

18.03SC Practice Problems 24

Step and delta functions

1. Let $Q(t) = \begin{cases} 0 & \text{for } t < 1 \\ 2t - 2 & \text{for } 1 < t < 2 \\ 2t - 1 & \text{for } 2 < t < 3 \\ 5 & \text{for } 3 < t \end{cases}$

- (a) Sketch a graph of this function. Is it piecewise smooth?
- (b) Find the generalized derivative $q(t) = Q'(t)$, and sketch it.
- (c) Describe a scenario which might be modeled by the equation $\dot{x} + kx = q(t)$ (your choice of k) with rest initial conditions.
- (d) Describe a scenario which might be modeled by the equation $2\ddot{x} + 4\dot{x} + 4x = q(t)$ with rest initial conditions.

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