MATH 21: ANALYTIC GEOMETRY AND CALCULUS

CHAPTER 2: Conic Sections, its Equations and Graph

PARABOLA

Opens up or down Equation: $(x-h)^2 = 4p(y-k)$	Opens left or right Equation: $(y-k)^2 = 4p(x-h)$
Vertex: $= (h, k)$	
Focus (p units from vertex) $(h,\ k+p)$	Focus (p units from vertex) $(h+p,\ k)$
Directrix (|p| units from vertex, other side) $y = k - p$	Directrix (|p| units from vertex, other side) $x = h - p$
Principal axis: $x = h$	Principal axis: $y = k$
Endpoints of L.R: (|2p| units from focus) $(h \pm 2p,\ k+p)$	Endpoints of L.R: (|2p| units from focus) $(h+p,\ k \pm 2p)$

ELLIPSE

If the principal axis is a horizontal line: Equation: $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	If the principal axis is a vertical line: Equation: $\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$
Center: (h, k)	
Vertices: $(h \pm a,\ k)$	Vertices: $(h,\ k \pm a)$
Endpoints of minor axis: $(h,\ k \pm b)$	Endpoints of minor axis: $(h \pm b,\ k)$
Principal axis: $y = k$	Principal axis: $x = h$
Length of major axis: $2a$	
Length of minor axis: $2b$	
Foci: $(h \pm c,\ k) c = \sqrt{a^2 - b^2}$	Foci: $(h,\ k \pm c) c = \sqrt{a^2 - b^2}$
Eccentricity: $e = \frac{c}{a}$	
Equation for directrices: $x = h \pm \frac{a}{e}$	Equation for directrices: $y = k \pm \frac{a}{e}$

HYPERBOLA

If the principal axis is a horizontal line: Equation: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	If the principal axis is a vertical line: Equation: $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
Center: (h, k)	
Vertices: $(h\pm a,\ \ k)$	Vertices: $(h,\ \ k\pm a)$
Foci (c units away from vertex) $c = \sqrt{a^2 + b^2}$ $((h\pm a)\pm c,\ \ k))$	Foci (c units away from vertex) $c = \sqrt{a^2 + b^2}$ $(h,\ \ (k\pm a)\pm c)$
Principal axis: $y = k$	Principal axis: $x = h$
Endpoints of conjugate axis: $(h,\ \ k\pm b)$	Endpoints of conjugate axis: $(h\pm b,\ \ k)$
Length of transverse axis: $2a$	
Length of conjugate axis: $2b$	
Eccentricity: $e = \frac{c}{a}$	
Equation for directrices: $x = h\pm \frac{a}{e}$	Equation for directrices: $y = k\pm \frac{a}{e}$