Q1 Using Laplace transforms solve the initial value problem \( y'' + 3y' + 2y = 1 \), where \( y = y(t) \) and \( y(0) = 1 \) and \( y'(0) = 0 \).

Q2 Use Laplace transforms to solve the IVP \( c^2 u_{xx} + 1 + u_x, x > 0, t > 0 \) with \( u(0, t) = 0, \lim_{x \to 0^+} u_x = 0 \) and \( u_t(x, 0) = 0, u(x, 0) = 0, x > 0 \).

Q3 Evaluate
(a): \( L^{-1}\left[ \frac{1}{4 + (s - 1)^2} \right] \)
(b): \( L^{-1}\left[ \frac{1}{s^2 + 2s + 3} \right] \)
(c): \( L\left[ \int_0^t (t - \tau) \sin \tau \, d\tau \right] \)

Q4 Find Fourier sine integral representation of \( f(x) = e^{-x} \).

Q5 Given the SL problem \( (xy')' + \frac{\lambda}{x} y = 0 \), obtain generalized Fourier series representation of \( f(x) = \alpha_0 \) with \( y(1) = 0 \) and \( y(b) = 0 \).