Step-1

There is only one prime number which is also an even number, that is, 2. So, X will either choose 2 or any other prime number. Y will guess if it is even or odd with a gain or loss of $1.

Step-2

The payoff matrix for X is given below,

$$A=\begin{bmatrix} & odd & even \\ not2 & -1 & 1 \\ 2 & 1 & -1 \end{bmatrix}$$

Step-3

Let X choose even prime number $\frac{2}{3}$ times and odd prime number $\frac{1}{3}$ times. Then the gain of X will be,

$\frac{2}{3}\times 1+\frac{1}{3}\times -1=\frac{2}{3}-\frac{1}{3}=\frac{1}{3}$.

Hence, X will have an advantage in this game if he uses this strategy to choose 2 more often.