Step-1

Therefore,

$$\begin{aligned}v &= y^* A x^* \\ &= (y_1, y_2, y_3)\begin{bmatrix}1 & 0 & 0\\0 & 2 & 0\\0 & 0 & 3\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix} \\ &= (y_1, y_2, y_3)\begin{bmatrix}x_1\\2x_2\\3x_3\end{bmatrix} \\ &= x_1y_1 + 2x_2y_2 + 3x_3y_3\end{aligned}$$

Step-2

In order to make very small payments, if *Y* decides to go for $(1,0,0)$, *X* will understand his policy and will have his policy $(1,0,0)$. Thus, *Y* will have to pay 1 to *X*. On the other hand if *X* decides to go for $(0,0,1)$ to have maximum amount from *Y*, *Y* will have $y_3 = 0$.

Thus, the optimal strategy will be to have $x^* = \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$ and $y^* = \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$.

Therefore,

$$\begin{aligned}v &= x_1y_1 + 2x_2y_2 + 3x_3y_3 \\ &= \left(\frac{1}{3}\right)\left(\frac{1}{3}\right) + 2\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) + 3\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) \\ &= \frac{6}{9} \\ &= \frac{2}{3}\end{aligned}$$

Step-3

Thus, $x^* = \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$, $y^* = \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\right)$, $v = \frac{2}{3}$.