10. $\vec{r}(u,v) = 6u\,\vec{i} - v\,\vec{j} + v\,\vec{k} \qquad 0 \le u \le 2 \qquad 0 \le v \le 4$

$$\vec{r}_u = 6\vec{i} + 0\vec{j} + 0\vec{k}$$

$$\vec{r}_v = 0\vec{i} - \vec{j} + \vec{k}$$

$$\vec{r}_u \times \vec{r}_v = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 6 & 0 & 0 \\ 0 & -1 & 1 \end{vmatrix}$$

$$= \vec{i}\begin{vmatrix} 0 & 0 \\ -1 & 1 \end{vmatrix} - \vec{j}\begin{vmatrix} 6 & 0 \\ 0 & 1 \end{vmatrix} + \vec{k}\begin{vmatrix} 6 & 0 \\ 0 & -1 \end{vmatrix}$$

$$= -6\vec{j} - 6\vec{k}$$

$$\|\vec{r}_u \times \vec{r}_v\| = \sqrt{(-6)^2 + (-6)^2} = \sqrt{36+36} = \sqrt{72} = \sqrt{6\cdot 6\cdot 2} = 6\sqrt{2}$$

$$SA = \int_{u=0}^{u=2} \int_{v=0}^{v=4} 6\sqrt{2}\, dv\, du$$

$$= 6\sqrt{2} \int_{u=0}^{u=2} [v]_{v=0}^{v=4}\, du$$

$$= 6\sqrt{2} \int_{u=0}^{u=2} [4-0]\, du$$

$$= 24\sqrt{2}\,[u]_{u=0}^{u=2}$$

$$= 24\sqrt{2}\,[2-0]$$

$$= \boxed{48\sqrt{2}}$$