Calculus Study Guide: 11.2

Find the speed at $t = \pi/4$ of a particle whose position is given by $c(t) = (\sin 4t, \cos 3t)$.

$\frac{dx}{dt} = 4\cos 4t \rightarrow 4\cos \pi = -4$

$\frac{dy}{dt} = -3\sin 3t \rightarrow -3\sin\frac{3\pi}{4} = -\frac{3\sqrt{3}}{2}$

$\text{speed} = \sqrt{16 + \frac{27}{2}} = 5.431$

Find the length of the curve $c(t)$ for $0 \le t \le \pi$.

$\int_0^{\pi} \sqrt{16\cos^2 4t + 9\sin^2 3t}\, dt = 11.051$

Find the speed at $t = 1$ of a particle whose position is given by $m(t) = (3^{1.5t}, \ln(1 + 2t))$.

$\frac{dx}{dt} = 3^{1.5t} \cdot \ln 3 \cdot 1.5 \rightarrow 3^{1.5}(\ln 3)(1.5) = 4.562$

$\frac{dy}{dt} = \frac{1}{1+2t} \cdot 2 \rightarrow \frac{2}{3}$ $\qquad \sqrt{4.562^2 + \frac{4}{9}} = 4.587$

Find the length of the curve $m(t)$ for $0 \le t \le 1$.

$\int_0^1 \left[\left(3^{1.5t} \cdot \ln 3 \cdot 1.5\right)^2 + \left(\frac{2}{1+2t}\right)^2\right]^{1/2} dt$

$= 4.427$