1. Solve the given initial value problem

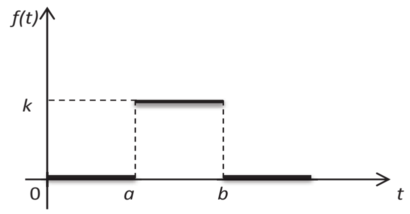
$$y' + 6y + 5\int_0^t y(\tau)d\tau = 1 + t, \qquad y(0) = 1$$

using Laplace transform.

2. Find the solution of the integro-differential equation

$$y' + 5y + 4\int_0^t y(\tau)d\tau = f(t)$$

under the condition $y(0) = 2$ and f(t) is a rectangular pulse as given in the figure below



3. Solve the given initial value problem

$$y'' + 6y' + 9y = 8te^{2t}, \qquad y(0) = 0, \qquad y'(0) = -1$$

using Laplace transform.

4. Using Convolution theorem solve the initial value problem

$$y'' + 9y = \sin(3t), \qquad y(0) = 0, \qquad y'(0) = 0.$$

5. Solve the given boundary value problem

$$y'' + 4y = -8t^2, \qquad y(0) = 3, \qquad y(\frac{\pi}{4}) = 0$$

using Laplace transform.

6. Find the solution of the initial value problem

$$y'' + ty' - 2y = 6 - t, \qquad y(0) = 0, \qquad y'(0) = 1,$$

given that $\mathcal{L}[y(t)]$ exists.

7. Solve the given initial value problem

$$y'' + y' = 2t, \qquad y(\frac{\pi}{4}) = \frac{\pi}{2}, \qquad y'(\frac{\pi}{4}) = 2 - \sqrt{2},$$

by shifting the initial condition at $t = 0$.

8. Determine the response of the damped mass-spring system governed by

$$y'' + 3y' + 2y = r(t), \qquad y(0) = 0, \qquad y'(0) = 0,$$

where $r(t)$ is:

(a) the square wave, $r(t) = u(t-1) - u(t-2)$.

(b) the unit impulse at time $t = 1$, $r(t) = \delta(t-1)$.

9. Solve the given system of simultaneous linear equations

$$x'' + kx + k(x - y) = 0,$$

$$y'' + ky + k(y - x) = 0,$$

$$x(0) = 1, \qquad y(0) = 1, \qquad x'(0) = \sqrt{3k}, \qquad y'(0) = -\sqrt{3k},$$

using Laplace transform.

10. Find $f(t)$ as the solution of the integral equation

$$f(t) = t + e^{-2t} + \int_0^t f(\tau)e^{2(t-\tau)}d\tau.$$

———end———