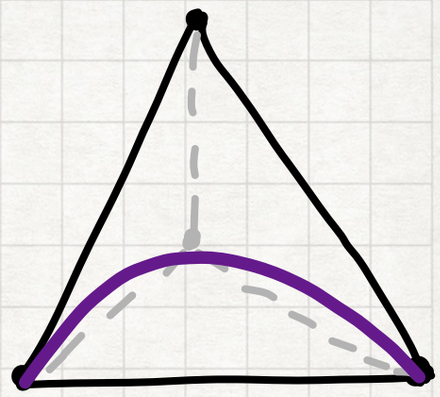
Example 3.2.9: Binomial Random variable



- Consider a biased coin, $P(H)=\theta$, $P(T)=1-\theta$

  X = "number of heads in two trials"

  $\mathcal{B}_2 = \{ ((1-\theta)^2, 2(1-\theta)\theta, \theta^2) : 0 \le \theta \le 1 \}$ → Parametric Description

  $= \{ (p_0, p_1, p_2) \in \mathbb{R}^3 : p_0+p_1+p_2=1,\ p_2^2 - 4p_1p_3 = 0,\ p_0, p_1, p_2 \ge 0 \}$ → Implicit Description.

- Suppose we have two coins C_1, C_2, we select one at random, toss the coin twice and record # of heads, Y

$$P(Y=0) = \underbrace{P(C=C_1)}_{\lambda}\underbrace{P(X_{C_1}=0)}_{(1-\theta_1)^2} + \underbrace{P(C=C_2)}_{(1-\lambda)}\underbrace{P(X_{C_2}=0)}_{(1-\theta_2)^2}$$

$$= \lambda\cdot(1-\theta_1)^2 + (1-\lambda)(1-\theta_2)^2$$