Day 1

Parabolas: That open up/down

vertex: midpoint of the segment connecting the Focus and ⊥ to the directrix

A parabola is the set of all points in a plane that are equidistant from a fixed line (directrix) and a fixed point (focus).

The axis of symmetry is the line that goes through the vertex and focus and is ⊥ to the directrix.

$$y = ax^2 + bx + c$$

vertex $(0,0)$ st. form $y = ax^2$

a describes narrowness or wideness
a is positive ↷, negative ↶

$p = \frac{1}{4}$ • reciprocal of a

Focus: $(0, p)$ $(0, -p)$
directrix: $y = -p$ $y = p$
axis of symmetry $x = 0$ (y-axis)

p = distance from the vertex to directrix
p = distance from the vertex to focus

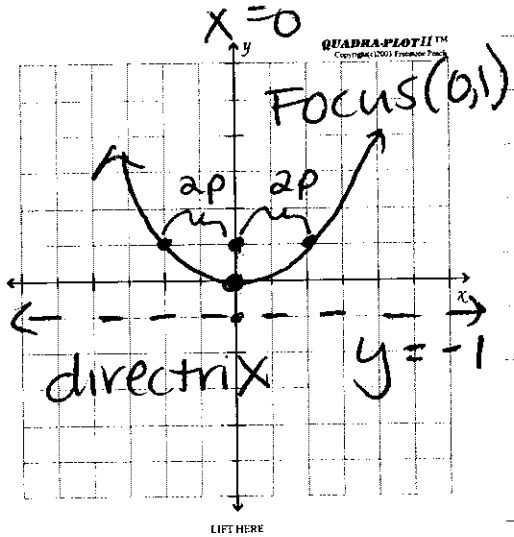
ex

$x^2 = 4y$ $\quad a = \frac{1}{4}$ (opens up)

$\frac{4y}{4} = \frac{x^2}{4}$ $\quad p = \frac{1}{4} \cdot \frac{4}{1} = 1$

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

vertex: (0, 0)



From the focus go left and right 2·p

axis of symmetry $x = 0$

ex

$x^2 + 16y = 0$

$-x^2 \quad -x^2$

$\frac{16y}{16} = \frac{-x^2}{16}$

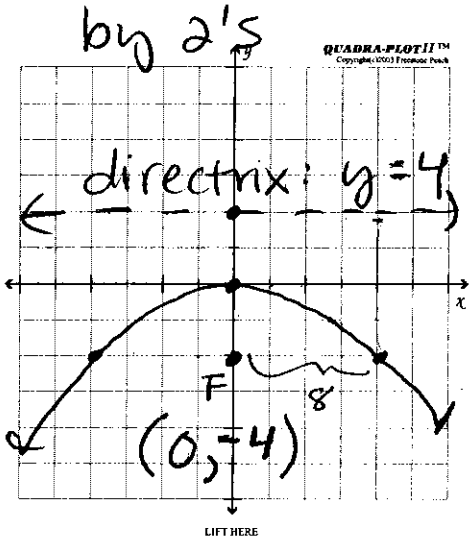
$y = -\frac{1}{16}x^2$

down

$a = -\frac{1}{16}$

$p = \frac{1}{4} \cdot \frac{-16}{1}$

$\boxed{p = -4}$



Focus (0, -4)

vertex (0, 0)

A.O.S. $x = 0$

directrix ($y = 4$)

vertex (h,k) $y = a(x-h)^2 + k$

Focus: $(h, k+p)$ ↑
$(h, k-p)$ ↓

directrix (horizontal line): $y = k-p$ ↑
$y = k+p$ ↓

axis of symmetry: $x = h$ (vertical line)

(ex) standard form:

$$x^2 - 8x - y + 19 = 0$$
$$+y \quad -19 \quad -19 \quad +y$$

$$x^2 - 8x + \boxed{16} = y - 19 + \boxed{16}$$

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

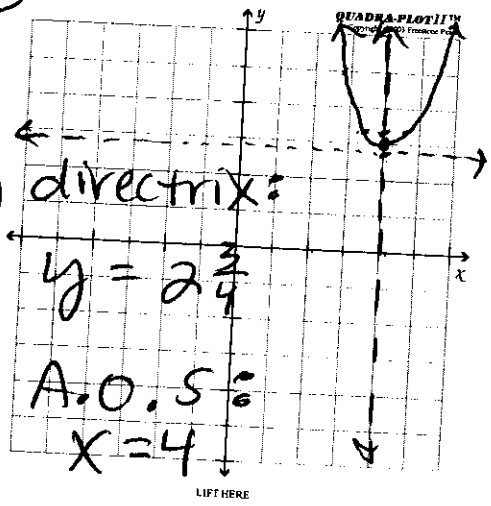
$$\boxed{(x-4)^2 + 3 = y}$$

vertex: $(4, 3)$

Focus: $(4, 3\frac{1}{4})$

$a = 1$

$p = \frac{1}{4} \cdot 1 = \frac{1}{4}$



ex $x^2 + 4x + 8y + 12 = 0$

$-8y + 12 \quad -8y + 12$

$x^2 + 4x + \boxed{4} = -8y + 12 + \boxed{4}$

$(x+2)^2 = -8y + 16$

$-16 \qquad -16$

$\frac{1}{-8}(x+2)^2 - \frac{16}{-8} = \frac{-8y}{-8}$

$$\boxed{-\frac{1}{8}(x+2)^2 + 2 = y}$$

vertex $(-2, 2)$

$a = -\frac{1}{8} \qquad p = \frac{1}{4} \cdot -\frac{8}{1} = -2$

A.O.S.: $x = -2$