Math Formulas: Conic Sections

Parabola Formualas

The standard formula of a parabola
1.

$$y^2 = 2px$$

Parametric equations of the parabola:
2.

$$x = 2pt^2$$

$$y = 2pt$$

Tangent line in a point D(x_0,y_0) of a parabola $y^2 = 2$px is:
3.

$$y_0 y = p(x + x_0)$$

Tangent line with a given slope m:
4.

$$y = mx + \frac{p}{2m}$$

Tangent lines from a given point

Take a fixed point P(x_0, y_0). The equations of the tangent lines are:
5.

$$y - y_0 = m_1(x - x_0)$$

$$y - y_0 = m_2(x - x_0)$$

$$m_1 = \frac{y_0 + \sqrt{y_0^2 - 2px_0}}{2x_0}$$

$$m_2 = \frac{y_0 - \sqrt{y_0^2 - 2px_0}}{2x_0}$$

The Ellipse Formulas

The set of all points in the plane, the sum of whoose distance from two fixed points, called the foci, is a constant.
The standard formula of a ellipse:
6.

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

Parametric equations of the ellipse:
7.

$$x = asint$$

$$y = bsint$$

Tangent line a point D(x_0, y_0)of a ellipse:
8.

$$\frac{x_0x}{a^2} + \frac{y_0y}{b^2}$$

Eccentricity of the ellipse:
9.

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

Foci of the ellipse:
10.

$$if \quad a \geq b \Rightarrow F_1(-\sqrt{a^2 - b^2}, 0) \quad F_2(\sqrt{a^2 - b^2}, 0)$$
$$if \quad a < b \Rightarrow F_1(0, -\sqrt{b^2 - a^2}) \quad F_2(0, \sqrt{b^2 - a^2})$$

Area of the ellipse:
11.

$$A = \pi \cdot a \cdot b$$

The Hyperbola Formulas

The set of all points in the plane, the difference of whose distance from two fixed points, called to foci, remains constant.
The standard formulas of the Hyperbola:
12.

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

Parametric equations of the Hyperbola:
13.

$$x = \frac{a}{sint}$$

$$y = \frac{bsint}{cost}$$

Tangent line in a point D(x_0, y_0) of a Hpyerbola:
14.

$$\frac{x_0x}{a^2} - \frac{y_0y}{b^2} = 1$$

foci:
15.

$$if \quad a \geq b \Rightarrow F_1(-\sqrt{a^2 + b^2}, 0) \quad F_2(\sqrt{a^2 + b^2}, 0)$$
$$if \quad a < b \Rightarrow F_1(0, -\sqrt{a^2 + b^2}) \quad F_2(0, \sqrt{a^2 + b^2})$$

Asymptotes:
16.

$$if \quad a \geq b \Rightarrow y = \frac{b}{a}x \quad and \quad y = -\frac{b}{a}x$$
$$if \quad a < b \Rightarrow y = \frac{a}{b}x \quad and \quad y = -\frac{a}{b}x$$

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