§ 32

$\Sigma_{f,R}$ is the surface obtained by taking the portion of the graph of $f(x,y)$ directly above (or below) the region R in $\mathbb{R}^2$.

For $g: \mathbb{R}^3 \longrightarrow \mathbb{R}$,

$$\iint_{\Sigma_{f,R}} g(x,y,z)\,dS = \iint_{R} g(x,y,f(x,y))\sqrt{\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 + 1}\,dA$$

$$\iint_{\Sigma_{f,R}} dS = \text{Surface area}\left(\Sigma_{f,R}\right)$$