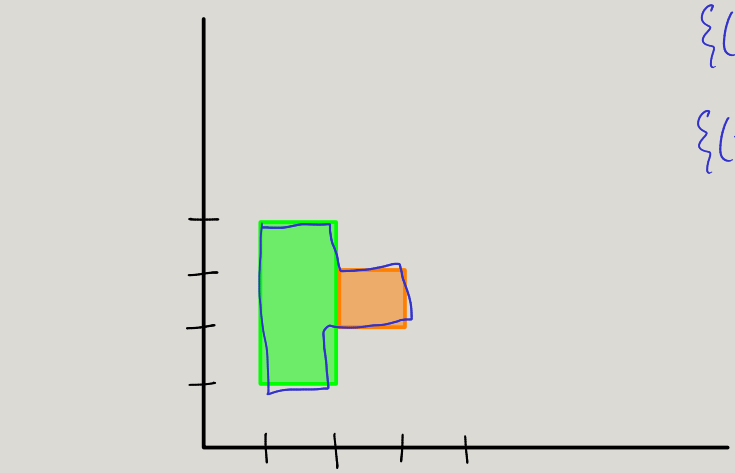
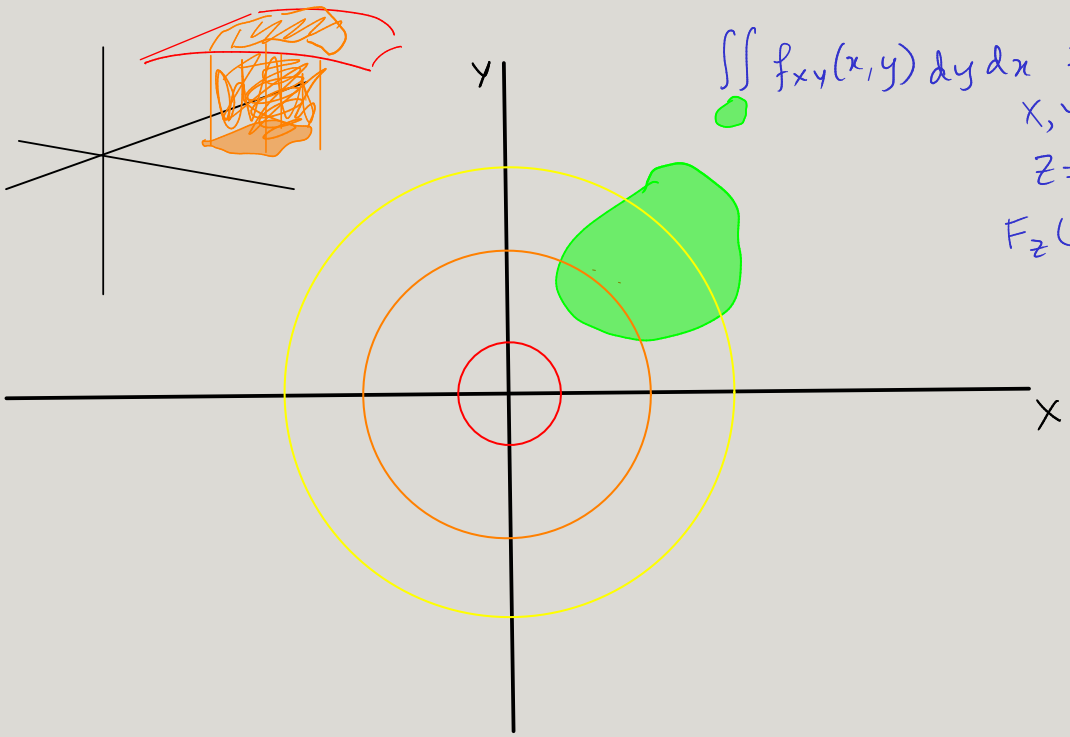
$\{(x,y): 1<x<2,\ 1<y<4\}$

$\{(x,y): 2<x<3,\ 2<y<3\}$

$\iint \quad + \iint$





$\iint f_{XY}(x,y)\,dy\,dx = \Pr[\ ]$

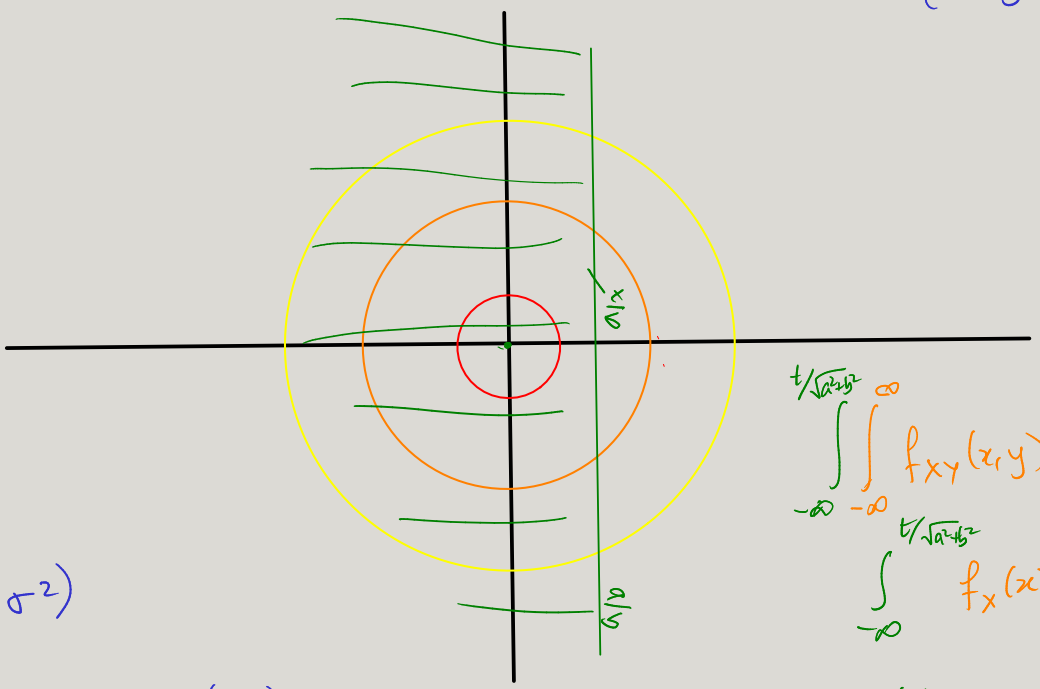
$X, Y \sim W(0,1)$

$Z = aX + bY$

$F_Z(t) = \Pr[Z \le t]$

$= \Pr[aX + bY \le t]$

$\{(x,y): ax+by \le t\}$



$aX + bY \le t$

$ax + by \le t$

$\Rightarrow y \le \frac{t}{b} - \frac{a}{b}x$

$\int_{-\infty}^{\infty}\int_{-\infty}^{t/b - ax/b} f_{XY}(x,y)\,dy\,dx$

$\int_{-\infty}^{t/\sqrt{a^2+b^2}}\int_{-\infty}^{\infty} f_{XY}(x,y)\,dy\,dx$

$\int_{-\infty}^{t/\sqrt{a^2+b^2}} f_X(x)\,dx$

$X \sim W(\mu, \sigma^2)$

$Z = \frac{X-\mu}{\sigma} \sim W(0,1)$

$= F_X\left(t/\sqrt{a^2+b^2}\right) = \Phi\left(t/\sqrt{a^2+b^2}\right)$