You are playing a game with a friend where you flip a coin and if it comes up heads you give her X dollars and if it comes up tails she gives you Y dollars. The odds that the coin is heads in d. What is your expected earnings?

ODDS THAT YOU LOSE ON A GIVEN ROUND ARE GIVEN BY

$$\frac{p}{(1-p)} = d \rightarrow p = \frac{d}{1+d}$$

$$E[W] = -Xp + Y(1-p)$$

$$= -X\left(\frac{d}{1+d}\right) + Y\left(1 - \frac{d}{1+d}\right)$$

$$= -X\left(\frac{d}{1+d}\right) + Y\left(\frac{1+d-d}{1+d}\right)$$

$$E = -X\left(\frac{d}{1+d}\right) + Y\left(\frac{1}{1+d}\right)$$

You are playing a game with a friend where you flip a coin and if it comes up heads you give her X dollars and if it comes up tails she gives you Y dollars. The probability that the coin is heads is p (some number between 0 and 1.) What has to be true about X and Y to make so that both of your expected total earnings is 0. The game would then be called "fair".

$p \rightarrow P(\text{COIN IS HEADS})$

$1-p \rightarrow P(\text{COIN IS TAILS})$

$$E = -Xp + Y(1-p)$$

$$0 = -Xp + Y(1-p)$$

$$Xp = Y(1-p)$$

$$\frac{p}{1-p} = \frac{Y}{X}$$