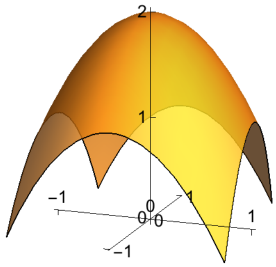
Math 254 *Mathematica* Project 2 Name________________________________

10/28/17 [/25]

Be sure to use text cells for typing non-math input; to type in a math expression in a text cell select Format→Style→InlineFormula. The short cut is CTRL+(. Remove (or hide) unnecessary cells. Don't remove the output cells. Make a nice, clean, error-free paper that can be printed.

1. Find the area of the surface of the paraboloid $f(x, y) = 2 - x^2 - y^2$ that lies above the square region bounded by $-1 \le x \le 1$ and $-1 \le y \le 1$.



a) Set up the integral for the surface area.
b) Evaluate by hand the inner integral (it may help to convert to polar coordinates.)
c) Use Simpson's Rule with $n = 10$ to evaluate the outer integral. Some useful *Mathematica* commands:
   i) To evaluate a function at a range of values: `x^2/.x→Range[0,4,1/2]`
   ii) To multiply two lists of numbers together: `{1,2,3,4}.{9,8,7,6}`

d) Evaluate the integrals with *Mathematica,* (the original double integral with rectangular coordinates, and the single integral in polar coordinates.) Compare with part (c).

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2. Use *Mathematica* to graph the solid whose volume is given by the iterated integral and rewrite the integral using the indicated order of integration.

$$\int_0^3 \int_0^{\sqrt{9-x^2}} \int_0^{6-x-y} dz\, dy\, dx.$$ Rewrite in the order $dz\, dx\, dy$. Evaluate both integrals with *Mathematica*.

A useful command is **`RegionFunction`**. Use "help" to see how it's used (or me).

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3. Find the volume between the spheres $x^2 + y^2 + z^2 = a^2$ and $x^2 + y^2 + z^2 = b^2$, $b > a$, and inside the cone $z^2 = x^2 + y^2$.

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4. Find the center of mass of the solid bounded below by the triangle in the xy-plane with corner points (0, 0), (2, 2), and (0, 2), and the surface $z = 5 - x^2$, if the density is $\delta(x, y, z) = x\, y + z$. Make a plot of the surface, and plot a point for the center of mass. Use **`Opacity`** to make the solid a little see-thru. Also, **`Filling`** and **`FillingStyle`** may be a useful option.

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5. Evaluate the integral $\iint_R x\, y\, dA$ where R is the region bounded by the curves $y = \sqrt{x}$, $y = \sqrt{2\, x}$, $y = \frac{x^2}{3}$, and $y = \frac{x^2}{4}$. Use the change of variables $x = u^{1/3}\, v^{2/3}$ and $y = u^{2/3}\, v^{1/3}$.