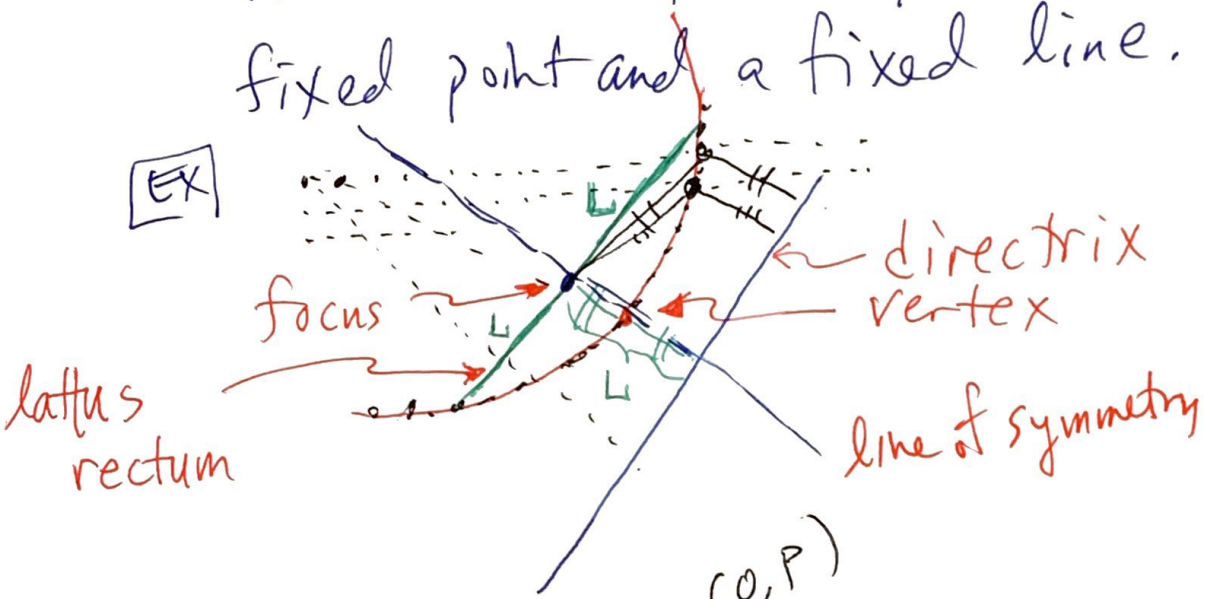
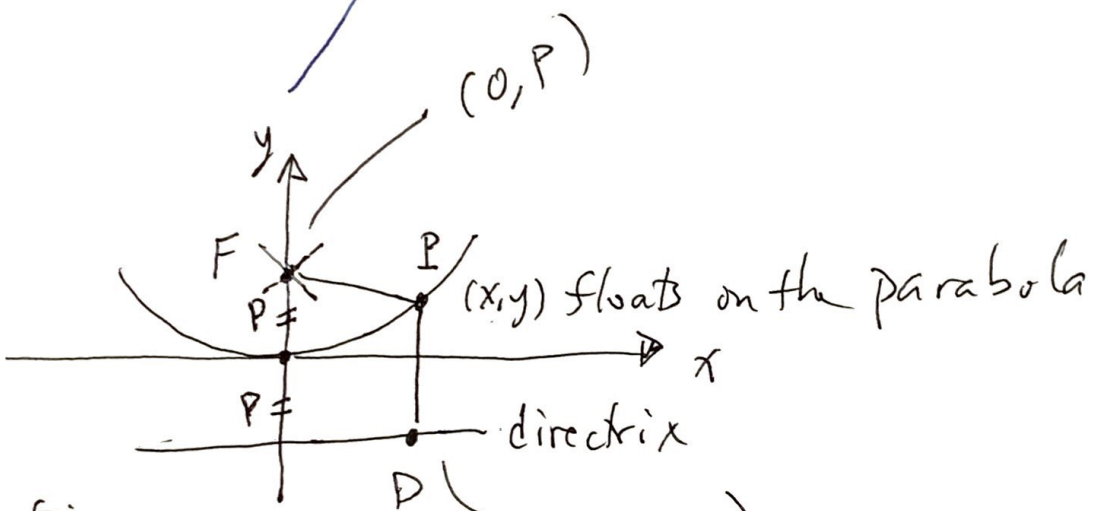
10.3 Parabola

Geometric definition of a parabola:

The locus of points equidistant from a fixed point and a fixed line.

EX





Geom. Def:

$m\overline{FP} = m\overline{PD}$

$\sqrt{(0-x)^2+(p-y)^2} = \sqrt{(x_2-x_0)^2+(y-(-p))^2}$ $\qquad x_P = x_D$

$x^2 + p^2 - 2py + y^2 = 0 + y^2 + 2yp + p^2$

$x^2 = 4py$

or $\boxed{4py = x^2}$

Alg I: $y = ax^2+bx+c$

Alg II: $y = a(x-h)^2+k$

PreCal: $4py = x^2$

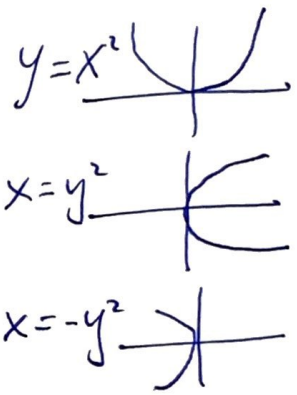
$\boxed{4p(y-k) = (x-h)^2}$

EX is $x^2+12x-6y^2-51+82=0$ a parabola?

No does not look like it would factor into $4p(y-k)=(x-h)^2$ since we see a "y^2" term. This is most likely a hyperbola

EX Give the vertex, focus, directrix and graph:

(a) $y=\frac{1}{8}x^2$



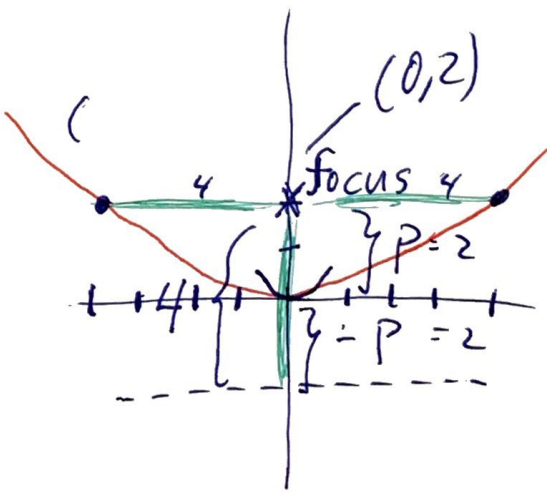
(i) opens (up) or sideways?

(ii) form $4py=x^2$

here $\boxed{8y=x^2}$

(iii) match the 8 with $4p$ and solve: $\boxed{p=2}$

(iv) . vertex @ $(x,y)=(0,0)$
. focus @ $(x,y)=(0,2)$
. directrix: $y=-2$



(v) plot the above, plot the latis rectum end points:

$(0,2)+(0\pm4,2)$

$\boxed{(-4,2) \text{ and } (4,2)}$

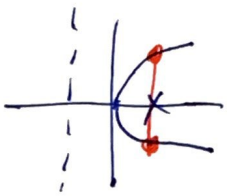
reminder

$y = x^2$

* sideways:

EX $\quad x = \frac{y^2}{36}$

(i) Up/Dwn or L/R ?



(ii) form $4px = y^2$

(iii) match : $36x = y^2$ to $4px = y^2 \Rightarrow \boxed{p = 9}$

(iv) data: vertex : $(0,0)$

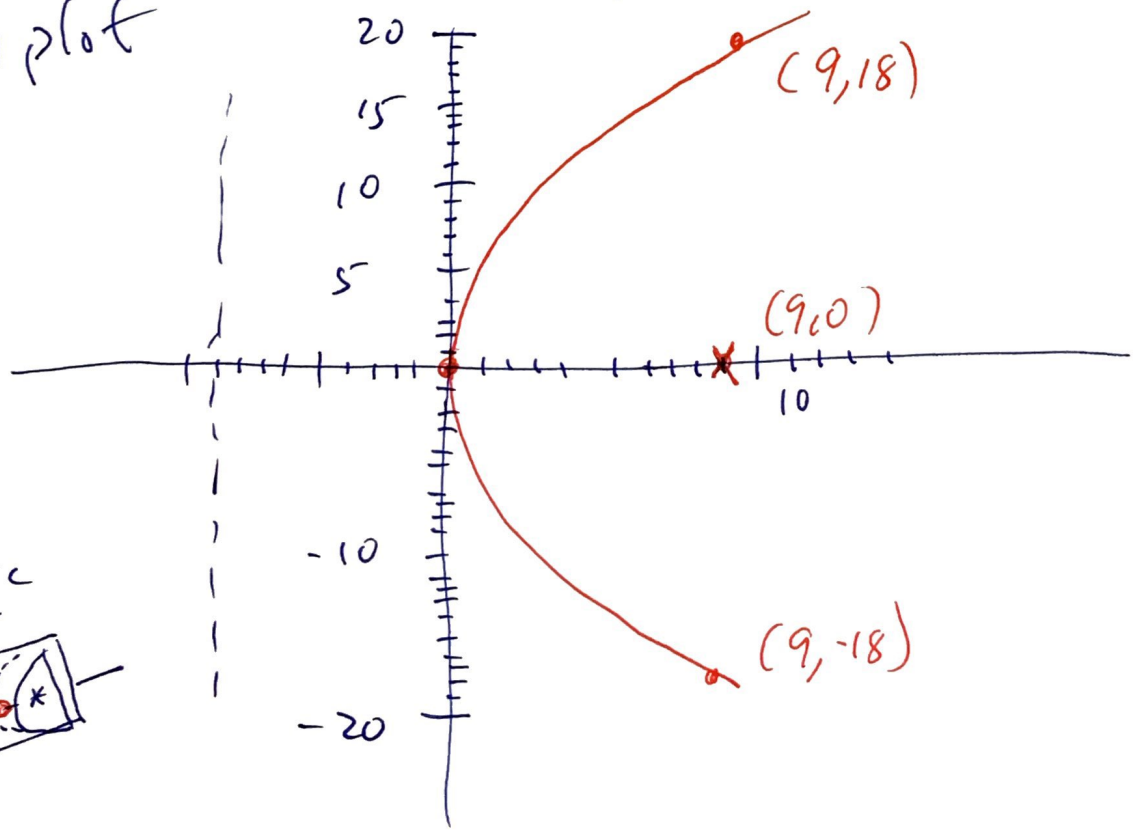
focus : $(p, 0) = (9, 0)$

directrix: $x = -9$

L.R: $(9, +2p) = (9, 18)$

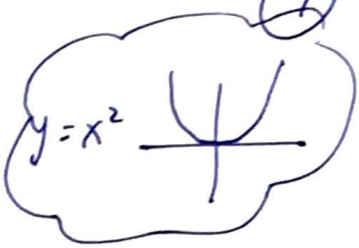
$(9, -2p) = (9, -18)$

(v) plot



parabolic cooker

* off origin vertecies.



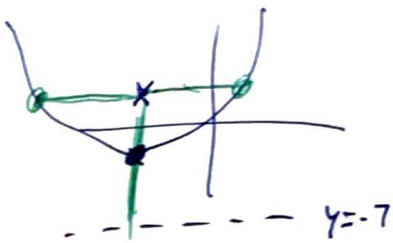
EX Analyz this $(x+4)^2 = 24(y+1)$

(i) L/R or Up/Dn ?

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

(iii) match $24(y+1) = (x+4)^2$

$24 = 4p$ and $\boxed{p=6}$



(iv) Data: vertex: $(x,y) = \boxed{(-4,-1)}$ opens up

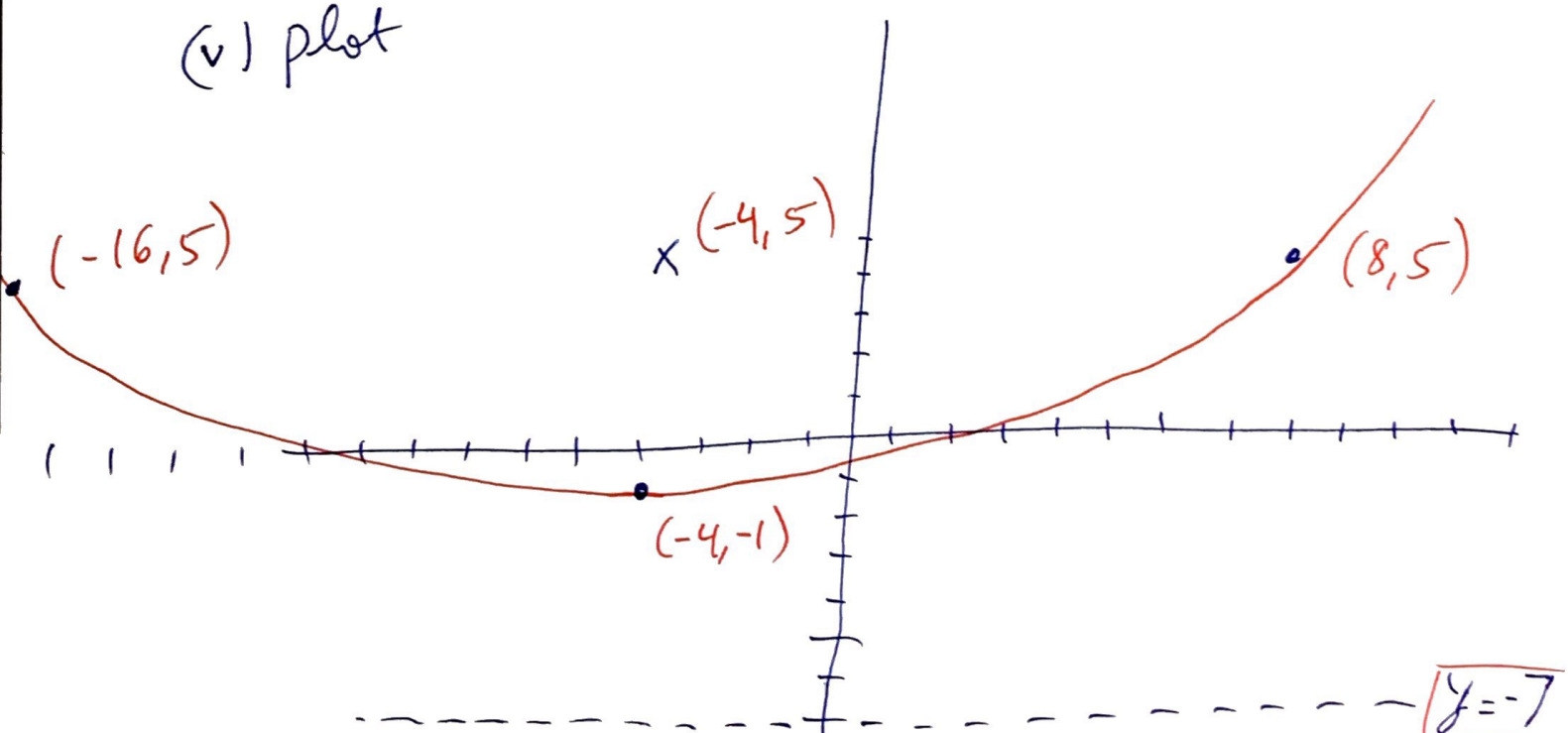
focus: $(-4,-1)+(0,6) = \boxed{(-4,5)}$

directrix: $y = -1-6 = -7$ $\boxed{y=-7}$

L.R: $(-4-2\cdot6, 5)$ & $(-4+2\cdot6, 5)$

$\boxed{(-16,5), (8,5)}$

(v) plot



* C.S.I.

EX describe & give eqn & graph:

vertex is $(-2, 3)$, directrix $x = -\frac{7}{2}$

and focus is @ $(-\frac{1}{2}, 3)$ superfluous info.

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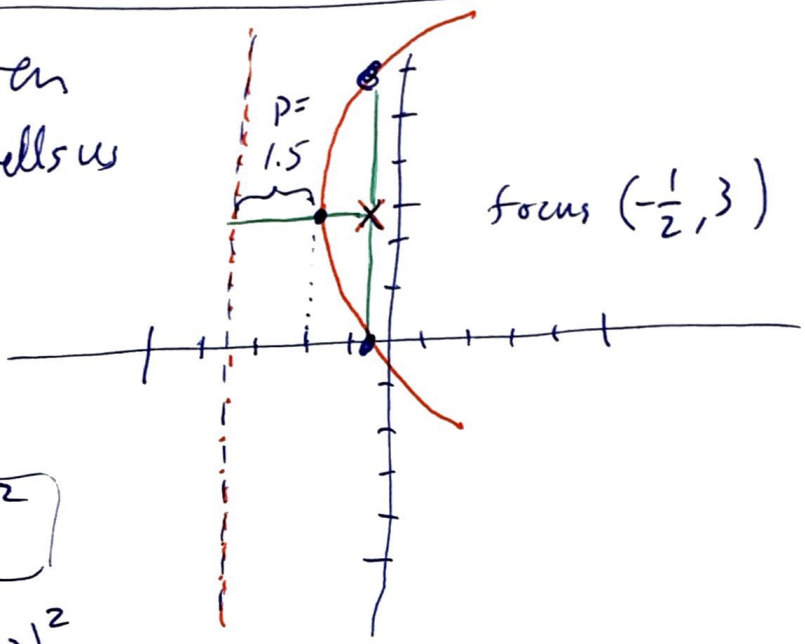
plot data given

- vertex & directrix tells us we open right



- form:

$$4px = y^2$$

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

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

- eqn $6(x+2) = (y-3)^2$

- L.R: $\left(-\frac{1}{2}, 3+2p\right)^{3/2} = \left(-\frac{1}{2}, 6\right)$

$\left(-\frac{1}{2}, 3-2p\right) = \left(-\frac{1}{2}, 0\right)$

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[2] Find the vertex, focus, directrix eqn, latus rectum end points, then graph:

$$y = x^2$$

(i) up/down or left/right ?

(ii) $4py = x^2$

(iii) match to 1. $y = x^2$ so $4p = 1$, $\boxed{p = 1/4}$

(iv) data:

vertex @ $(0,0)$

focus @ $(0, 1/4)$

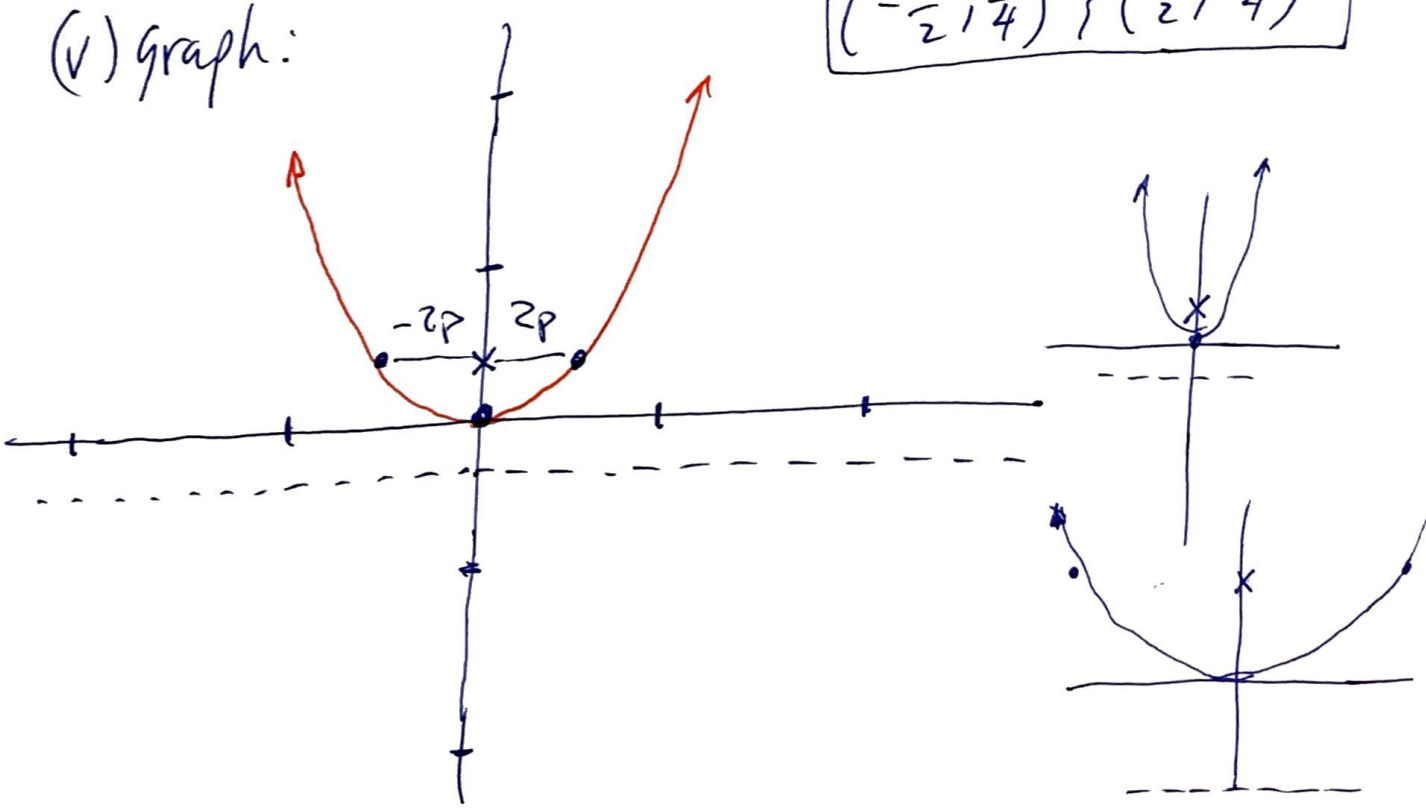
directrix: $y = -1/4$

L.R. end points: $(-2p, \frac{1}{4})$ & $(+2p, \frac{1}{4})$

$(-\frac{2}{4}, \frac{1}{4})$, $(\frac{2}{4}, \frac{1}{4})$

$\boxed{(-\frac{1}{2}, \frac{1}{4}) \text{ & } (\frac{1}{2}, \frac{1}{4})}$

(v) graph:



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[3] Tell me all about $(y-2)^2 = \frac{-4}{5}(x+4)$

(i)