(ANNOTATED)

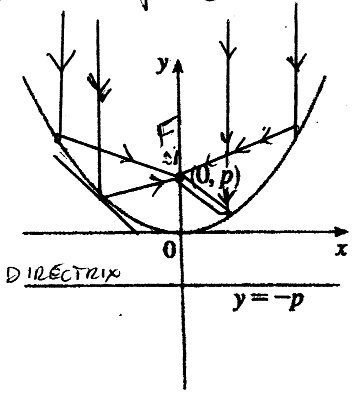
CONIC SECTIONS

PARABOLAS (ANNOTATED)

> **1** An equation of the parabola with focus $(0, p)$ and directrix $y = -p$ is
> $$x^2 = 4py$$

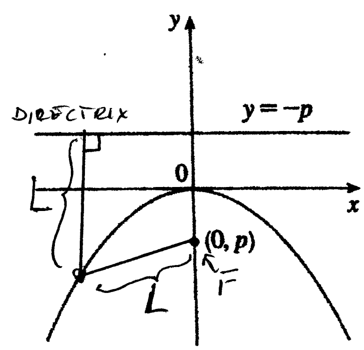
THE Axis of Symmetry is (parallel to) the axis of the degree-1 VARIABLE.

$p > 0$



(a) $x^2 = 4py$, $p > 0$

$p < 0$



(b) $x^2 = 4py$, $p < 0$

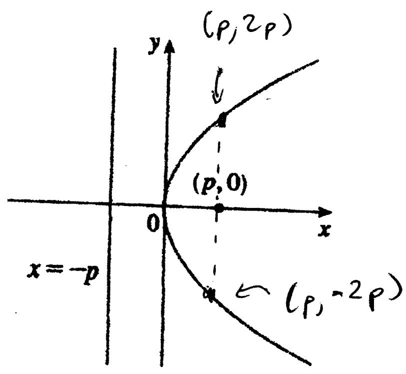
Both Distances ARE EQUAL (Both = L)

SAME HERE

$$y^2 = 4px$$

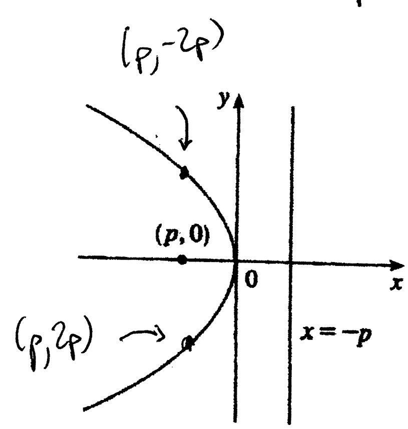
For $p > 0$,
when $x = p$,
$y^2 = 4p \cdot p = 4p^2$
$y^2 = (2p)^2$
$|y| = 2p$
$y = \pm 2p$

$p > 0$



(c) $y^2 = 4px$, $p > 0$

$p < 0$



(d) $y^2 = 4px$, $p < 0$

Ellipses (ANNOTATED)

4 **The ellipse**

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \qquad a \geqslant b > 0$$

has foci ($\pm c$, 0), where $c^2 = a^2 - b^2$, and vertices ($\pm a$, 0).

THE MAJOR AXIS is (parallel to) the axis of the variable with the LARGER DENOMINATOR.

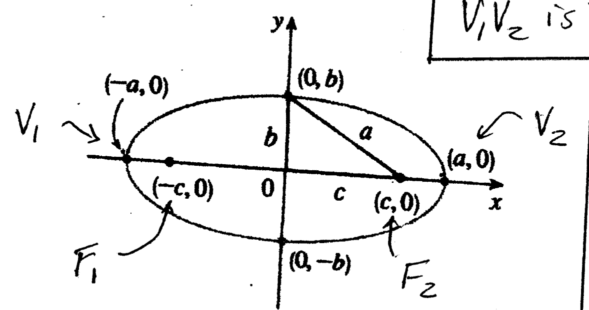


FIGURE 8

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,\ a \geqslant b$

$a \geq c$, too.

$\overline{V_1V_2}$ is the MAJOR AXIS

VERTICES ARE V_1 and V_2.

FOCI ARE F_1 and F_2

"Center" O is at (0, 0)

$a^2 = b^2 + c^2$

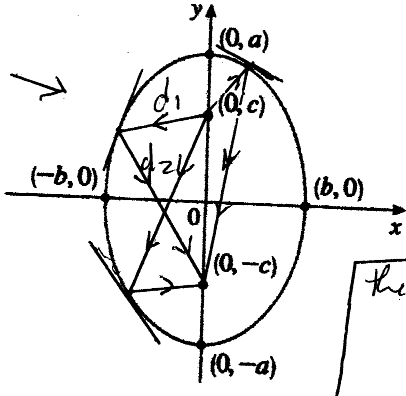
SAME HERE

5 **The ellipse**

$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1 \qquad a \geqslant b > 0$$

has foci (0, $\pm c$), where $c^2 = a^2 - b^2$, and vertices (0, $\pm a$).

$d_1 + d_2 = 2a$



The Commn Sum is 2a.

THE MINOR AXIS is the segment between the 2 points where the line ⊥ the MAJOR AXIS and Through the "Center" intersects the ellipse,

FIGURE 9

$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1,\ a \geqslant b$, $a \geq c$, too

Hyperbolas (ANNOTATED)

7 **The hyperbola**

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

has foci $(\pm c, 0)$, where $c^2 = a^2 + b^2$, vertices $(\pm a, 0)$, and asymptotes $y = \pm(b/a)x$.

THE Axis of Symmetry NOT INTERSECTING THE Hyperbola IS (PARALLEL TO) THE AXIS OF THE VARIABLE THAT IS SUBTRACTED.

THERE is NO RELATIONSHIP BETWEEN THE MAGNITUDES OF a and b, but $c \geq a$ and $c \geq b$

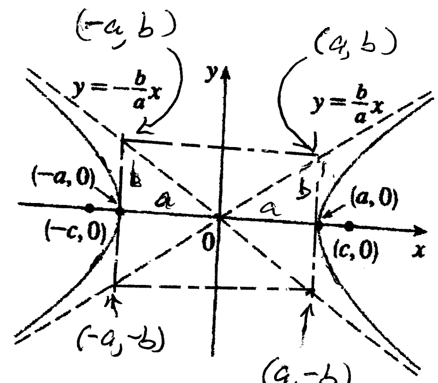
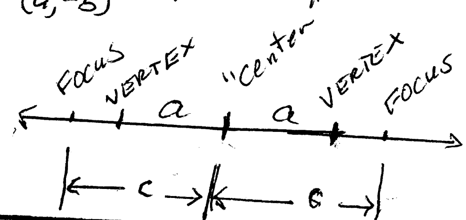


FIGURE 12
$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

DRAW THE BOX LIGHTLY FIRST, THEN DRAW THE Asymptotes.



8 **The hyperbola**

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

has foci $(0, \pm c)$, where $c^2 = a^2 + b^2$, vertices $(0, \pm a)$, and asymptotes $y = \pm(a/b)x$.

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SAME HERE

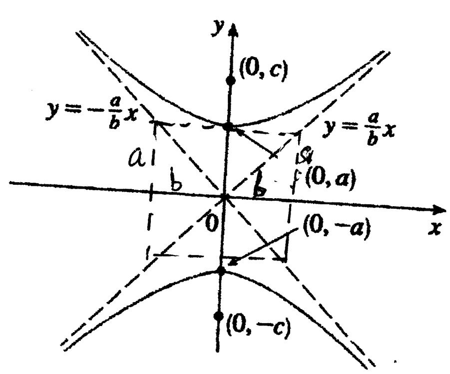

FIGURE 13
$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$