

Quiz February 8, 2008

$$\text{Let } \vec{r}(t) = \ln t \vec{i} + 2t \vec{j} + t^2 \vec{k}$$

$$\text{Find } \int_1^3 \|\vec{r}'(t)\| dt.$$

$$\int_1^3 \|\vec{r}'(t)\| dt = \int_1^3 \left\| \frac{1}{t} \vec{i} + 2 \vec{j} + 2t \vec{k} \right\| dt = \int_1^3 \sqrt{\left(\frac{1}{t}\right)^2 + 4 + 4t^2} dt$$

$$= \int_1^3 \sqrt{\left(\frac{1}{t} + 2t\right)^2} dt = \int_1^3 \left(\frac{1}{t} + 2t\right) dt = \left[\ln t + t^2 \right]_1^3$$

$$= \ln 3 + 9 - (\ln 1 + 1)$$

$$= \boxed{\ln 3 + 8}$$