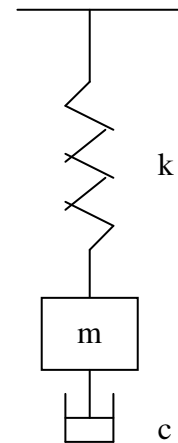


1. $f(x, y, z) = x^2 + xy + z^2$, 且 $x(t) = t$, $y(t) = t^2$, $z(t) = t^3$ 求 $\frac{df}{dt}$ (15%)
2. Find the solution of T: $\frac{dT}{dt} = k(T - T_m)$; $T(0) = T_0$, k, T_m and T_0 are constants (15%)
3. Solve: $x^2 y'' - 2xy' + 2y = x^4 e^x$ (15%)
4. 解 $\ddot{x} + 3\dot{x} + 4x = t$, $\ddot{x}(0) = 0$, $\dot{x}(0) = 0$, $x(0) = 1$ (15%)
5. $y'' + 4y = -2$, $y\left(\frac{\pi}{8}\right) = \frac{1}{2}$, $y'\left(\frac{\pi}{8}\right) = 2$ (15%)
6. 求解 $y''' - y'' + 2y = 0$ (10%)
7. A mechanical system with mass m , spring constant k and damping constant c , as shown below, is governed



by linear D.E. $m\ddot{y} + c\dot{y} + ky = 0$, plot the motion on the $y - t$ plane for (15%)

- (a) $c=0$ (undamped)
- (b) $c^2 > 4mk$ (overdamping), and
- (c) $c^2 < 4mk$ (underdamping)