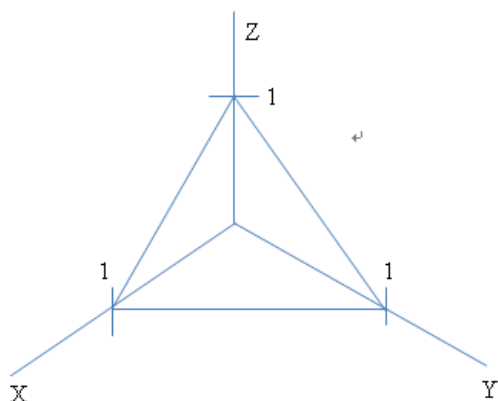


- 1: Find out the coordinate transferring equation to transform the following quadratic form into principal axes:

$$Q=17x_1^2 - 30x_1x_2 + 17x_2^2 = 128$$

- 2: Evaluate surface integral $\iint \vec{F} \cdot d\vec{S}$ when $F=[x^2, 0, 3y^2]$ and S is the portion of the plane $x+y+z=1$ in the first octant



3. Solve the given problem: $x^3y''' - 3x^2y'' + 6xy' - 6y = x^4 \ln x$

4. Determine the response of the damped mass-spring system modeled by

$$y'' + 3y' + 2y = r(t)$$

$$r(t) = 1, \text{ if } 1 < t < 2 \text{ and } 0 \text{ otherwise}$$

$$y(0) = y'(0) = 0$$

5. The transfer function of a linear system is defined as the ratio of the Laplace transform of the output variable to the Laplace transform of the input variable, with all initial conditions assumed to be zero. The transfer function of a system is

$$\frac{Y(s)}{R(s)} = \frac{2.5(s+2)}{s^3 + 7s^2 + 11s + 5}$$

Determine $y(t)$ when $r(t)$ is a unit step input.