Graphing Parabolas
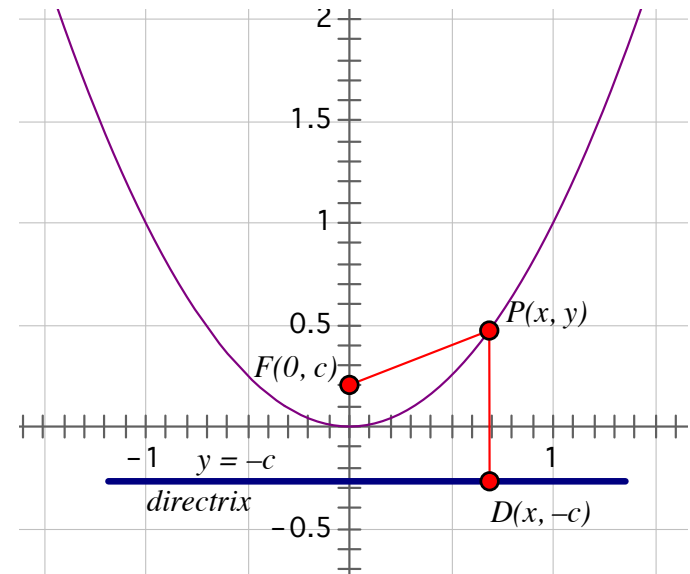
A parabola is a set of points P whose distance from a fixed point F, called the *focus*, is equal to the perpendicular distance from P to a line, called the *directrix.* Since this curve is being defined by distances – we need to know the distance formula.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

By the definition of a parabola, we know FP = PD.

$$FP = PD$$

$$\sqrt{(x-0)^2 + (y-c)^2} = \sqrt{(x-x)^2 + (y+c)^2}$$

Squaring, $\quad x^2 + (y-c)^2 = 0^2 + (y+c)^2$

Expanding $\quad x^2 + y^2 - 2yc + c^2 = y^2 + 2yc + c^2$

Subtracting c^2 & y^2 $\quad x^2 - 2yc = 2yc$

$$x^2 = 4yc$$

$$\frac{1}{4c}x^2 = y$$

This is an equation of a parabola with vertex at the origin and c being the distance between the Focus, F, and the origin and the origin and the directrix.

Mathematically, we write $\{(x, y)/ \; y = \frac{1}{4c}x^2 \}$ is the graph of a parabola with focus

F(0, C) and directrix with equation $y = -c$.