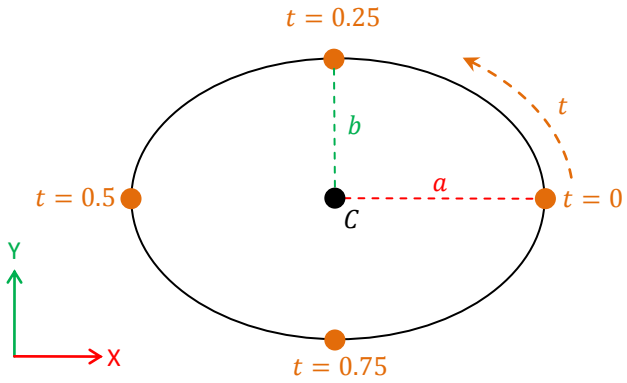
Parametric Ellipse

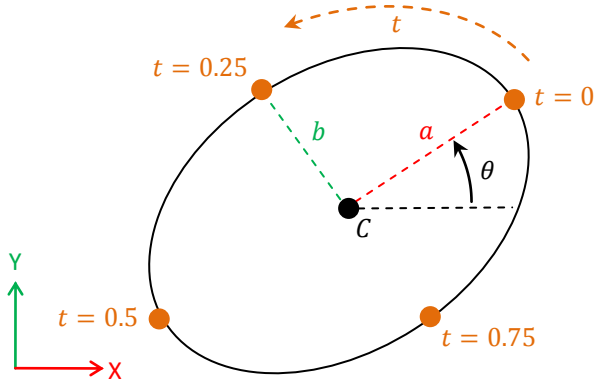
A simple ellipse aligned with x/y axes is defined by minor and major axes of the ellipse a and b and a rotational parameter t.



$$x = x_C + a \cdot \cos(2\pi t)$$
$$y = y_C + b \cdot \sin(2\pi t)$$

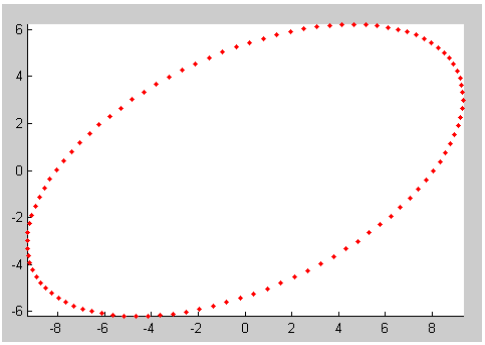
The independent variable t can have values from $-\infty < t < \infty$ but uniquely defines the whole ellipse when constrained to $0 < t < 1$. This allows any ellipse with its minor and major axes aligned to the x, y-axes to be drawn in 2-dimensions.

This definition can be extended by adding a rotation about the z-axis into the equations. The angle θ is introduced as the rotation of the 1st ellipse axis a with respect to the coordinate system x-axis.



$$x = x_C + a \cdot \cos(2\pi t) \cdot \cos(\theta) - b \cdot \sin(2\pi t) \cdot \sin(\theta)$$
$$y = y_C + a \cdot \cos(2\pi t) \cdot \sin(\theta) + b \cdot \sin(2\pi t) \cdot \cos(\theta)$$

An example ellipse is shown below sampled uniformly in t. This gives a uniform sampling of points with respect to angle about the center of the ellipse.


6
4
2
0
-2
-4
-6
-8
-6
-4
-2
0
2
4
6
8
