

EXPECTED VALUE:

$$E(h(X, Y)) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \underbrace{h(x, y)}_{\text{values}} \underbrace{f(x, y)}_{\text{density (joint pdf)}} dy dx$$

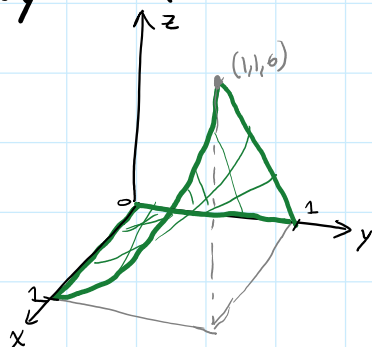
COVARIANCE:

$$\text{Cov}(X, Y) = E[(X - \mu_X)(Y - \mu_Y)] = \underbrace{E(XY) - E(X)E(Y)}_{\text{shortcut formula}}$$

CORRELATION:

$$\text{Corr}(X, Y) = \frac{\text{Cov}(X, Y)}{\sigma_X \cdot \sigma_Y}$$

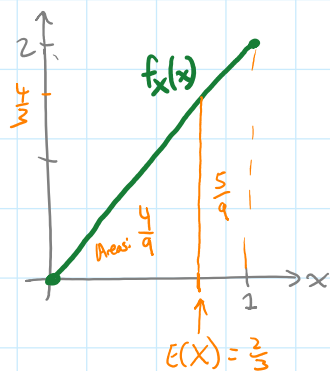
1. $f(x, y) = 6xy^2$ for $0 \leq x \leq 1, 0 \leq y \leq 1$



Compute $f_X(x)$:

$$f_X(x) = \int_0^1 6xy^2 dy = 2xy^3 \Big|_{y=0}^{y=1} = 2x(1)^3 - 2x(0)^3 = 2x$$

for x from 0 to 1
 $0 \leq x \leq 1$



$$\begin{aligned} E(X) &= \int_0^1 x \cdot f_X(x) dx \\ &= \int_0^1 x(2x) dx = \int_0^1 2x^2 dx \\ &= \frac{2}{3} x^3 \Big|_0^1 = \frac{2}{3} \end{aligned}$$