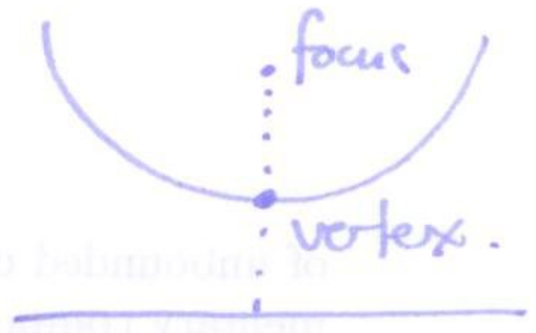
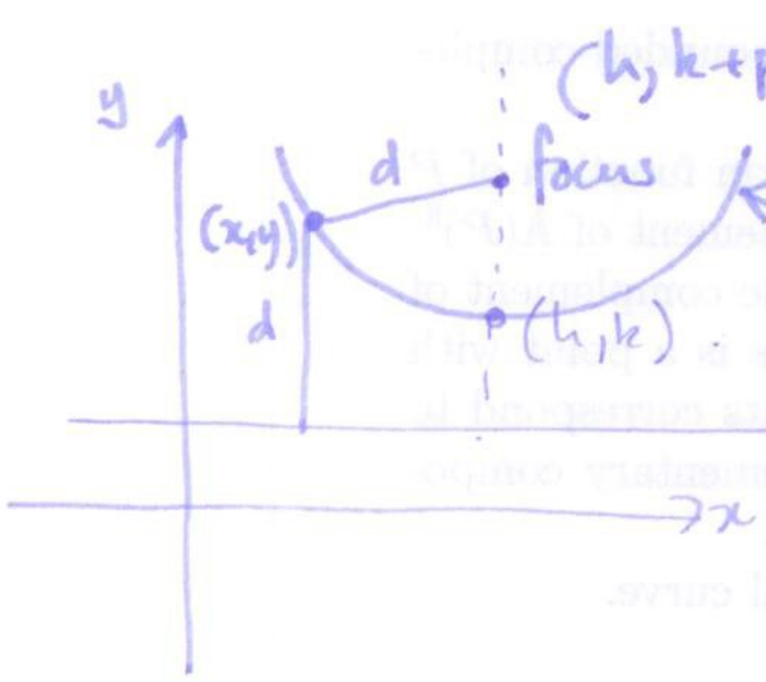
§10.1 Parabolas

① graph of a function $f(x) = ax^2+bx+c \quad (a\neq 0)$

② set of points equidistant from a line.





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

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

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

$$\cancel{x^2-2xh+h^2} + \cancel{(y-k)^2} - 2(y-k)p + \cancel{p^2} = \cancel{(y-k)^2} + 2(y-k)p + \cancel{p^2}$$

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

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

focus: $(h, k+p)$

vertex: (h,k)

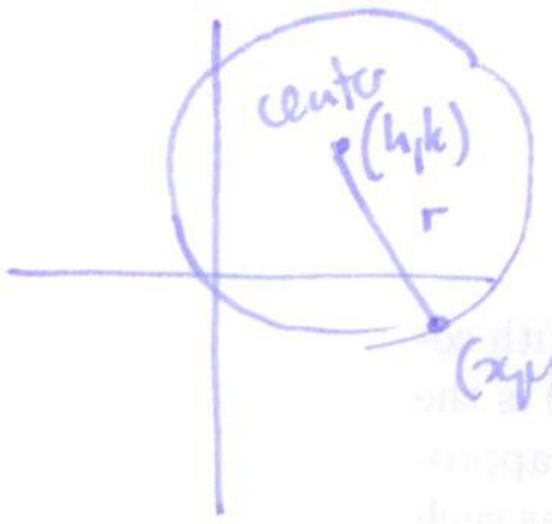
directrix: $y = k-p$.

how do you go back? Example:

$y = 3x^2+4x+1$. complete the square!

$y = (x+2)^2 - 3$. $\frac{1}{4p} = 1 \quad h = -2 \quad k = -3$.

§10.2 Circles / ellipses



circle:
all points distance r from a center (h,k).

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

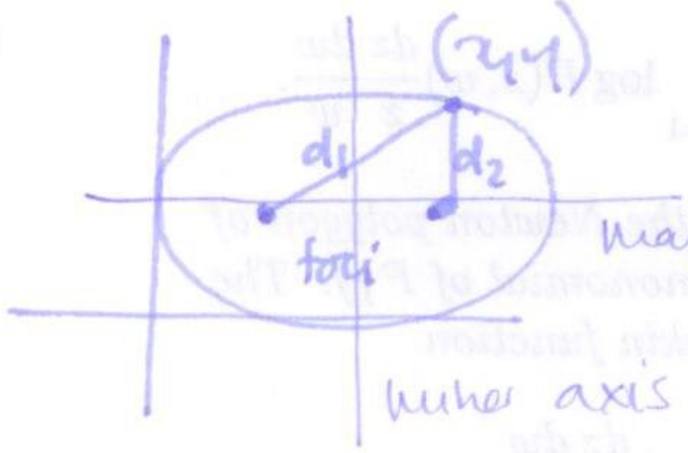
Example $x^2+y^2-16x+14y+32=0$

Find center and radius: complete the square!

$$(x-8)^2 - 64 + (y+7)^2 - 49 + 32 = 0.$$

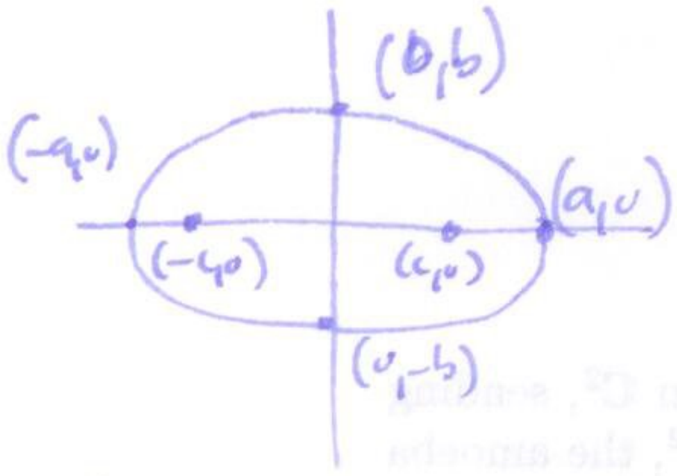
$$(x-8)^2 + (y+7)^2 = 81. \quad \text{center } (8,-7) \text{ radius } 9.$$

Ellipses



$d_1 + d_2 = \text{constant}.$

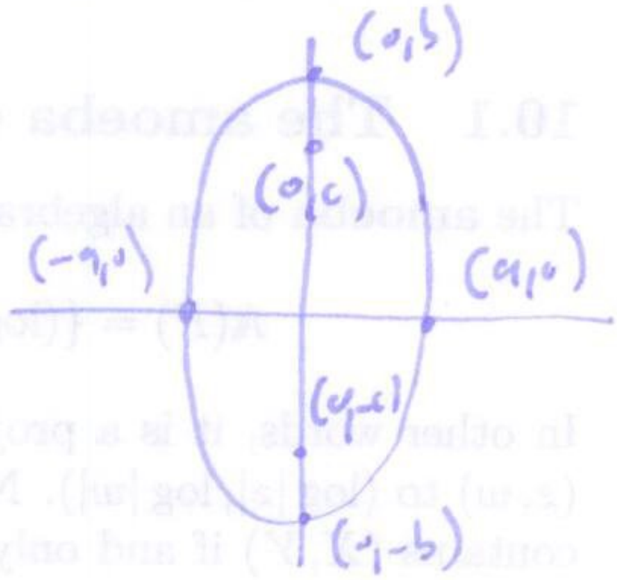
major axis horizontal



$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad a > b > 0.$$

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

major axis vertical.



$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \quad b > a > 0.$$

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