



## 4. Nonlinear Systems of Three or More Ordinary Differential Equations

1.  $ax'_t = (b - c)yz$ ,  $by'_t = (c - a)zx$ ,  $cz'_t = (a - b)xy$ .
2.  $ax'_t = (b - c)yzf(x, y, z, t)$ ,  $by'_t = (c - a)zxf(x, y, z, t)$ ,  $cz'_t = (a - b)xyf(x, y, z, t)$ .
3.  $x'_t = a(y - x)$ ,  $y'_t = bx - y - xz$ ,  $z'_t = -cz + xy$ . *Lorenz equations.*
4.  $x'_t = cF_2 - bF_3$ ,  $y'_t = aF_3 - cF_1$ ,  $z'_t = bF_1 - aF_2$ , where  $F_n = F_n(x, y, z, t)$ .
5.  $x'_t = czF_2 - byF_3$ ,  $y'_t = axF_3 - czF_1$ ,  $z'_t = byF_1 - axF_2$ , where  $F_n = F_n(x, y, z, t)$ .
6.  $x'_t = x(cF_2 - bF_3)$ ,  $y'_t = y(aF_3 - cF_1)$ ,  $z'_t = z(bF_1 - aF_2)$ , where  $F_n = F_n(x, y, z, t)$ .
7.  $x'_t = h(z)F_2 - g(y)F_3$ ,  $y'_t = f(x)F_3 - h(z)F_1$ ,  $z'_t = g(y)F_1 - f(x)F_2$ .
8.  $x''_{tt} = \frac{\partial F}{\partial x}$ ,  $y''_{tt} = \frac{\partial F}{\partial y}$ ,  $z''_{tt} = \frac{\partial F}{\partial z}$ , where  $F = F(r)$ ,  $r = \sqrt{x^2 + y^2 + z^2}$ .
9.  $x''_{tt} = xF$ ,  $y''_{tt} = yF$ ,  $z''_{tt} = zF$ , where  $F = F(x, y, z, t, x'_t, y'_t, z'_t)$ .
10.  $x''_{tt} = F_1$ ,  $y''_{tt} = F_2$ ,  $z''_{tt} = F_3$ , where  $F_n = F_n(t, tx'_t - x, ty'_t - y, tz'_t - z)$ .
11.  $x''_{tt} = cF_2 - bF_3$ ,  $y''_{tt} = aF_3 - cF_1$ ,  $z''_{tt} = bF_1 - aF_2$ , where  $F_n = F_n(x, y, z, t, x'_t, y'_t, z'_t)$ .

The EqWorld website presents extensive information on solutions to various classes of ordinary differential equations, partial differential equations, integral equations, functional equations, and other mathematical equations.