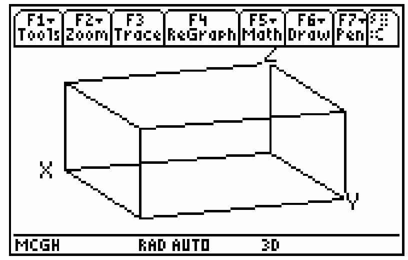
Assignment 30: Triple Integrals (13.4-7) **Name_______________________**
Please provide a handwritten response.

1a. To graph the portion of $z = f(x, y) = e^{x^2+y^2}$ inside $x^2 + y^2 = 1$ graph $z1 = e \wedge (x \wedge 2 + y \wedge 2)$ where $-1 \le x \le 1, -1 \le y \le 1, 1 \le z \le 3$, $eye\theta = 70, eye\phi = 60, eye\Psi = 0$ and record your graph on the axes provided below.



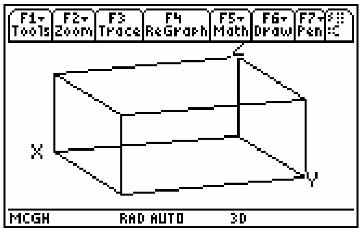
1b. The formula for surface area, $S = \iint_R \sqrt{\left(f_x(x,y)\right)^2 + \left(f_y(x,y)\right)^2 + 1}\, dA$. We can find the surface area for this surface by evaluating

$$\int\left(\int\left(\sqrt{}\left(\left(2x * e \wedge (x \wedge 2 + y \wedge 2)\right) \wedge 2 + \left(2y * e \wedge (x \wedge 2 + y \wedge 2)\right) \wedge 2 + 1\right), y, -\sqrt{}(1 - x \wedge 2),\right.\right.$$
$$\left.\left.\sqrt{}(1 - x \wedge 2)\right), x, -1, 1\right)$$
Record the result below.

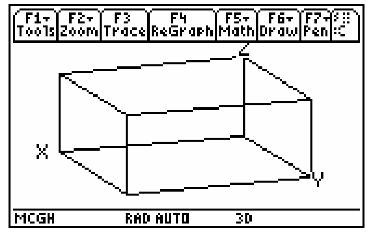
1c. Convert the integral in **1b** to polar coordinates by entering $\int\left(\int\left(r * \sqrt{}\left(4r \wedge 2 * e \wedge (2r \wedge 2) + 1\right), r, 0, 1\right), \theta, 0, 2\pi\right)$, evaluate it, and record the result below. Does this make the calculation go any faster? Did you get the same result?

2. Evaluate the triple integral $\int_0^2 \int_0^{4-2x} \int_0^{4-2x-z} 6xy\, dydzdx$ by executing $\int\left(\int\left(\int(6x * y, y, 0, 4 - 2x - z), z, 0, 4 - 2x\right), x, 0, 2\right)$. Record your result below.

3a. To examine the region $\boldsymbol{Q}$ between the surfaces $z=\sqrt{x^2+y^2}$ and $z=\sqrt{4-x^2-y^2}$ you can plot each surface separately over $-1.5 \le x \le 1.5,\ -1.5 \le y \le 1.5,\ 0 \le z \le 2$. Plot each surface on the axes provided below.



$z=\sqrt{x^2+y^2}$



$z=\sqrt{4-x^2-y^2}$

How would you describe in words the shape of this region?

3b. The triple integral $\iiint_Q ze^{\sqrt{x^2+y^2}}\,dV$ is written as $\int_0^{2\pi}\int_0^1\int_r^{\sqrt{4-r^2}} rze^r\,dz\,dr\,d\theta$ when it is converted to cylindrical coordinates. Compute this integral on your calculator and record the result below.

4a. The "roof" of the region below $x^2+y^2+z^2=4z$ and above $z=\sqrt{x^2+y^2}$ can be graphed on your calculator only by solving for $z=2+\sqrt{4-x^2-y^2}$. Graph the "roof" and describe it below. This surface is readily written in spherical coordinates as $\rho=4\cos\phi$.

4b. Sketch and describe the "floor" of the solid, $z=\sqrt{x^2+y^2}$. Rewritten in spherical coordinates this surface can be described as $\phi=\dfrac{\pi}{4}$.

4c. Set up an integral in spherical coordinates which gives the volume of the solid described in **4a** and **4b**. Evaluate the integral using your calculator and record the result below.