Line integrals of scalar fields

I can't find any command that directly calculates the line integral for a scalar field $f$, specifying only $f$ and the parameterization, possibly because if you know those two things already, it's pretty simple to break it out step by step with the substitutions and do an ordinary integral. No matter what, you'd still have to come up with the parametization on your own; it's not like you can say, "Hey Maple, write me a circle of radius 2!"... and once you've got that, the rest is trivial anyway.

I'll just pull the examples out of a few of the suggested problems (I wanted to check my integration anyway). I'm using "rp" for "r prime" which isn't precisely what that is either, but I need something to denote the square root of the squares part of $ds$. Calling it "ds" made the integral look silly, because I still had to specify the "dt" at the end...

**P1:**

Evaluate the line integral $\int_{C} (x - y) \, ds$ over the path $C : r(t) = 4t \mathbf{i} + 3t \mathbf{j}$, $0 \leq t \leq 2$.

\[
\begin{align*}
\mathbf{f} := (x, y) &\rightarrow x - y : \\
\mathbf{x} := t &\rightarrow 4t : \\
\mathbf{y} := t &\rightarrow 3t : \\
\mathbf{rp} := \sqrt{x'(t)^2 + y'(t)^2} ; &
\end{align*}
\]

\[
\begin{align*}
a := 0 : b := 2 &:\n\int_{a}^{b} f(x(t), y(t)) \cdot \mathbf{rp} \, dt; &
\end{align*}
\]

**P2:**

Evaluate the line integral $\int_{C} (x^2 + y^2 + z^2) \, ds$ over the path $C : r(t) = \sin(t) \mathbf{i} + \cos(t) \mathbf{j} + 8t \mathbf{k}$, $0 \leq t \leq 2$.

\[
\begin{align*}
\mathbf{f} := (x, y, z) &\rightarrow x^2 + y^2 + z^2 : \\
\mathbf{x} := t &\rightarrow \sin(t) : \\
\mathbf{y} := t &\rightarrow \cos(t) : \\
\mathbf{z} := t &\rightarrow 8t : \\
\mathbf{rp} := \sqrt{x'(t)^2 + y'(t)^2 + z'(t)^2} ; &
\end{align*}
\]

\[
\begin{align*}
\mathbf{rp} := \text{simplify}(\mathbf{rp}) &:
\end{align*}
\]

\[
\begin{align*}
a := 0 : b := \frac{\Pi}{2} &:
\end{align*}
\]
\[
\int_{a}^{b} f(x(t), y(t), z(t)) \cdot rp \, dt;
\]

\[
\frac{1}{2} \sqrt{65} \pi + \frac{8}{3} \sqrt{65} \pi^3
\]  

(5)

evalf(\%)

679.2790836  

(6)

**P4:**
The density of a wire in the shape of the circular helix \( \mathbf{r}(t) = 3 \cos(t) \mathbf{i} + 3 \sin(t) \mathbf{j} + 2t \mathbf{k} \) is given by \( \rho(x, y, z) = \frac{1}{2} \left( x^2 + y^2 + z^2 \right) \). Find the total mass of two turns of the wire \((0 \leq t \leq 4 \pi)\).

\[
\rho := (x, y, z) \rightarrow \frac{1}{2} \left( x^2 + y^2 + z^2 \right) ;
\]

\[
x := t \rightarrow 3 \cos(t) ;
\]

\[
y := t \rightarrow 3 \sin(t) ;
\]

\[
z := t \rightarrow 2t ;
\]

\[
\rho := \sqrt{x'(t)^2 + y'(t)^2 + z'(t)^2} ;
\]

(7)

\[
\rho := \text{simplify}(\rho)
\]

\[
\sqrt{13}
\]  

(8)

\[
a := 0 ; b := 4 \cdot \Pi ;
\]

\[
\int_{a}^{b} f(x(t), y(t), z(t)) \cdot rp \, dt;
\]

(9)

\[
36 \sqrt{13} \pi + \frac{256}{3} \sqrt{13} \pi^3
\]

\[
evalf(\%)
\]

9947.594391  

(10)