0.1 The Circle

0.2 Circular Functions (trigonometry)

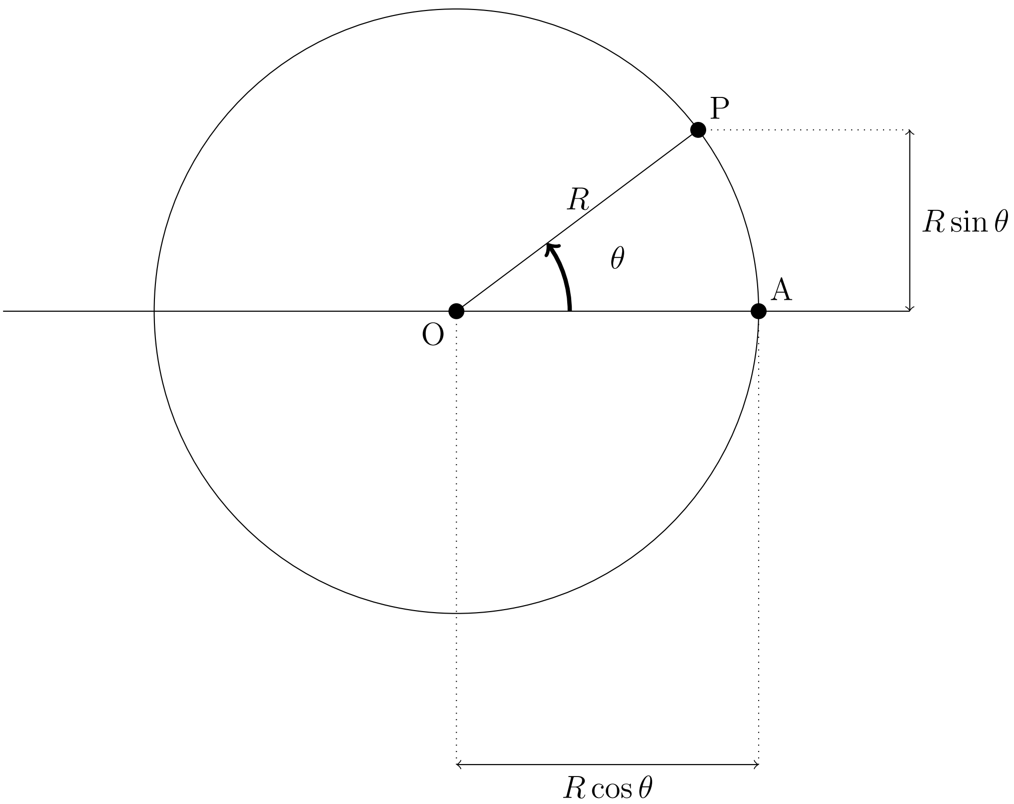

Figure 0.1: The definition of sine and cosine

Trigonometric functions may be written with or without parentheses $sin\theta$, $sin(\theta)$ and so on.

0.3 The Ellipse

The two foci are marked as F_1 and F_2. The two points at the ends of the majoraxis (V_1 and V_2) are sometimes refeerred to as “vertices” while the two points at the ends of the minor axis (V_3 and V_4) are referred to as “co-vertices”.

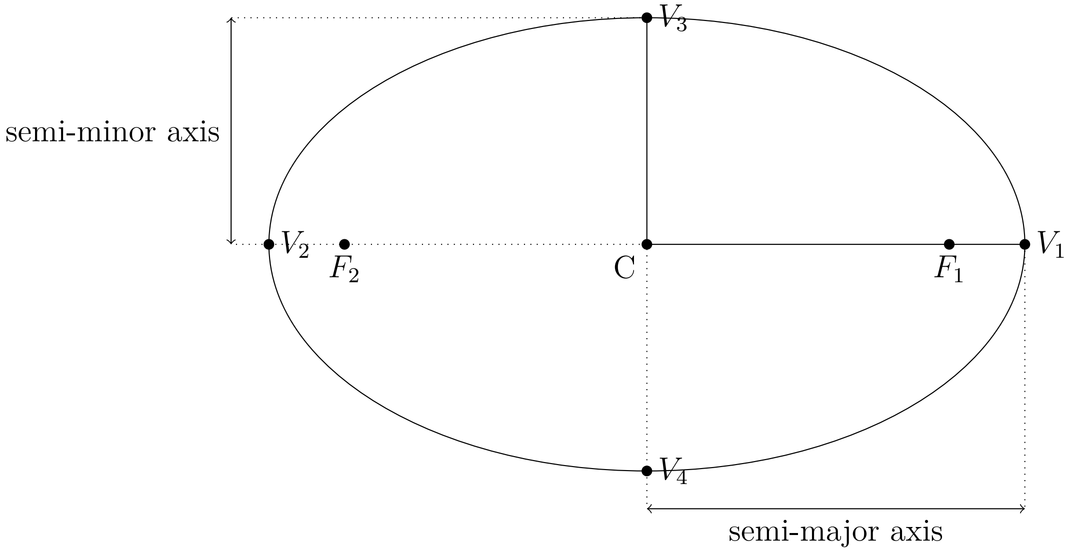

Figure 0.2: Ellipse dimensions

$CF_1 = CF_2$	linear eccentricity	c	half-focal separation (e, f)
$CV_1 = CV_2$	semi-major axis	a	
$CV_3 = CV_4$	semi-minor axis	b	
$\frac{c}{a}$	eccentricity	e	first eccentricity, mathematical eccentricity (ϵ)

$$e = \sqrt{\frac{a^2 - b^2}{a^2}}$$

$$c = \sqrt{a^2 - b^2}$$

The *t*rue anomaly of a point P on an ellipse is the angle between the major axis and the line from a focus to that point – $\angle VCP$ in the diagram labelled c. The true anomaly is also written θ or ν in the literature.

The *e*ccentric anomaly is constructed by using an "auxiliary" circle of radius a. The point P is projeted (?) "up" to the auxiliary circle onto point P'. The eccentric anomaly is then $\angle VCP'$, in other words the angle between the semi-major axis and the line connecting the centre to P'.

The standard ellipse

The standard ellipse is given by the cartesian coordinate formula:

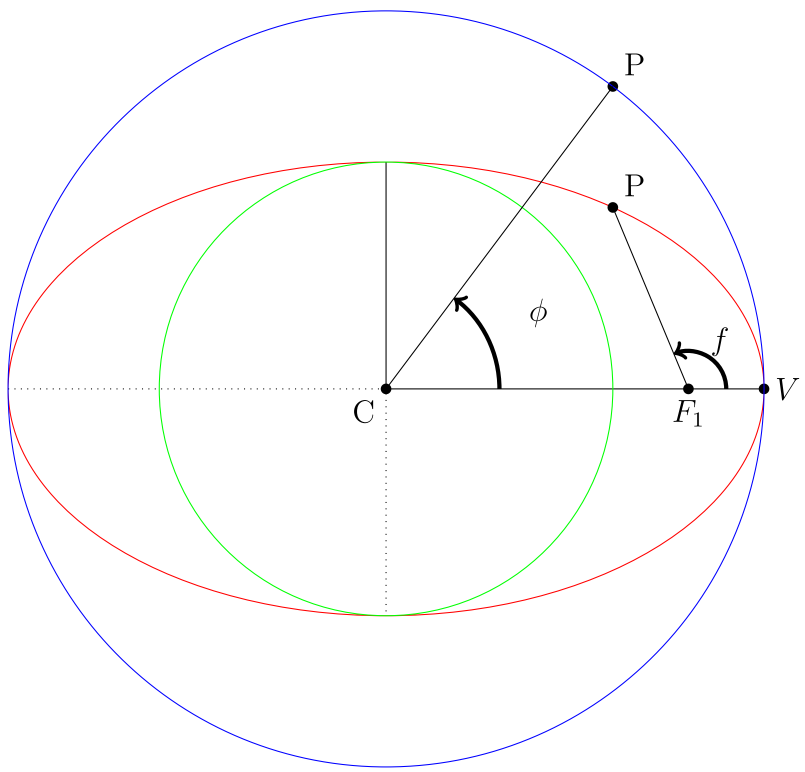

Figure 0.3: Ellipse angles

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

And has the following properties:

Semi-major axis	a
Semi-minor axis	b
Eccentricity	$\sqrt{\frac{a^2-b^2}{a^2}}$
General point	$(acos(\phi), bsin(\phi))$