$\boxed{\text{Solution to Exercise 11.2.44}}$

$$s = \int_0^{\pi} \sqrt{(dy/dt)^2 + (dx/dt)^2}\, dt$$

$$= \int_0^{\pi} \sqrt{(-3\sin t + 3\sin 3t)^2 + (3\cos t - 3\cos 3t)^2}\, dt$$

$$= \int_0^{\pi} \sqrt{\begin{array}{l} 9\sin^2 t - 18\sin t\sin 3t + 9\sin^2 3t + 9\cos^2 t \\ \quad - 18\cos t\cos 3t + 9\cos^2 3t \end{array}}\, dt$$

$$= \int_0^{\pi} \sqrt{9 + 9 - 18\sin t\sin 3t - 18\cos t\cos 3t}\, dt$$

$$= \int_0^{\pi} \sqrt{18 - 18(\sin t\sin(t+2t) - \cos t\cos(t+2t))}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{\begin{array}{l} 1 - \sin t(\sin t\cos 2t + \cos t\sin 2t) \\ \quad - \cos t(\cos t\cos 2t - \sin t\sin 2t) \end{array}}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{\begin{array}{l} 1 - \sin^2 t\cos 2t - \cancel{\cos t\sin t\sin 2t} \\ \quad - \cos^2 t\cos 2t + \cancel{\cos t\sin t\sin 2t} \end{array}}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{1 - \cos 2t(\sin^2 t + \cos^2 t)}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{1 - \cos 2t}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{1 - (1 - 2\sin^2 t)}\, dt$$

$$= \frac{\cancel{2\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{\cancel{1} - \cancel{1} + 2\sin^2 t}\, dt$$

$$= \frac{2\cancel{\sqrt{3}}}{3\sqrt{2}} \int_0^{\pi} \sqrt{2\sin^2 t}\; dt$$

$$= \frac{2\cancel{\sqrt{3}}}{3\sqrt{2}} \cdot \sqrt{2} \int_0^{\pi} \sin t \; dt$$

$$= \frac{2\cancel{\sqrt{6}}}{6} \left[-\cos t \right] \Big|_0^{\pi}$$

$$= \frac{2\cancel{\sqrt{6}}}{6} \left[-\cos \pi - (-\cos 0) \right]$$

$$= \frac{2\cancel{\sqrt{6}}}{6} \left[-(-1) + 1 \right]$$

$$= \frac{2\cancel{\sqrt{6}}}{6} \left[2 \right]$$

$$= \boxed{\frac{4\cancel{\sqrt{6}}}{12} \text{ units}}$$