Jacobian:

For coordinates transformations u =u(p, q), v = v(p, q)

$$Jacobian\_{2}=J\_{2}=det\left[\begin{matrix}\frac{∂u}{∂p}&\frac{∂u}{∂q}\\\frac{∂v}{∂p}&\frac{∂v}{∂q}\end{matrix}\right]=\frac{∂u}{∂p}\frac{∂v}{∂q}-\frac{∂u}{∂q}\frac{∂v}{∂p}$$

For translation p = x, q = y, u = x + a, v = y + b, where a and b are constants, J2 = 1.

For rotation p = x, q = y, u = x cos A – y sin A, v = x sin A + y cos A, where A is the angle of rotation, J2 = 1.

For polar coordinates u=x, v = y, p = R, q = A, x = R cos A, y = R sin A, J2 = R.

$$J\_{2}=det\left[\begin{matrix}\frac{∂x}{∂R}&\frac{∂x}{∂A}\\\frac{∂y}{∂R}&\frac{∂y}{∂A}\end{matrix}\right]=\frac{∂x}{∂R}\frac{∂y}{∂A}-\frac{∂x}{∂A}\frac{∂y}{∂R}$$

For coordinates transformation u =u(p, q, s), v = v(p, q, s), w=w(p, q, s)

$$J\_{3}=det\left[\begin{matrix}\frac{∂u}{∂p}&\frac{∂u}{∂q}&\frac{∂u}{∂s}\\\frac{∂v}{∂p}&\frac{∂v}{∂q}&\frac{∂v}{∂s}\\\frac{∂w}{∂p}&\frac{∂w}{∂q}&\frac{∂w}{∂s}\end{matrix}\right]=det\left[\begin{matrix}\frac{∂v}{∂q}&\frac{∂v}{∂s}\\\frac{∂w}{∂q}&\frac{∂w}{∂s}\end{matrix}\right]\frac{∂u}{∂p}-det\left[\begin{matrix}\frac{∂v}{∂p}&\frac{∂v}{∂s}\\\frac{∂w}{∂p}&\frac{∂w}{∂s}\end{matrix}\right]\frac{∂u}{∂q}+det\left[\begin{matrix}\frac{∂v}{∂p}&\frac{∂v}{∂q}\\\frac{∂w}{∂p}&\frac{∂w}{∂q}\end{matrix}\right]\frac{∂u}{∂s}$$

For cylindrical coordinates u = x, v = y, w = z, p = R, q = A, s = z,

x = R cos A, y = R sin A, z = z, J3 = R.

For spherical coordinates u = x, v = y, w = z, p = R, q = A, s = B,

x = R cos A sin B, y = R sin A sin B, z = R cos B,

J3 =R2 sin B.