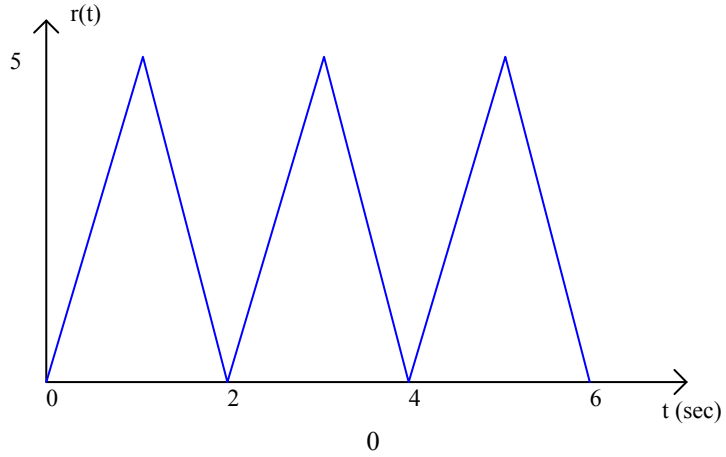
0. Keep working on your project!

1. Let's add tracking capability to the D.C. servo system in such that the output, x_1, tracks the following signal:



(Hint: discretize r(t) using $t = kT_s$ for k=0,1,2,...,599 (i.e., 5.99 seconds)

a) Use Q=10 and R=1 and simulate your optimal tracker on Matlab. Plot y_k and r_k vs. kT_s

b) We can obtain a suboptimal tracking system by solving the ARE in the tracker problem for the unique, positive definite S_∞ then plugging this constant kernel value in for the control gains, K_∞ $K_{v\infty}$.and use these constant gains in calculating u_k and v_k. Repeat part a) using a suboptimal tracker. Compare results.

2.a) The dual of the tracking problem is deterministic rejection where you want to find an optimal control to minimize the effects of an external disturbance. Solve the deterministic discrete disturbance rejection problem outlined in **EXERCISE** (not problem) 4.4-3 on page 242.

b) Suppose our DC servo is subjected to the following disturbance: $d_k = \begin{bmatrix} r_k \\ 0 \end{bmatrix} 0$where r_k is the signal defined in problem 1. Use your answer to part 2a) to find the optimal disturbance rejection control for the D.C servo and simulate on MATLAB. Use $Q = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$ and $R = 1\ 0$. Plot x_k with no control and under your optimal disturbance rejection control.