Step-1

Therefore,

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

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,

$$\begin{aligned}
v &= x_1 y_1 + 2x_2 y_2 + 3x_3 y_3 \\
&= \left(\frac{1}{3}\right)\left(\frac{1}{3}\right) + 2\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) + 3\left(\frac{1}{3}\right)\left(\frac{1}{3}\right) \\
&= \frac{6}{9} \\
&= \frac{2}{3}
\end{aligned}$$

Step-3

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