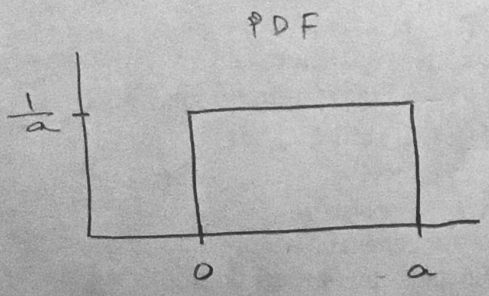
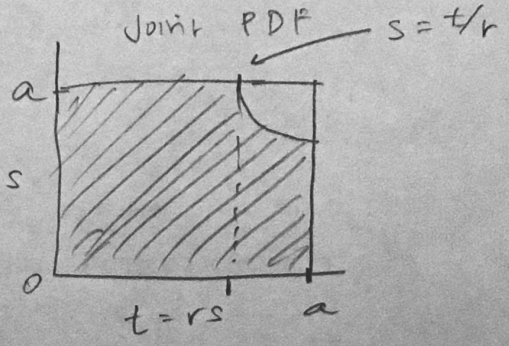
1. e) θ goes to $\pi/2$ as the mean and the mode approach equality. We want θ to be a large as possible, but it can't go to ∞ because then it would just be spinning around the unit circle...

2.





random variables $Z = X * Y$

deterministic var: $t = r * s$

$s = t/r$

$$F_{xy}(r,s) = F_{xy}(r, t/r)$$

$$F_Z(t) = \int_{-\infty}^{\infty} F_{xy}(r, t/r)\,dr$$

$$F_X(r) = \begin{cases} a^{-1} & \text{for } 0 \le r \le a \\ 0 & \text{elsewhere} \end{cases} \qquad F_Y(s) = \begin{cases} a^{-1} & \text{for } 0 \le s \le a \\ 0 & \text{elsewhere} \end{cases}$$

Joint PDF: $F_{xy}(r,s) = \begin{cases} a^{-2} & \text{for } 0 \le r \le a,\ 0 \le s \le a \\ 0 & \text{elsewhere} \end{cases}$

integrate shaded part to get CDF

$$\int_0^{a*r} dt + \text{area under curve}$$

rectangle $= (a*r)a$

$$F_Z = \begin{cases} ta^{-2} & 0 \le t \le a \\ (a - t/a)a^{-2} & a \le t \le a^2 \\ 0 & \text{elsewhere} \end{cases}$$