Math 208 Fall 2020 **Exam 2** **Recitation Section:** ________

Print Your Name Legibly: ____________ **NUID:** ____________

1(15pts) Let $f(x, y) = 6x^2 - 2x^3 + 3y^2 + 6xy$.

(a) Find all critical points of the function.

(b) Classify all critical points as local max, or local min, or saddle, or undetermined by the second derivative test.

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2(15pts) Use the Lagrange multiplier method to find the constraint maximum and minimum of function $f(x, y, z) = x + y + 2z$ subject to $x^2 + y^2 + 2z^2 = 1$.

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3(15pts) **(a)** Sketch the region of the integral $\int_0^1 \int_y^1 \sqrt{x^2 + y^2} dx dy$.

(b) Switch the iterated integral to polar coordinates. (**Do not evaluate any of the iterated integrals.**)

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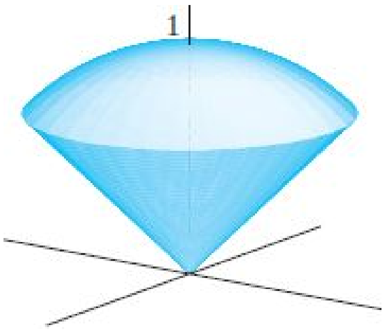
4(15pts) Let W be a sphere-capped cone bounded by $x^2+y^2+z^2=1$ and $z=\sqrt{x^2+y^2}$. The volume of the solid is given, which is $\dfrac{(2-\sqrt{2})\pi}{12}$. Find the center $(\bar{x}, \bar{y}, \bar{z})$ of the solid. (You can use the symmetry of the solid as a shortcut to find $\bar{x}$, $\bar{y}$.)



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5(10pts) **(a)** Sketch the region for the double integral $\int_0^{\pi/4}\int_0^{\sec(\theta)} r^3 dr d\theta$.

(b) Compute the iterated integral. (You can use the identities: $\sec^2(t) = 1+\tan^2(t)$, $\tan'(t) = \sec^2(t)$.)

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6(15pts) Let G be the solid bounded by these surfaces: the xy-plane, three vertical planes: $y = x$, $y = -x$, and $x = 1$, and the cone $z = \sqrt{x^2 + y^2}$. Let $\delta(x, y, z) = x$ be the density of the solid.

(a) Set up an iterated integral in the order of $dzdydx$ for the mass of the solid. **Do not evaluate the integral.**

(b) Set up an iterated integral in the spherical coordinate for the mass of the solid. **Do not evaluate the integral.**

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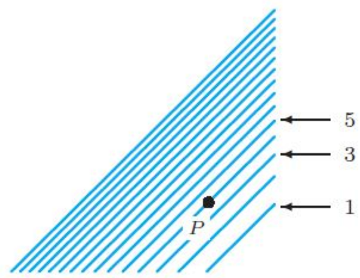
7(15pts) **(a)** Find the quadratic Taylor polynomial for $z = f(x, y) = \sin(x+3y)$ at $(\frac{\pi}{2}, 0)$.

(b) Use the quadratic Taylor polynomial to approximate $f(\frac{\pi}{2}, 0.1)$.

(c) The level curves of the function $z = f(x, y)$ are given by the contour diagram as shown. Determine the sign of $f_{xx}(P)$ (positive, negative, or zero). Assume the x- and y-axes are in the usual positions. You must show work to receive credit.



2 pt Bonus Question: The first capital city of Nebraska was: (a) Lincoln (b) Grand Island (c) Omaha (d) None of the above. (... *The End*)