Translation of Axes Encyclopedia Article

Translation of Axes

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In the plane, using Cartesian coordinates, a **circle** with radius 1 with center at the origin is described by the equation $x^2 + y^2 = 1$. In other words, this circle is the set of all points of the form (x, y) in the plane that satisfy the above equation. In order to describe a circle whose center is not at the origin, we can translate the axes. In other words, we move the origin to a new point say (x_0, y_0). So if (p, q) is a point with respect to the old coordinates, then it is $(p + x_0, q + y_0)$ with respect to the new coordinates. Thus the equation for the circle in the new coordinates is $(x + x_0)^2 + (y + y_0)^2 = 1$. In general, if a curve is described by the equation f(x, y) = c for some function f and some real constant c, then the curve is described in the new coordinates by the equation $f(x + x_0, y + y_0) = c$. **Translation** preserves the **distance** between points. In other words, the distance between point (p, q) are (r, s) is the same as the distance between the points $(p + x_0, q + y_0)$ and $(r + x_0, s + y_0)$. These ideas extend in a natural way to n-dimensional **space** for any positive integer n.