

1. Answer any one of (a) or (b)

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- a. Suppose an object of mass m is falling from rest through a resistive medium under constant gravitational force. Assume that the resistance is proportional to the object's speed, that no other forces are in action and motion is considered in one dimension only. Formulate the differential equation for this system. Solve it and find the equations of velocity and displacement of the object at time t .
- b. Suppose an object of weight 9 N stretches a vertical spring attached to a rigid support by 0.15 m. The body is released from the equilibrium position with an initial upward velocity of 5 m/s. Assume the motion takes place in one dimension only, no damping or external forces act on the system, and displacement is measured from the equilibrium position. Formulate the differential equation of the system and determine the amplitude of oscillation. Assume $g = 10 \text{ m/s}^2$.

2. Answer any one of (a) or (b)

3+2

a.i. Solve using method of variation of parameters $y'' - 2y' + y = \frac{e^x}{1+x^2}$.a.ii. Solve $(4x^2y - 6)dx + x^3dy = 0$.b.i. Solve $x^3y' = y^3 + y^2\sqrt{y^2 - x^2}$, $x \neq 0$.b.ii. Find the general solution of $4y'' - 12y' + 5y = 0$.

3. Answer any one of (a) or (b)

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a. Solve the initial value problem $y'' + y = \tan t$; $-\frac{\pi}{2} < t < \frac{\pi}{2}$ with $y(0) = 1 = y'(0)$.b. Solve the initial value problem using the method of Euler-Cauchy $x^2y'' + 4xy' + 2y = \log x$ with $x > 0, y(1) = 2, y'(1) = 0$.