Total time: 10 minutes.

Problem 1 (2+2+2=6 points). Calculate:

$$\frac{\mathrm{d}}{\mathrm{d}t}\langle t^2, t^2 \sin t\rangle = \langle 2t, 2t \sin t + t^2 \cos t\rangle$$

$$\int (t\mathbf{i} + \mathbf{j})\,\mathrm{d}t = \langle \frac{1}{2}t^2, t\rangle + \vec{C}$$

$$\int_0^\pi \langle \cos t, \sin t\rangle\,\mathrm{d}t = \langle \sin t|_0^\pi, -\cos t|_0^\pi\rangle = \langle 0, 2\rangle$$

Problem 2 (4 points). Write a definite integral to represent the arclength of the curve

$$\mathbf{r}(t) = \langle \cos(2t), \sin t, t\rangle$$

from $t = 0$ to $t = \pi$. Do not calculate this integral.

$$\mathbf{r}'(t) = \langle -2\sin(2t), \cos t, 1\rangle$$

$$\int_0^\pi \|\mathbf{r}'(t)\|\,\mathrm{d}t = \int_0^\pi \sqrt{4\sin^2(2t) + \cos^2 t + 1}\,\mathrm{d}t$$