

6.1 Circles:

center = $(0,0)$, radius = r

$$x^2 + y^2 = r^2$$

center = (h,k) , radius = r

$$(x-h)^2 + (y-k)^2 = r^2$$

General Form:

$$x^2 + y^2 + cx + dy + e = 0$$

Parabolas:

vertex: $(0,0)$

$$y^2 = 4cx$$

focus: $(c,0)$

directrix: $x = -c$

axis: $y = 0$

\curvearrowright $c > 0$

\curvearrowleft $c < 0$

$$x^2 = 4cy$$

focus: $(0,c)$

directrix: $y = -c$

axis: $x = 0$

\cup $c > 0$

\cap $c < 0$

vertex: (h,k)

$$(y-k)^2 = 4c(x-h)$$

$$x = \frac{1}{4c}(y-k)^2 + h$$

$$(x-h)^2 = 4c(y-k)$$

$$y = \frac{1}{4c}(x-h)^2 + k$$

note: focus is distance c or $-c$ from vertex

6.2 Ellipses

Standard forms for Ellipses:
(center at (0,0))

$$\longleftrightarrow \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad (a > b)$$

vertices: $(\pm a, 0)$

endpts of minor axis: $(0, \pm b)$

foci: $(\pm c, 0)$

$$c^2 = a^2 - b^2$$

$$\updownarrow \frac{y^2}{a^2} + \frac{x^2}{b^2} = 1 \quad (a > b)$$

vertices: $(0, \pm a)$

endpts of minor axis: $(\pm b, 0)$

foci: $(0, \pm c)$

$$c^2 = a^2 - b^2$$

(center at (h, k))

$$\longleftrightarrow \frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

major axis length $2a$

minor axis length $2b$

$$c^2 = a^2 - b^2$$

$$\updownarrow \frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$$

major axis length $2a$

minor axis length $2b$

$$c^2 = a^2 - b^2$$

6.2 Hyperbolas:

center (0,0)

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

vertices: $(\pm a, 0)$

asymptotes: $(y = \pm \frac{b}{a}x)$

foci: $(\pm c, 0)$

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

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

vertices: $(0, \pm a)$

asymptotes: $(y = \pm \frac{a}{b}x)$

foci: $(0, \pm c)$

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

center (h,k)

$$\longleftrightarrow \frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

vertices: $(h \pm a, k)$

asymptotes: $y = \pm \frac{b}{a}(x-h) + k$

foci: $(h \pm c, k)$

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

$$\updownarrow \frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

vertices: $(h, k \pm a)$

asymptotes: $y = \pm \frac{a}{b}(x-h) + k$

foci: $(h, k \pm c)$

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

6.3 Summary of Conics:

General form

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

(either
A or C is
non-zero)

parabola

if either $A=0$ or $C=0$ but not both

circle

if $A=C \neq 0$

ellipse

if $A \neq C, AC > 0$

hyperbola

if $AC < 0$

Eccentricity:

$$e = \frac{\text{distance b/w point \& focus}}{\text{distance b/w point \& directrix}}$$

parabola

$$e = 1$$

circle

$$e = 0$$

ellipse

$$e = \frac{c}{a} \quad 0 < e < 1$$

hyperbola

$$e = \frac{c}{a} \quad e > 1$$

(c & a are not
the C & A from
above!)