$y = ax^2 + bx + c$

vertex = (h, k)

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

focus = $(h, k+q)$

$x^2 - 2xh + h^2 = 4qy - 4qk$

$4qy = x^2 - 2xh + 4qk + h^2$

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

$a = \frac{1}{4q}$ $\quad b = -\frac{h}{2q}$ $\quad c = k + \frac{h^2}{4q}$

$q = \frac{1}{4a}$ $\quad b = -2ha$

$h = -\frac{b}{2a}$

$c = k + \frac{b^2}{4a^{\not 2}} \cdot \not a$

$k = c - \frac{b^2}{4a}$

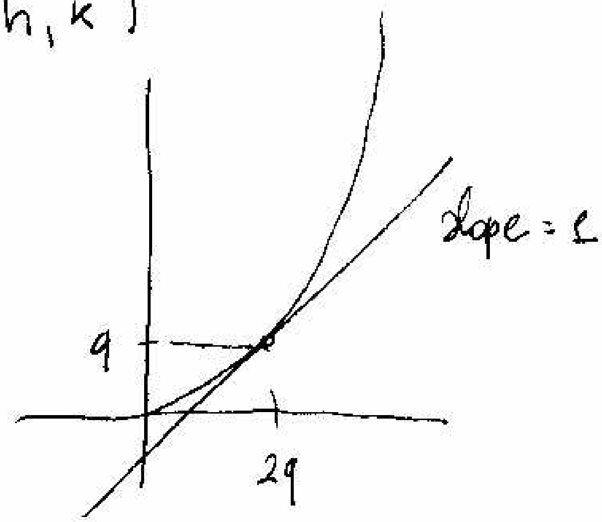
```
plot parabola points (x, y, a, b, c) {
        xv = - b / 2a
        yv = c - b^2 / 4a
        if (a < 0)
                y = -y
        plot (x + xv, y + yv)
        plot (-x + xv, y + yv)
}
```

assume vertex in $(0,0) = (h,k)$

$$(x-h)^2 = 4q\,(y-k)$$

$$x^2 = 4qy$$

$$F(x,y) = x^2 - 4qy$$



<u>explicit:</u>

$$f(x) = y = \frac{1}{4q}\,x^2$$

$$\frac{df}{dx} = \frac{1}{2q}\,x = 1$$

$$x = 2q$$

$$y = q$$

for $x = 0$ to $2q$
plot E or NE
for $y = q$ to y_{max}
plot N or NE

First point is $(0,0)$

$$d_{old} = F(x+1, y+1/2) = (x+1)^2 - 49(y+1/2)$$

$$= x^2 + 2x + 1 - 49y - 29$$

$$d_E = F(x+2, y+1/2) = (x+2)^2 - 49(y+1/2)$$

$$= x^2 + 4x + 4 - 49y - 29$$

$$= d_{old} + 2x + 3$$

$$d_{NE} = F(x+2, y+3/2) = (x+2)^2 - 49(y+3/2)$$

$$= x^2 + 2x + 4 - 49y - 69$$

$$= d_{old} + 2x + 3 - 49$$

$$d_{old} = F(x+1/2,\ y+1) = (x+1/2)^2 - 49(y+1)$$

$$= x^2 + x + \frac{1}{4} - 49y - 49$$

$$d_{NE} = F(x+3/2,\ y+2) = \left(x+\frac{3}{2}\right)^2 - 49(y+2)$$

$$= x^2 + 3x + \frac{9}{4} - 49y - 89$$

$$= d_{old} + 2x + 2 - 49$$

$$d_N = F(x+1/2,\ y+2) = \left(x+\frac{1}{2}\right)^2 - 49(y+2)$$

$$= x^2 + x + \frac{1}{4} - 49y - 89$$

$$= d_{old} - 49$$