

$$12. \quad \vec{F}(x, y) = x^2 \vec{i} + 3y \vec{j}$$

$$C: x=t \quad y=t^2 \quad (0,0) \text{ to } (3,9)$$

$$W = \int_0^3 (t^2 + 6t^3) dt$$

$$= \left[\frac{1}{3}t^3 + \frac{6}{4}t^4 \right]_0^3$$

$$= \frac{1}{3}(3)^3 + \frac{3}{2}(3)^4$$

$$= 9 + \frac{243}{2}$$

$$= \frac{18}{2} + \frac{243}{2} = \left(\frac{261}{2} \right)$$

$$\vec{r} = \begin{matrix} x(t) & y(t) \\ t \vec{i} & + t^2 \vec{j} \\ (0,0) & \quad \quad \quad (3,9) \end{matrix}$$

$$\begin{array}{cc} 0=t & 0=t^2 \\ t=0 & t=0 \\ t=0 & \quad \quad \quad t=3 \end{array} \quad \begin{array}{cc} 3=t & 9=t^2 \\ t=3 & t=3 \end{array}$$

$$F(x(t), y(t))$$

$$\bullet \quad F(t, t^2) = t^2 \vec{i} + 3t^2 \vec{j}$$

$$\bullet \quad \vec{r}'(t) = \vec{i} + 2t \vec{j}$$

$$\vec{F} \cdot \vec{r}' = t^2 + 6t^3$$