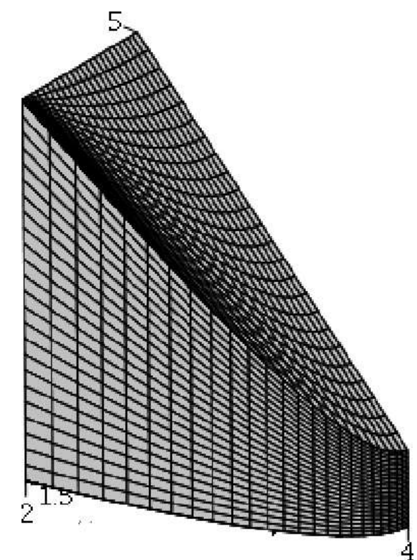
View from the x-axis; the z-axis is up and the y-axis is horizontal.



View from the y-axis; the z-axis is up and the x-axis is horizontal.



View from the z-axis; the y-axis is up and the x-axis is horizontal.



Oblique view; the z-axis is up, the x-axis is to the left and the y-axis is to the right.

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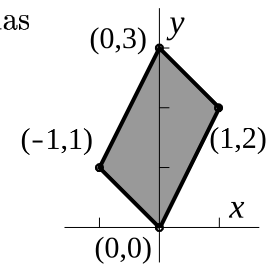
(16) 6. Calculate the volume of the sphere $x^2+y^2+z^2=a^2$, using <u>both</u> spherical and cylindrical coordinates.
Problem 48 in section 15.4

Note A formula alone for the volume earns *no credit.* In each case, you must set up an iterated triple integral and compute it.

Spherical

Cylindrical

(16) 7. The region R in $\mathbb{R}^2$ is the parallelogram shown to the right which has vertices (corners) at $(1,2)$, $(0,3)$, $(-1,1)$, and $(0,0)$.



Verify that $\iint_R (y+x)^6 \cos(y-2x)\, dA_{xy} = \dfrac{3^6 \sin(3)}{7}$.

$\iint_{R_{uv}}$(Func described with u and v)**|JAC|**$dA_{uv} = \iint_{R_{xy}}$(Func described with x and y) dA_{xy}

A A

Section Exam for Math 251, sections 1, 2 & 3

April 15, 2010

NAME ______________________________

SECTION ________

Do all problems, in any order.
Show your work. An answer alone may not receive full credit.
No notes and no calculators may be used on this exam.

"Simplification" of answers is not necessary, but standard values of traditional functions such as e^0 and $\sin\left(\frac{\pi}{2}\right)$ should be given.

Problem Number	Possible Points	Points Earned:
1	12	
2	12	
3	16	
4	12	
5	16	
6	16	
7	16	
Total Points Earned:		

A A