MATH 2339, HW 38: Solution

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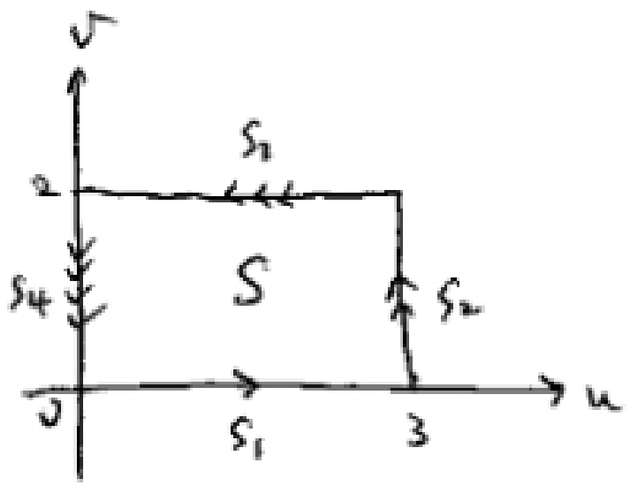
$S = \{(u,v) \mid 0 \le u \le 3,\ 0 \le v \le 2\}$; $x = 2u + 3v$, $y = u - v$

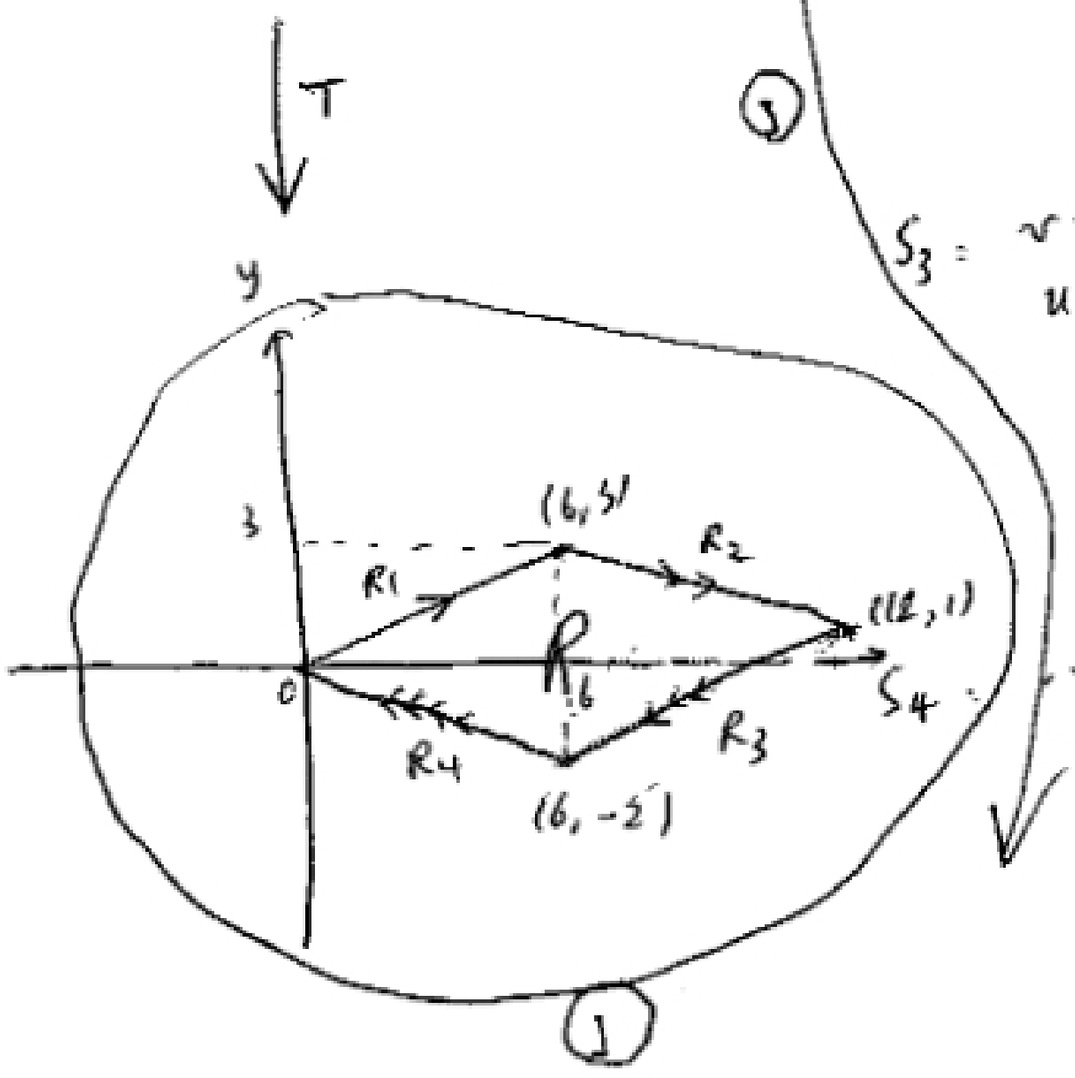


S_1: $v = 0$, $u = 0 \to 3$ $\}\to$ R_1: $\begin{cases} x = 2u + 3v = 2u \\ y = u - v = u \end{cases}$

$\Rightarrow x = 2y$, $y = u = 0 \to 3$

S_2: $u = 3$, $v = 0 \to 2$ $\}\to$ R_2: $\begin{cases} x = 6 + 3v \\ y = 3 - v \end{cases}$ $\Rightarrow x = 6 + 9 - 3y = 15 - 3y$

$y = 3 - v = 3 \to 1$



S_3: $v = 2$, $u = 3 \to 0$ $\}\to$ R_3: $\begin{cases} x = 2u + 6 \\ y = u - 2 \end{cases}$ $\Rightarrow x = 2y + 4 + 6 = 2y + 10$

$y = u - 2 = 1 \to -2$

S_4: $u = 0$, $v = 2 \to 0$ $\}\to$ R_4: $\begin{cases} x = 3v \\ y = -v \end{cases}$ $\Rightarrow x = -3y$

$y = -v = -2 \to 0$

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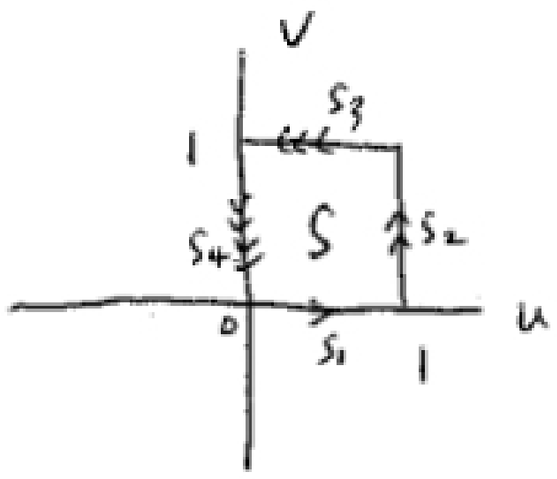

$x = v$

$y = u(1+v^2)$

S_1: $u = 0 \to 1$, $v = 0$ $\longrightarrow$ R_1: $\begin{cases} x = 0 \\ y = u = 0 \to 1 \end{cases}$

S_2: $u = 1$, $v = 0 \to 1$ $\longrightarrow$ R_2: $\begin{cases} x = v = 0 \to 1 \\ y = 1 + v^2 = 1 + x^2 \end{cases}$

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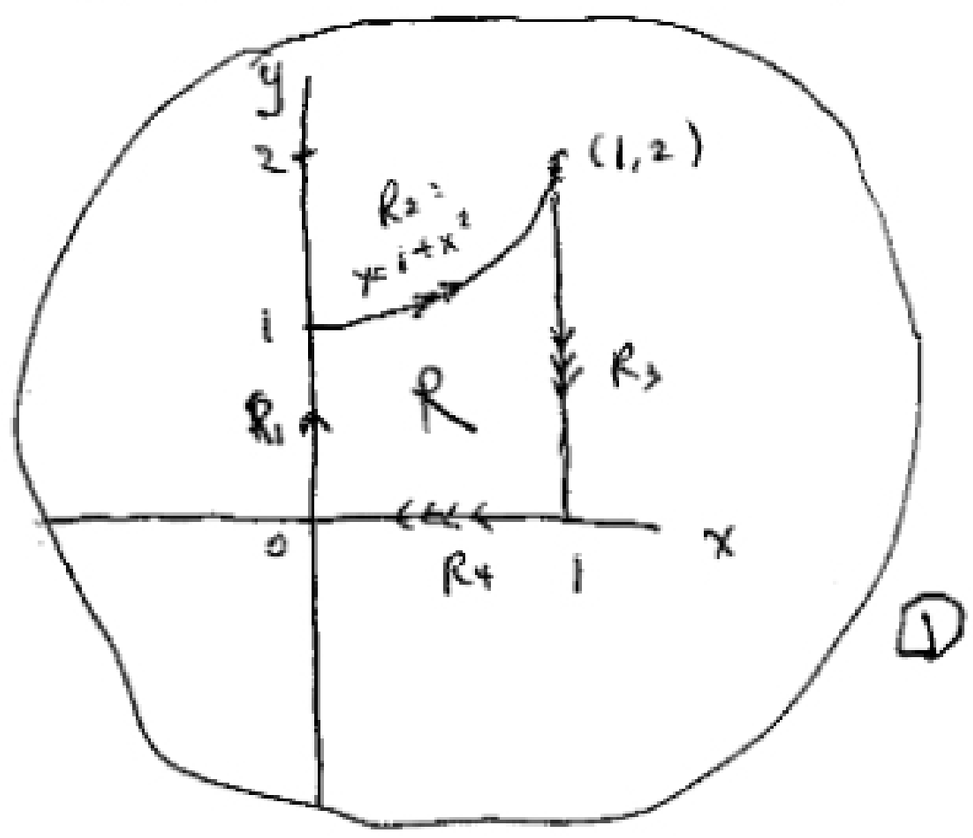
S_3: $v = 1$, $u = 1 \to 0$ $\longrightarrow$ R_3: $\begin{cases} x = 1 \\ y = 2u = 2 \to 0 \end{cases}$

S_4: $v = 1 \to 0$, $u = 0$ $\longrightarrow$ R_4: $\begin{cases} x = v = 1 \to 0 \\ y = 0 \end{cases}$



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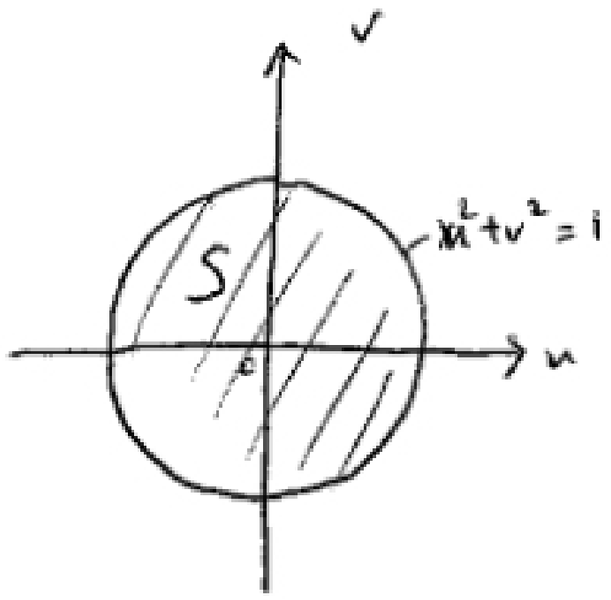
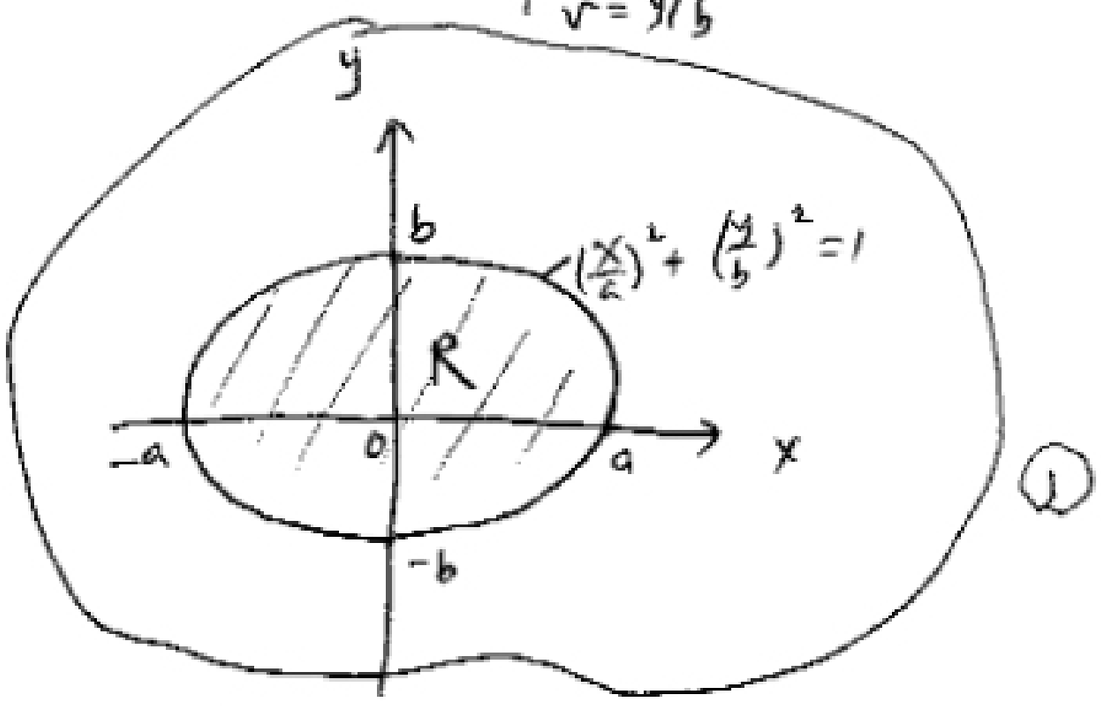


$x = au$

$y = bv$

$$u^2 + v^2 \le 1 \xrightarrow[\begin{cases} x = au \\ y = bv \end{cases}]{} \left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 \le 1$$

$$\begin{cases} u = x/a \\ v = y/b \end{cases}$$



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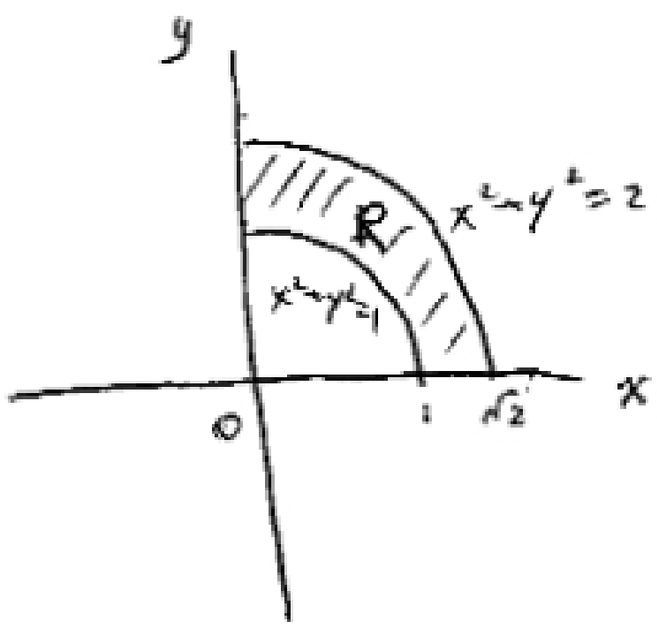
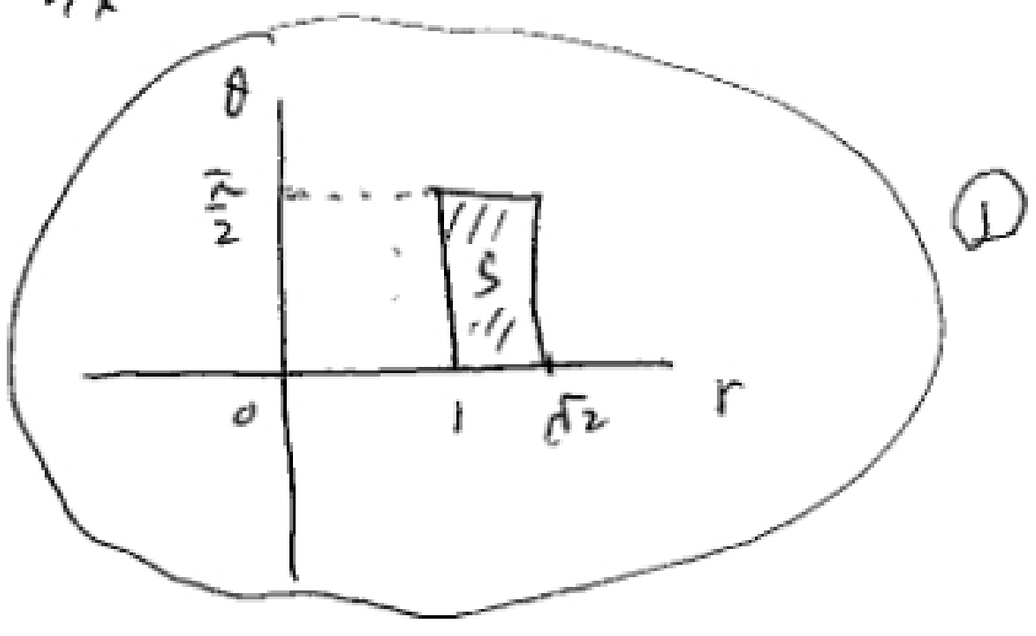


T^{-1}:
$\begin{cases} r = \sqrt{x^2+y^2} \\ \tan\theta = y/x \end{cases}$

T:
$\begin{cases} x = r\cos\theta \\ y = r\sin\theta \end{cases}$



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