정보통신 수학 및 실습
Lab assignment

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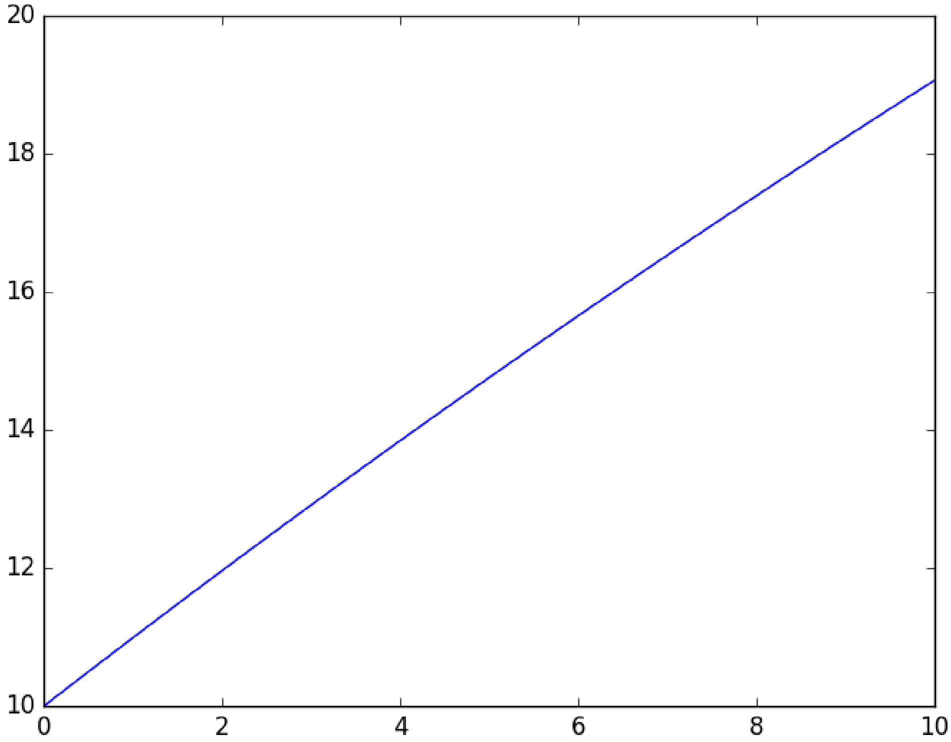
Chapter 8 Lab Assignment

1. **If the outlet is a pipe that discharges to atmospheric pressure pa and provides a resistance, R, to flow that is proportional to the pressure difference across its ends, then find the outlet flow rate qmo and the differential equation of h(t). Hint: qmo is (1/R)* (the pressure difference across its ends).**
   Now solve your differential equation of h(t) using MATLAB and plot h(t) against the time. The values of the parameters are as follows: (units are ignored)
   qmi = 25, R = 5, A = 10, h(0) = 10, ρ = 2.

$$q_{mo} = q_{mi} - \rho A \frac{dh}{dt} = \frac{1}{R} P = \frac{\rho h(t)}{R}$$
$$q_{mi} - \rho A \frac{dh(t)}{dt} = \frac{\rho h(t)}{R}$$
$$\frac{1}{A}\left(\frac{q_{mi}}{\rho} - \frac{h(t)}{R}\right) = \frac{dh(t)}{dt}$$
$$\frac{1}{A}\left(\frac{q_{mi}}{\rho} - \frac{h(t)}{R}\right) = \frac{h(t+\Delta t) - h(t)}{\Delta t}$$
$$h(t+\Delta t) = \frac{\Delta t}{A}\left(\frac{q_{mi}}{\rho} - \frac{h(t)}{R}\right) + h(t)$$
$$h(k+1) = \frac{\Delta t}{A}\left(\frac{q_{mi}}{\rho} - \frac{h(k)}{R}\right) + h(k)$$

```
k = 1
delta = 0.0001
h = [0: delta :0.1];
h(1) = 10
A = 10
qmi = 25
r = 2
R = 5
for t = [0: delta :0.1]
    h(k+1) = delta / A * (qmi / r - h(k) / R) + h(k)
    k = k + 1
end
plot(t, h(1,end-1)
```



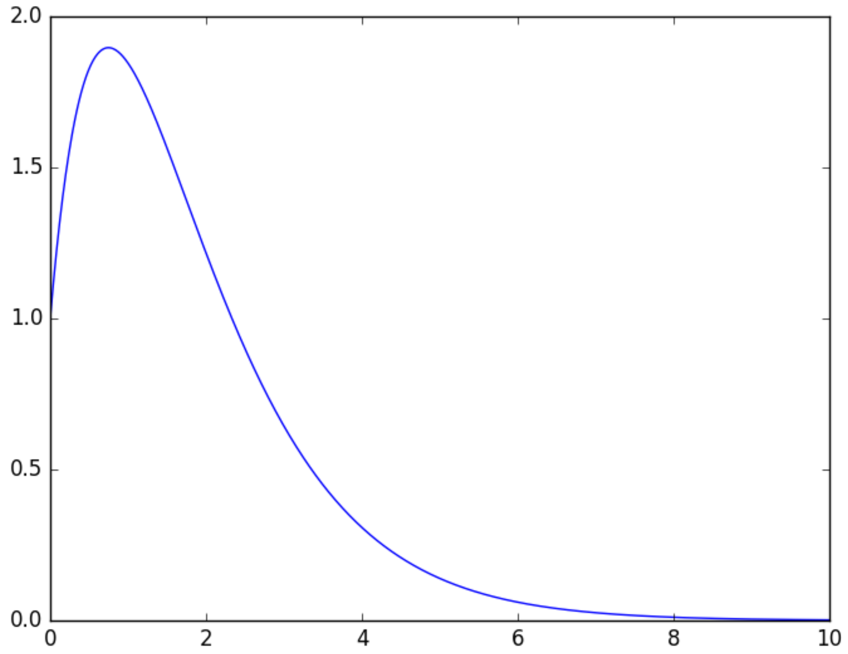
2. Solve the following 2 order differential equation using MATLAB.

$y'' + 2y' + y = 0, y(0) = 1, y'(0) = 3$

$$y''(t) + 2y'(t) + y(t) = 0$$
$$y'(t) = z(t)$$
$$\frac{y(t+\Delta t) - y(t)}{\Delta t} = z(t)$$
$$y(k+1) = z(k)\Delta t + y(k)$$
$$z'(t) + 2z(t) + y(t) = 0$$
$$\frac{z(t+\Delta t) - z(t)}{\Delta t} + 2z(t) + y(t) = 0$$
$$z(k+1) = -\Delta t(2z(k) + y(k)) + z(k)$$
$$z(0) = 3$$

```
delta = 0.01
t = [0: delta :10];
z(1) = 3;
y(1) = 1;
k = 1
for x = [0: delta :10]
    y(k+1) = delta * z(k) + y(k);
    z(k+1) = -delta * (2 * z(k) + y(k)) + z(k);
```

```
    k = k+1;
end
plot(t, y(1,end-1), '.')
```



3. **For the following differential equation, solve the response y[n] when x[n] is the sampling values of sin(2*pi*t), 0≤t≤2*pi, Δt=0.01. Plot y[n] and x[n] against n.**
   y[n] = 0.7*x[n] + 0.3*x[n-1]