Fermat's Spiral Encyclopedia Article

Fermat's Spiral

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Fermat's Spiral

Fermat's **spiral** is a special kind of spiral shape having the polar equation: $r = a\Theta^{½}$. **Pierre de Fermat**, a French lawyer who studied mathematics in his spare time, developed this shape in 1636. The equation for Fermat's spiral shows that for any given value of Θ there are two corresponding values of *r*. One value is negative and the other corresponding value is positive. Because of this the resulting spiral is symmetric about the line $y = -x$ as well as the origin. Fermat's spiral is sometimes also referred to as the parabolic spiral.

The general form of a spiral is given by the polar equation $r = a\Theta^{1/n}$, where *r* is the radial **distance**, Θ is the **angle** in polar coordinates, and *n* is a constant determining how tightly the spiral is wound. There are special names given to spirals having $n = -2, -1, 1,$ and 2. As can be seen in the equation given in the paragraph above for $n = 2$, the spiral is called Fermat's spiral. If $n = -2$ the spiral is called the lituus and is equal to the inverse curve of Fermat's spiral with the origin as the inversion center. "Lituus" is translated as "crook" in the sense of a bishop's crosier. The lituus curve originated with Cotes in 1722, well after Fermat developed the spiral that bears his name. The curvature of Fermat's spiral is given by k where: $k(\Theta) = (((3a^2)/(4\Theta)) + a^2\Theta)/(((a^2/4\Theta) + a^2\Theta)^{3/2})$.