1. For the parametric curve $c(t) = (x(t), y(t))$, the length of the arc from $t = a$ to $t = b$ is given by
\[
\int_a^b \sqrt{(x'(t))^2 + (y'(t))^2} \, dt
\]

Example: The graph of $c(t) = (t^2, t^2)$ with $-1 \leq t \leq 1$ is a line segment. Find its length using the formula above. Is this right?

2. For a particle moving along the path $c(t) = (x(t), y(t))$, the speed of the particle is given by the derivative $\frac{ds}{dt}$ for the arclength function
\[
s(t) = \int_{t_0}^t \sqrt{(x'(r))^2 + (y'(r))^2} \, dr
\]

By the Fundamental Theorem of Calculus, speed at time $t = a$ is given by
\[
\sqrt{(x'(a))^2 + (y'(a))^2}
\]
The following are odd exercises from the textbook, so their answers will be in the back of the book.

1. Find the length of the path \((3t + 1, 9 - 4t)\) over the interval \(0 \leq t \leq 2\). Since the path is linear, find the length using the plain old distance formula, for comparison.

2. Find the length of the path \((\sin 3t, \cos 3t)\) over the interval \(0 \leq t \leq \pi\). Since the path is a circle, find the length using geometry, for comparison.

3. Determine the speed \(s(t)\) of the particle with trajectory \((\ln (t^2 + 1), t^3)\) at \(t = 1\).

4. Find the minimum speed of a particle with trajectory \(c(t) = (t^3 - 4t, t^2 + 1)\) for \(t \geq 0\).