Analytic Geometry Formulas

by David Pleacher

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

center (h, k)
radius = r

2. Parabola

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

opens up
vertex (h, k)
focus (h, k+p)
directrix $y = k - p$

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

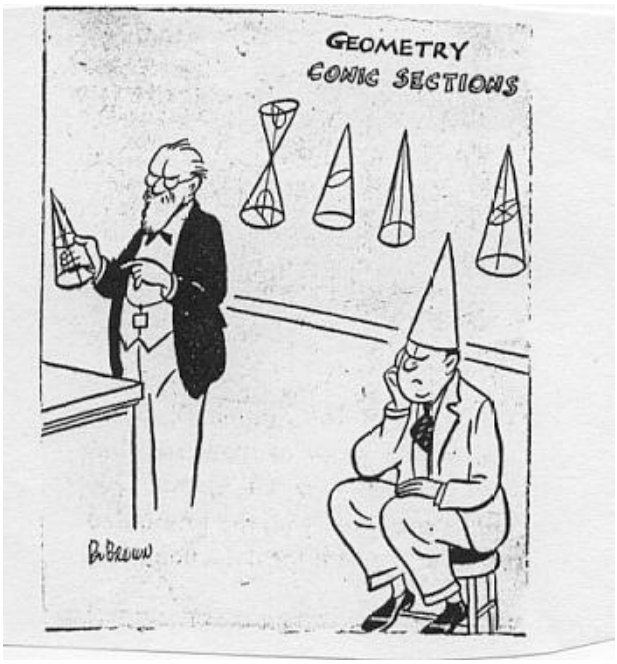
opens down
vertex (h, k)
focus (h, k-p)
directrix $y = k + p$

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

opens right
vertex (h, k)
focus (h + p, k)
directrix $x = h - p$

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

opens left
vertex (h, k)
focus (h - p, k)
directrix $x = h + p$



3. Ellipse

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

center (h, k)

$a^2 - b^2 = c^2$ or $a^2 = b^2 + c^2$
foci (h - c, k), (h + c, k)
sum of distances to foci = 2a
major axis is parallel to x-axis = 2a
minor axis is parallel to y-axis = 2b
eccentricity = $\frac{c}{a}$
vertices (h + a, k), (h - a, k),
(h, k + b), (h, k - b)

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

center (h, k)

$a^2 - b^2 = c^2$ or $a^2 = b^2 + c^2$
foci (h, k+c), (h, k-c)
sum of distances to foci = 2a
major axis is parallel to x-axis = 2a
minor axis is parallel to y-axis = 2b
eccentricity = $\frac{c}{a}$
vertices (h + b, k), (h - b, k),
(h, k + a), (h, k - a)

4. Hyperbola

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

center is (h, k)

$c^2 = a^2 + b^2$
vertices (h + a, k), (h – a, k)
foci (h + c, k), (h – c, k)
asymptotes $y-k=\pm\frac{b}{a}(x-h)$

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

center is (h, k)

$c^2 = a^2 + b^2$
vertices (h, k + a), (h, k - a)
foci (h, k + c), (h, k - c)
asymptotes $y-k=\pm\frac{a}{b}(x-h)$