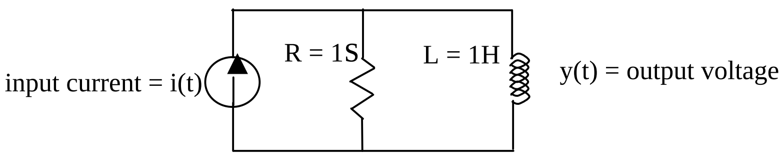
1. P8.5-3 (note: y[k] – y[k-1] . Tf[k] is also a valid approximation of an integrator)
2. P8.5-4a
3. P9.1-1 (solve by hand, first three terms ⇒ y[0], y[1], y[2])
4. P9.1-2 (solve by hand, first three terms ⇒ y[0], y[1], y[2])
5. For the difference equations given, determine their order and if they are linear, time-invariant, and causal. Note y[k] is the output and f[k] the input.
   a. $y[k+1] = y[k]f[k-1]$
   b. $y[k+2] - 5y[k+1] + 7y[k] + 1 = 4f[k+1] - 2f[k]$
   c. $y[k] + 2^k y[k-1] + 3y[k-3] = 1.5^{k-1} f[k+1] + f[k]$
   d. $3.3y[k+1] + y[k] - 1.2y[k-1] = 2f[k+1] + 2.1f[k] + 2.2f[k-1]$
6. Consider the RL circuit shown.



   a. Compute the output voltage y(t) (express in analytical form) for all t $ 0 when $y(0^-) = 0$ and i(t) = u(t)–u(t-1) where u(t) is the unit step function.
   b. Using Euler's approximation of derivatives with T arbitrary and input i(t) arbitrary, derive a difference equation model for the RL circuit.
   c. Use your answer to part b with T = 0.1sec, i(t) = u(t)–u(t-1) (that needs to be discretized), and matlab to recursively solve for and plot the approximation of y(t) for 0sec # t # 5sec. Plot the exact solution from part a on the same graph and compare the results.
7. Consider the differential equation $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = 0, y(0^-) = 1, \dot{y}(0^-) = 0$.
   a. Compute y(t) and express in analytical form, then plot y(t) for 0sec # t # 10sec.
   b. Using Euler's approximation to the derivative with T arbitrary, derive a difference equation model from the differential equation.
   c. Recursively solve your difference equation in part b using T = 0.4 and then T = 0.1 for 0sec # t # 10sec and plot your results. Compare these numerical solutions to the exact solution plotted in part a. Which time interval T gives a better approximation? Why?
8. Consider the differential equation model of a high-speed vehicle on a horizontal surface

$$12\frac{dv(t)}{dt} + 0.9v(t) + 0.6v^2(t) = f(t)$$
$$v(0^-) = 7$$
$$f(t) = 9t(u(t) - u(t-5))$$

   where v(t) is the vehicle velocity and f(t) is the drive/brake force.
   a. Solve for v(t) as an analytical expression.
   b. Using Euler's approximation to the derivative with T arbitrary, derive a difference equation model from the differential equation.
   c. Using the answer in part b with T = 0.2sec, compute and plot the approximation to v(t) using recursion for 0sec # t # 20sec.
   d. Using the answer in part b with T = 2.0sec, compute and plot the approximation to v(t) using recursion for 0sec # t # 20sec.
   e. Are you more confident in your approximation from part c or d? Why?