Name: __Key__

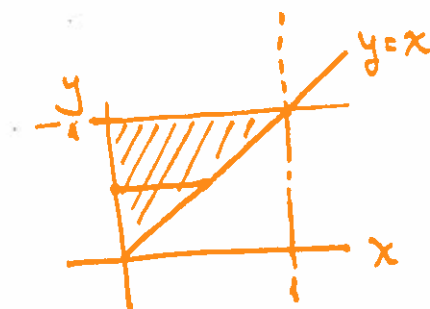**Show your work to earn full credit.**

1. Consider the integral $\int_0^1 \int_x^1 3e^{x/y} \, dy \, dx$.

   (i) Reverse the order of integration of the given integral. (*2 points*)

   $$\int_0^1 \int_0^y 3e^{x/y} \, dx \, dy$$

   (ii) Evaluate your integral from part (i). (*2 points*)

   Inner: $\int_0^y 3e^{x/y} \, dx = \left[3y \, e^{x/y}\right]_0^y = 3ey - 3y = 3(e-1)y$
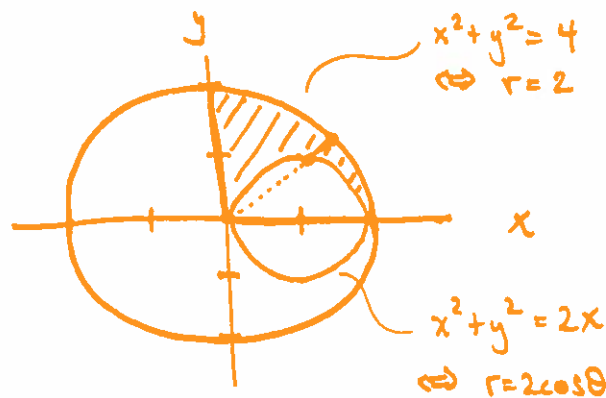
   Outer: $\int_0^1 3(e-1)y \, dy = \frac{3}{2}(e-1)\left[y^2\right]_0^1 = \boxed{\frac{3}{2}(e-1)}$

2. Set up the following integral by changing it to polar coordinates (**do not evaluate**). (*4 points*)

   $\iint_D x \, dA$, D is the region in the first quadrant that lies between $x^2 + y^2 = 4$ and $x^2 + y^2 = 2x$.

   Note: $x^2 + y^2 = 2x$

   $x^2 - 2x + 1 + y^2 = 1$ $\} \Leftrightarrow r = 2\cos\theta$ (in polar)

   $\Leftrightarrow (x-1)^2 + y^2 = 1$

   Circle with radius 1 centered at (1,0).

   $x^2 + y^2 = 4 \Leftrightarrow r = 2$

   $x^2 + y^2 = 2x \Leftrightarrow r = 2\cos\theta$

   Limits of Integration:

   $r = 2\cos\theta$ to $r = 2$

   $\theta = 0$ to $\theta = \frac{\pi}{2}$ (since staying in QI).

   Integral: Since $x = r\cos\theta$ and $dA = r \, dr \, d\theta$, we get

   $$\int_0^{\frac{\pi}{2}} \int_{2\cos\theta}^2 r^2 \cos\theta \, dr \, d\theta$$

Problem References:

1. MAC2313 L20 HW Assignment Problem #10 and L20 NYTI #3. Answer: (i) $\int_0^1 \int_0^y 3e^{x/y} \, dx \, dy$. (ii) $\frac{3}{2}(e-1)$.

2. MAC2313 L21 HW Assignment Problem #5. Answer: $\int_0^{\pi/2} \int_{2\cos\theta}^2 r^2 \cos\theta \, dr \, d\theta$.