② $I = \iint 8xy\,dx\,dy$, $x=0$, $y=x$, $y=1-x$, $y=2-x$

ⓐ $u = x+y$, $v = x-y$

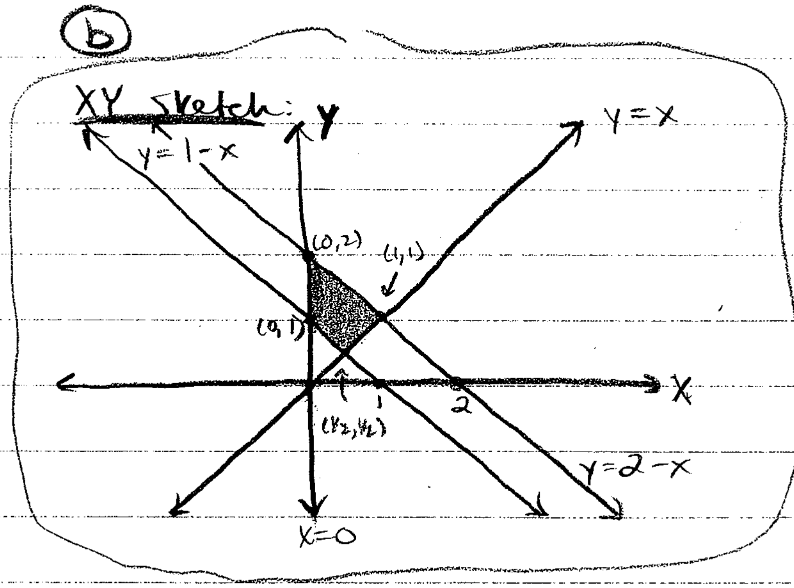
$x = u-y \Rightarrow v = u-y-y \qquad v = u-2y \qquad v-u=-2y$

$\boxed{y = \frac{u-v}{2}}$

$x = u - \left(\frac{u-v}{2}\right) = \frac{2u}{2} - \frac{u}{2} + \frac{v}{2}$

$= \frac{u}{2} + \frac{v}{2} = \frac{u+v}{2} \Rightarrow \boxed{x = \frac{u+v}{2}}$

ⓑ

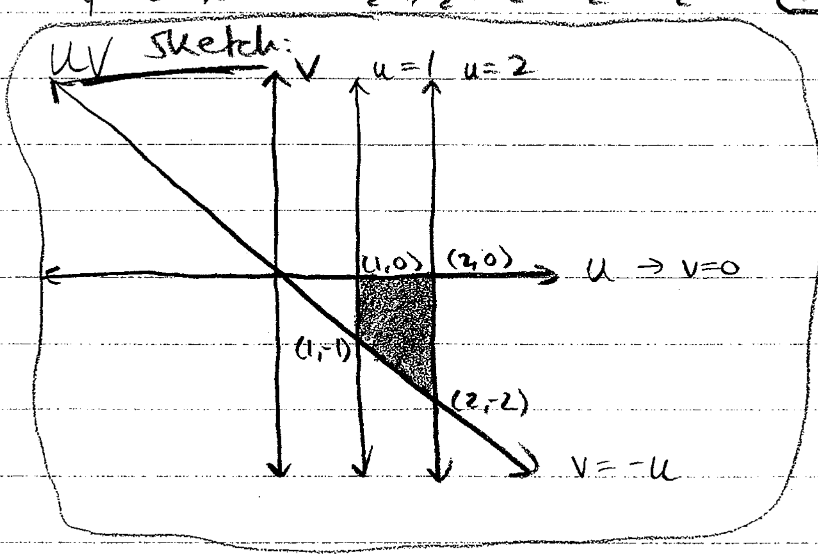


$x=0 \Rightarrow \frac{u}{2}+\frac{v}{2}=0 \qquad u+v=0 \qquad u=-v$ or $\boxed{v=-u}$

$y=x \Rightarrow \cancel{\frac{u}{2}} - \frac{v}{2} = \cancel{\frac{u}{2}} + \frac{v}{2} \qquad -v=v \Rightarrow \boxed{v=0}$

$y=1-x \Rightarrow \frac{u}{2} - \cancel{\frac{v}{2}} = 1 - \frac{u}{2} - \cancel{\frac{v}{2}} \Rightarrow \boxed{u=1}$

$y=2-x \Rightarrow \frac{u}{2} - \cancel{\frac{v}{2}} = 2 - \frac{u}{2} - \cancel{\frac{v}{2}} \Rightarrow \boxed{u=2}$



(c) $J(u,v) = \begin{vmatrix} 1/2 & 1/2 \\ 1/2 & -1/2 \end{vmatrix} = -1/4 - 1/4 = -1/2$

$$\int_1^2 \int_0^{-u} -1/2(8)\left(\frac{u+v}{2}\right)\left(\frac{u-v}{2}\right) dv\,du$$

$$= -\int_1^2 \int_0^{-u} (u+v)(u-v)\,dv\,du$$

$$= -\int_1^2 \int_0^{-u} (u^2+uv-uv-v^2)\,dv\,du$$

$$= -\int_1^2 \int_0^{-u} (u^2-v^2)\,dv\,du$$

$$= \boxed{\int_1^2 \int_0^{-u} (v^2-u^2)\,dv\,du}$$

(d) $\displaystyle\int_1^2 \left[\frac{v^3}{3} - vu^2\right]_0^{-u} du = \int_1^2 \left[\frac{-u^3}{3} + u^3 - 0 - 0\right] du$

$$= \int_1^2 \left[2/3\,u^3\right] du = 2/3\left[\frac{u^4}{4}\right]_1^2$$

$$= \frac{2}{3}\left[\frac{1}{4}\right](16-1) = \frac{1\,\cancel{2}\cdot 1\cdot \cancel{15}^{\,5}}{\cancel{3}\cdot\cancel{4}_{\,2}} = \boxed{5/2}$$

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