1. PRINT your name and check the pages first. There are 4 problems on 5 pages including this cover.

2. Always use the right notations. If you are using your own notations, symbols or theories, you need to define or explain them first. But if those are from our class, they do not have to be explained.

3. Your answer must include YOUR WORK and EXPLANATION, and you should explain them using correct English sentences. Do not assume that your grader knows what you are implying on your steps. If you are using some theorems or special properties, you should state them. Otherwise, you may get no credit.

4. If you put unnecessary information and if it is wrong, it will be counted, too. Of course, you should put your answers in right forms on the right places.

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<th>Number</th>
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1. (20pts) Find the area of the surface of the part of the plane $z = 6 - 2x - 3y$ that lies above the unit disk with center the origin.

Answer: ____________________________
2. (25pts) Show that the volume of a sphere of radius $a$ is $\frac{4}{3}\pi a^3$ using your choice of integration.

Answer: 

3
3. (25pts) Express the integral \( \iiint_E f(x,y,z) dV \) as an iterated integral in six different ways, where \( E \) is the solid bounded by \( z = 0, y = \sqrt{x}, \) and \( z = 1 - y.\)

Answer: 

\[
\int_0^1 \int_{-\sqrt{x}}^{\sqrt{x}} \int_0^{1-y} f(x,y,z) \, dz \, dy \, dx,
\]

\[
\int_0^1 \int_{-\sqrt{x}}^{\sqrt{x}} \int_{1-y}^1 f(x,y,z) \, dz \, dy \, dx,
\]

\[
\int_0^1 \int_{1-x}^{1-x} \int_{1-y}^1 f(x,y,z) \, dz \, dy \, dx,
\]

\[
\int_0^1 \int_{1-x}^{1-x} \int_{1-y}^1 f(x,y,z) \, dx \, dy \, dz,
\]

\[
\int_0^1 \int_{1-y}^1 \int_{-\sqrt{x}}^{\sqrt{x}} f(x,y,z) \, dy \, dz \, dx,
\]

\[
\int_0^1 \int_{1-y}^1 \int_{1-y}^1 f(x,y,z) \, dx \, dz \, dy.
\]
4. (30pts) Let $T$ is a function from the $uv$-plane to the $xy$-plane such that $T : x = \frac{1}{3}(u + v), y = \frac{1}{3}(v - 2u)$ and let $R$ be the region bounded by the lines $y = x, y = x - 2, y = -2x$ and $y = 3 - 2x$.

(a) (5pts) Find the Jacobian of $T$.

Answer:

(b) (15pts) Find the pre-image of the set $R$ under $T$. If you want to use a graph, it must be clearly scaled.

Answer:

(c) (10pts) Evaluate $\int \int_R (x - y) dA$.

Answer: