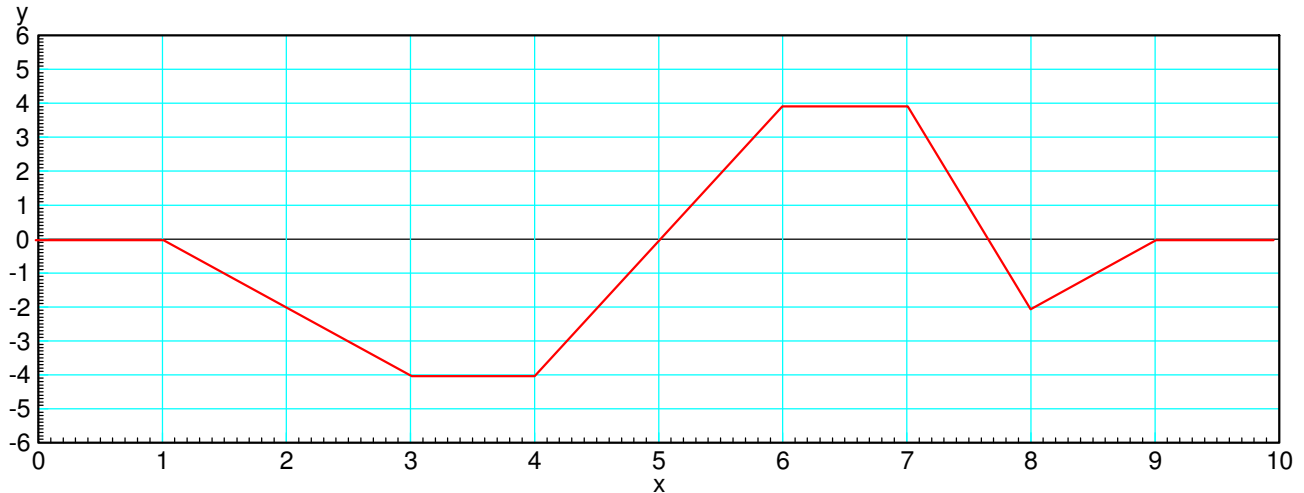


# ECE 111 - Homework #6:

Math 165: Differentiation  
Due Monday, October 2nd

1) Sketch the derivative of the following function

*If this is the balance of your checking account, how much money are you adding (positive) or withdrawing (negative) for the balance to be as shown?*



## Numerical Differentiation:

2) Use numerical methods to determine the derivative of y:

$$y = \left( \frac{\cos(x)}{x^2 + 0.5} \right)$$

$$z = \frac{d}{dx}(y)$$

for  $-10 < x < 10$ . ( a plot is sufficient ).

3) Use numerical methods to determine the derivative of y:

$$y = \sin(x) + 0.1 \cos(5x)$$

$$z = \frac{d}{dx}(y)$$

for  $-10 < x < 10$ . ( a plot is sufficient ).

## Path Planning

4) Assume a motor's angle is as follows:

$$\theta = \begin{cases} 0 & t < 0 \\ 0.5t & 0 < t < 2 \\ 1 & t > 2 \end{cases}$$

Calculate and plot using Matlab and numerical differentiation:

- The velocity vs. time (i.e. the voltage to the motor), and
- The acceleration vs. time (i.e. the current to the motor).

5) Assume a motor's angle is as follows:

$$\theta = \begin{cases} 0 & t < 0 \\ \frac{1}{2} - \frac{1}{2} \cos\left(\frac{1}{2}\pi t\right) & 0 < t < 2 \\ 1 & t > 2 \end{cases}$$

Calculate and plot using Matlab and numerical differentiation:

- The velocity vs. time (i.e. the voltage to the motor), and
- The acceleration vs. time (i.e. the current to the motor).

6) Assume a motor's angle is as follows:

$$\theta = \begin{cases} 0 & t < 0 \\ 0.5t^2 & 0 < t < 1 \\ 1 - 0.5(t-2)^2 & 1 < t < 2 \\ 1 & t > 2 \end{cases}$$

Calculate using Matlab and numerical differentiation:

- The velocity vs. time (i.e. the voltage to the motor), and
- The acceleration vs. time (i.e. the current to the motor).