Parabolas in General Form:

$Ax^2 + By^2 + Cx + Dy + E = 0$

If either $A = 0$ or $B = 0$ then the equation defines a parabola (x^2 or y^2 is missing).

Isolate the variable that is not squared and use the completing the square method to convert the equation to that of a Parabola in **Standard Form**.

Hint: Solve for y if there is no y^2 in the equation or solve for x if there is no x^2 in the equation.

Ex 1) For the parabola $x^2 + 6x + 4y + 5 = 0$ find the vertex, axis of symmetry, focus, directrix, and then graph the parabola.

$4y = -x^2 - 6x - 5$

$4y + 5 = -x^2 - 6x$

$4y + 5 = -1(x^2 + 6x \quad)$

$4y + 5 = -1(x^2 + 6x + 9)$

-9

$4y - 4 = -1(x+3)^2$

$+4 \qquad +4$

$\frac{4y}{4} = \frac{-1(x+3)^2}{4} + \frac{4}{4}$

$\boxed{y = -\frac{1}{4}(x+3)^2 + 1}$

down wide vertex $(-3, 1)$

axis of symmetry: $x = -3$

focus $\left(-3, 1 + \frac{1}{4\left(-\frac{1}{4}\right)}\right)$

$(-3, 1 + -1)$

$(-3, 0)$

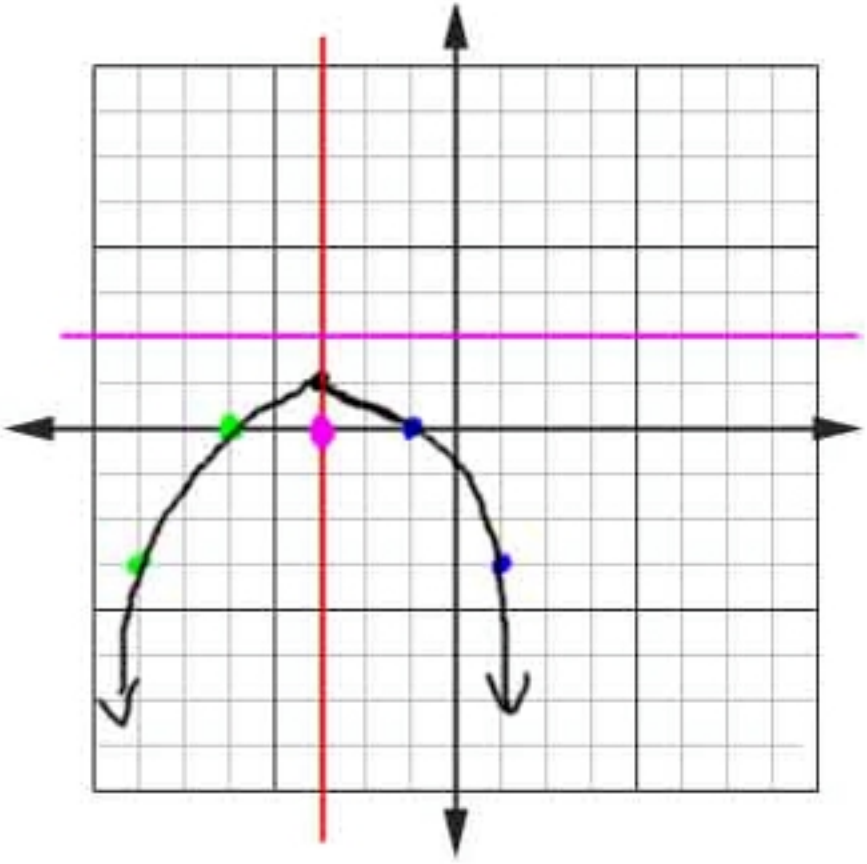
directrix: $y = 1 - \frac{1}{4\left(-\frac{1}{4}\right)}$

$y = 1 + 1$

$y = 2$

x	y
$(-2$	$\frac{3}{4})$
$(-1$	$0)$
$(0$	$-1\frac{1}{4})$
$(1$	$-3)$
$(2$	$)$

$y = -\frac{1}{4}(x+3)^2 + 1$



Ex 2) For the parabola $y^2 - 12x - 2y + 25 = 0$ find the vertex, axis of symmetry, focus, directrix, and graph the parabola.

$12x = y^2 - 2y + 25$

$12x - 25 = y^2 - 2y$

$12x - 25 = y^2 - 2y + 1$

$+1$

$12x - 24 = (y-1)^2$

$\frac{12x}{12} = \frac{1(y-1)^2}{12} + \frac{24}{12}$

$x = \frac{1}{12}(y-1)^2 + 2$

right wide vertex $(2, 1)$

axis of symmetry: $y = 1$

focus $\left(2 + \frac{1}{4\left(\frac{1}{12}\right)}, 1\right)$

$\left(2 + \frac{1}{\left(\frac{1}{3}\right)}, 1\right)$

$(2 + 3, 1)$

$(5, 1)$

directrix: $x = 2 - \frac{1}{4\left(\frac{1}{12}\right)}$

$x = 2 - 3$

$x = -1$

$$x = \frac{1}{12}(y - 1)^2 + 2$$

x	y
$(2\frac{1}{12}$	$2)$
$(2\frac{1}{3}$	$3)$
$(2\frac{3}{4}$	$4)$
$(3\frac{1}{3}$	$5)$
$($	$6)$
$(5$	$7)$