1. (a) Find the inverse L.T. of
\[ F(s) = \frac{2s^2 + 5}{(s+1)(s+2)} \]

(b) Solve the differential equation by means of
Laplace transform
\[ \frac{d^2y(t)}{dt^2} + 10 \frac{dy(t)}{dt} + 34y(t) = 6 \frac{df(t)}{dt} + 20q(t) \]
Assume zero initial conditions and \( f(t) = u(t) \)
Your answer should be written in the form
\[ y(t) = [A + B e^{-5t} \cos(\omega t + \theta)] u(t) \]
\( t.e., \) find \( A, B, \tau, \omega \) and \( \theta \).

2. Find the Laplace transform of the following functions:
(a) \[ f_1(t) \]
(b) \[ f_2(t) \]
(c) \[ f_3(t) = \frac{d}{dt} \left[ e^t \sin(2t) u(t) \right] \]

3. (a) The mass, spring, and damper representation of a rocket transport vehicle, which usually land on terrestrial bodies is shown in Figure 3(a). Find the differential equation relating the constant force \( f \) and the displacement \( y(t) \).

\[ f = Mg \]

\[ \text{Figure 3(a)} \]

(b) Find the differential equation relating the node voltages \( y_1(t) \) and \( y_2(t) \) to the input \( f(t) \) for the circuit shown below:

\[ f(t) \]

\[ y_1(t) \]

\[ y_2(t) \]
(c) For the system described by the differential equation below with the input \( f(t) \) and output \( y(t) \). Determine whether the system is linear or nonlinear.

\[
\frac{dy}{dt} + 6y(t) + 2 = f(t)
\]

(4) Evaluate the following integral:

(5/5) \[
\int_{-\infty}^{\infty} e^{(t-1)} \cos \frac{\pi}{2}(t-5) \, s(t-3) \, dt
\]