

## Problem 27

There are also equations, known as **integro-differential equations**, in which both derivatives and integrals of the unknown function appear. In each of Problems 26 through 28:

- (a) Solve the given integro-differential equation by using the Laplace transform.
- (b) By differentiating the integro-differential equation a sufficient number of times, convert it into an initial value problem.
- (c) Solve the initial value problem in part (b), and verify that the solution is the same as the one in part (a).

$$\phi'(t) - \frac{1}{2} \int_0^t (t - \xi)^2 \phi(\xi) d\xi = -t, \quad \phi(0) = 1$$