Calc III Sections

Fall 2025

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Calc III-Week 8 (Fall Break)

Topics: (1) Acceleration, (2) Arc Length, (3)

Proposition 1 (Newton's second law)**.** Let $c(t)$ be a path of a particle with mass m and $a(t) = c''(t)$ be the acceleration, then

$$F(c(t)) = ma(t)$$

where F is the force applying on the particle.

Definition 1 (arc length)**.** Let $c(t) = (x(t), y(t), z(t))$ be a path, then the length of the path from $t_0 \leq t \leq t_1$ is

$$\begin{aligned} L_{t_0 \to t_1}(c) &= \int_{t_0}^{t_1} \left(x(t)^2 + y(t)^2 + z(t)^2\right)^{\frac{1}{2}} dt \\ &= \int_{t_0}^{t_1} \|c'(t)\| dt \end{aligned}$$

Problem 1. Find the velocity, speed, and acceleration of the following path at $t = 0$:

$$c(t) = (\cos t, 2t, -\sin t)$$

Problem 2. Find