

Math 241 Exam 3 Sample 4

Directions: Do not evaluate or simplify unless indicated. No calculators are permitted. Show all work as appropriate for the methods taught in this course. Partial credit will be given for any work, words or ideas which are relevant to the problem. Very few pictures are required! Do not evaluate or simplify unless indicated!

Please put problem 1 on answer sheet 1

1. Let R be the region in the first quadrant and below $x + 2y = 10$. Consider $\iint_R x \, dA$.
- (a) Set up the integral as an iterated double integral treating R as vertically simple. [7 pts]
 - (b) Set up the integral as an iterated double integral treating R as horizontally simple. [8 pts]
 - (c) Set up the integral as an iterated double integral treating R as polar. [10 pts]
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Please put problem 2 on answer sheet 2

2. (a) Set up the iterated integral in cylindrical coordinates for the volume of D , the solid above the xy -plane, inside the cylinder $r = 2 \cos \theta$, outside the cylinder $r = 1$ and below the paraboloid $z = 9 - x^2 - y^2$. Draw the related region R . [15 pts]
- (b) Write down a parametrization for the portion of the plane $x + 2y = 6$ in the first octant and below $z = 7$. [5 pts]
- (c) Sketch the surface parametrized by $\vec{r}(x, \theta) = x \hat{i} + \cos \theta \hat{j} + 3 \sin \theta \hat{k}$ with $0 \leq x \leq 2$ and $0 \leq \theta \leq \pi$. Provide values or tick marks to give a sense of scale. [5 pts]
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Please put problem 3 on answer sheet 3

3. (a) Set up the iterated integral in rectangular coordinates for $\iiint_D x \, dV$ where D is the solid in the first octant and below the plane $x + 2y + 2z = 10$. Draw the related region R . [15 pts]
- (b) Set up the iterated integral in spherical coordinates for $\iiint_D y \, dV$ where D is the solid inside the cone $z = \sqrt{3x^2 + 3y^2}$, outside the sphere $x^2 + y^2 + z^2 = 1$, below the plane $z = 2$ and having $y \geq 0$. [10 pts]
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Please put problem 4 on answer sheet 4

4. (a) Reparametrize as polar but do not evaluate the integral $\int_{-1}^1 \int_0^{\sqrt{1-x^2}} e^{x^2+y^2} \, dy \, dx$. [5 pts]
- (b) Perform a change of variables which changes the integral $\iint_R x \, dA$ to an iterated double integral over a rectangle S in the uv -plane. Here R is the region bounded by the lines $y = x - 3$, $y = x + 5$, $y = -3x + 5$ and $y = -3x - 1$. Make sure all your steps are clear and draw both regions R and S . Your final answer should be an iterated integral. [20 pts]
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Welcome to the End of the Exam