

$$3. \vec{r}(t) = 5t \vec{i} + 2t \vec{j} - 3t \vec{k} \quad [0, 1]$$

$$\vec{r}'(t) = 5\vec{i} + 2\vec{j} - 3\vec{k}$$

$$\|\vec{r}'(t)\| = \sqrt{5^2 + 2^2 + (-3)^2} = \sqrt{25 + 4 + 9} = \sqrt{38}$$

$$S = \int_0^1 \sqrt{38} \, dt$$

$$S = \left[\sqrt{38} t \right]_0^1$$

$$S = \sqrt{38}(1) - \sqrt{38}(0)$$

$$S = \sqrt{38}$$

$$4. \vec{r}(t) = \langle 2t, 3 \cos t, -3 \sin t \rangle \quad \left[0, \frac{\pi}{2}\right]$$

$$\vec{r}'(t) = \langle 2, -3 \sin t, -3 \cos t \rangle$$

$$\|\vec{r}'(t)\| = \sqrt{2^2 + (-3 \sin t)^2 + (-3 \cos t)^2}$$

$$= \sqrt{4 + 9 \sin^2 t + 9 \cos^2 t}$$

$$= \sqrt{4 + 9(\sin^2 t + \cos^2 t)}$$

$$= \sqrt{4 + 9(1)}$$

$$= \sqrt{13}$$

$$S = \int_0^{\frac{\pi}{2}} \sqrt{13} \, dt$$

$$S = \left[\sqrt{13} t \right]_0^{\frac{\pi}{2}}$$

$$S = \sqrt{13} \left(\frac{\pi}{2} \right) - \sqrt{13}(0)$$

$$= \frac{\pi \sqrt{13}}{2}$$