

Sec 16.7

$$6. \oint F \cdot d\vec{r} = \iint_S (\nabla \times F) \cdot \vec{n} \, d\sigma.$$

$$\vec{n} = (0, 0, 1) \Rightarrow (\nabla \times F) \cdot \vec{n} = 3x^2y^2.$$

$$\oint F \cdot d\vec{r} = \iint_S 3x^2y^2 \, d\sigma.$$

$$\begin{aligned} &= \int_0^2 \int_0^{2\pi} 3r^2 \cos^2 \theta \, r^2 \sin \theta \, r \, d\theta \, dr \\ &\quad \begin{array}{l} x = r \cos \theta \\ y = r \sin \theta \\ d\sigma = r \, dr \, d\theta \end{array} \end{aligned}$$

$$= 8\pi$$