

7.5 Ellipse

Semimajor axis: a

Semiminor axis: b

Foci: $F_1(-c, 0)$, $F_2(c, 0)$

Distance between the foci: $2c$

Eccentricity: e

Real numbers: A, B, C, D, E, F, t

Perimeter: L

Area: S

645. Equation of an Ellipse (Standard Form)

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

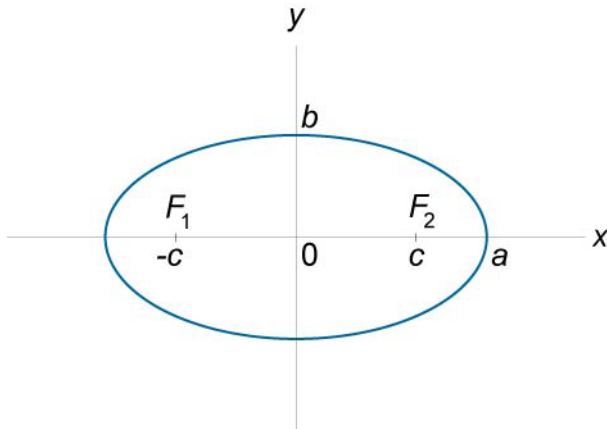


Figure 115.

646. $r_1 + r_2 = 2a$,

where r_1 , r_2 are distances from any point $P(x, y)$ on the ellipse to the two foci.

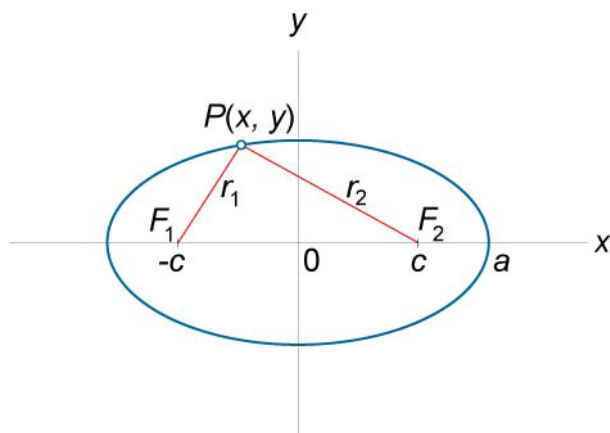


Figure 116.

647. $a^2 = b^2 + c^2$

648. Eccentricity

$$e = \frac{c}{a} < 1$$

649. Equations of Directrices

$$x = \pm \frac{a}{e} = \pm \frac{a^2}{c}$$

650. Parametric Form

$$\begin{cases} x = a \cos t \\ y = b \sin t \end{cases}, \quad 0 \leq t \leq 2\pi.$$

651. General Form

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0,$$

where $B^2 - 4AC < 0$.

652. General Form with Axes Parallel to the Coordinate Axes

$$Ax^2 + Cy^2 + Dx + Ey + F = 0,$$

where $AC > 0$.

653. Circumference

$$L = 4aE(e),$$

where the function E is the complete elliptic integral of the second kind.

654. Approximate Formulas of the Circumference

$$L = \pi \left(1.5(a + b) - \sqrt{ab} \right),$$

$$L = \pi \sqrt{2(a^2 + b^2)}.$$

655. $S = \pi ab$