I. Line Integrals, p. 1098. (§17.2).

A. 

\[ T(t) \]
\[ x = f(t) \]
\[ y = g(t) \]

B. Common Parametrization
\[ T \]
\[ x = \cos(t) \]
\[ y = \sin(t) \]
\[ 0 \leq t \leq 2\pi \]

C. 

\[ T(a) \]
\[ (x(b), y(b)) \]
Def. (p. 1098) If $z = f(x, y)$ is defined along a "smooth curve" $C$ given by the parametric equations

$$C: \begin{cases} x = x(t) \\ y = y(t) \end{cases} \quad a \leq t \leq b,$$

then the \textbf{line integral of $f$ along $C$} is defined by

$$\int_C f(x, y) \, ds = \lim_{n \to \infty} \sum_{i=1}^{n} f(x_i^*, y_i^*) \Delta s_i$$

if this limit exists.

Now previously we found that the \textbf{length of the smooth curve} $C$ is given by

$$L = \int_{t=a}^{t=b} \sqrt{(dx/dt)^2 + (dy/dt)^2} \, dt$$

12th "Working" Formula. (p. 1099)

$$\int_C f(x, y) \, ds = \int_{t=a}^{t=b} f(x(t), y(t)) \sqrt{(dx/dt)^2 + (dy/dt)^2} \, dt$$