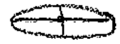
Precalculus **Name** Key

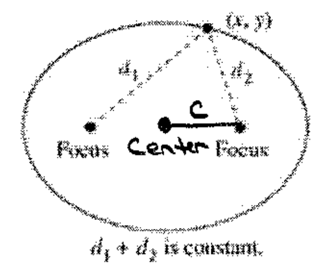
9.2 Notes: Ellipses

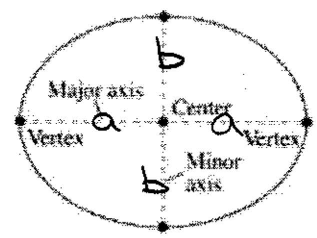
Ellipse: the set of all points (x, y) in a plane, the sum of whose distances from two fixed points called foci is constant.

Info about Ellipses:




	Horizontal Major Axis	Vertical Major Axis
Standard Equation	$\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$	$\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$
Center	(h,k)	(h,k)
Foci	$(h+c,k)$ and $(h-c,k)$	$(h,k+c)$ and $(h,k-c)$
Length of Major Axis	Horizontal $=2a$	Vertical $=2a$
Length of Minor Axis	Vertical $=2b$	Horizontal $=2b$
Vertices	$(h+a,k)$ and $(h-a,k)$	$(h,k+a)$ and $(h,k-a)$
* $c^2=a^2-b^2$	$a^2=b^2+c^2$ and $a>b$	

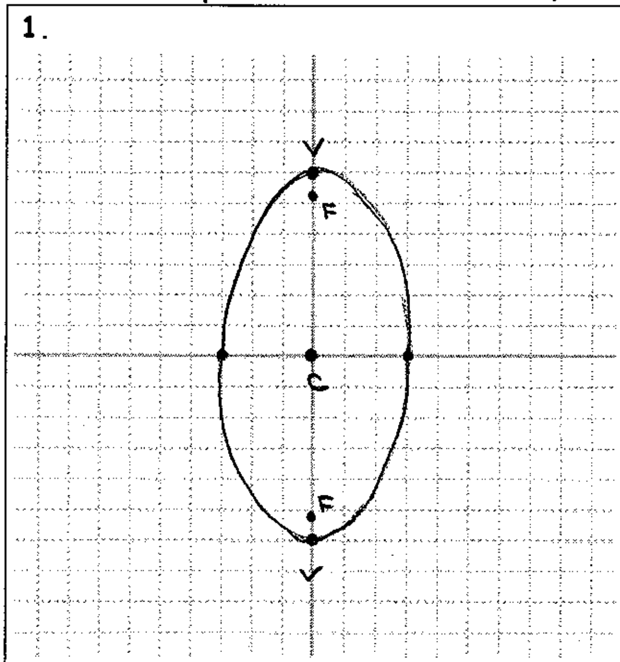




- The line through the **foci** intersects the ellipse at two points called vertices.
- The chord joining these points is the major axis, and its midpoint is the center of the ellipse.
- The chord perpendicular to the **major axis** at the center is the minor axis.
- To *recognize* that the equation of a conic is an **ellipse**, notice that there are two quadratic terms with different coefficients with the same sign.

Write each equation in standard form, find all indicated in formation and sketch the graph.

1.



Center
(0,0)

Vertices
(0, 6)
(0,−6)

Foci
$(0, 3\sqrt{3})$
$(0, -3\sqrt{3})$

Major Axis	**Minor Axis**
12	6

$\frac{4x^2}{36}+\frac{y^2}{36}=\frac{36}{36}$

* Vertical major axis

$\frac{x^2}{9}+\frac{y^2}{36}=1$

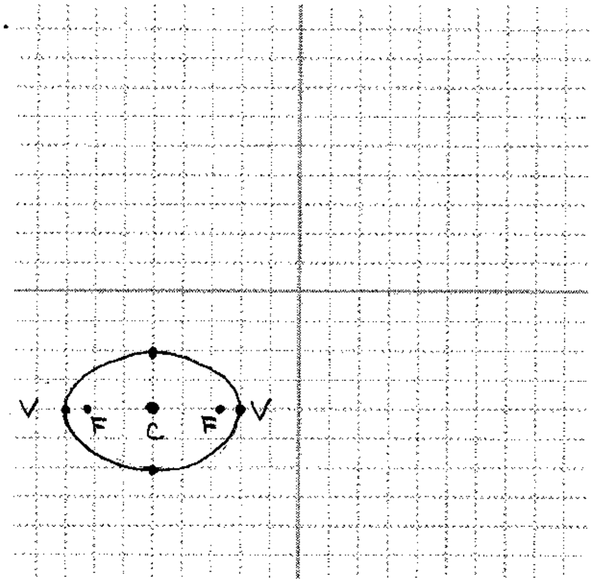
$a^2=36 \quad a=6$

$b^2=9 \quad b=3$

$c^2=36-9=27=3\sqrt{3}$

≈ 5.2

2.



Center
$(-5,-4)$

Vertices
$(-2,-4)$
$(-8,-4)$

Foci
$(-5+\sqrt{5},-4)$
$(-5-\sqrt{5},-4)$

Major Axis	Minor Axis
6	4

$4x^2+9y^2+40x+72y+208=0$

$(4x^2+40x)+(9y^2+72y)=-208$

$4(x^2+10x+25)+9(y^2+8y+16)=-208$
$+100$
$+144$

$\frac{4(x+5)^2}{36}+\frac{9(y+4)^2}{36}=\frac{36}{36}$

$\boxed{\frac{(x+5)^2}{9}+\frac{(y+4)^2}{4}=1}$

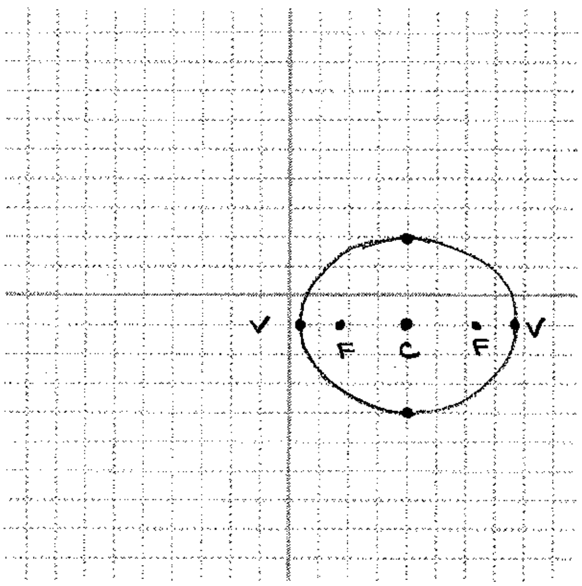
*Horizontal major axis

$a^2=9 \quad a=3$

$b^2=4 \quad b=2$

$c^2=9-4=5 \quad c=\sqrt{5}\approx 2.24$

3.



Center
$(4,-1)$

Vertices
$(4+\sqrt{14},-1)$
$(4-\sqrt{14},-1)$

Foci
$(4+\sqrt{5},-1)$
$(4-\sqrt{5},-1)$

Major Axis	Minor Axis
$2\sqrt{14}$	6

$\frac{(x-4)^2}{14}+\frac{(y+1)^2}{9}=1$ *Horizontal major axis

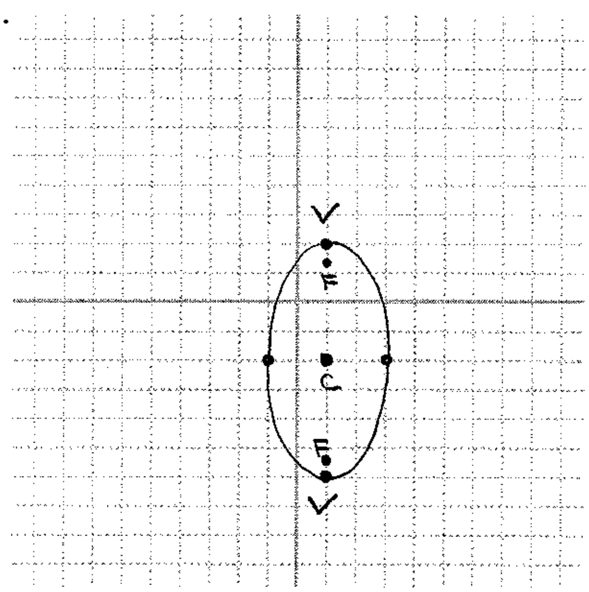
$a^2=14 \quad a=\sqrt{14}\approx 3.74$

$b^2=9 \quad b=3$

$c^2=14-9=5$

$c=\sqrt{5}\approx 2.24$

4.



Center
$(1,-2)$

Vertices
$(1,2)$
$(1,-6)$

Foci
$(1,-2+2\sqrt{3})$
$(1,-2-2\sqrt{3})$

Major Axis	Minor Axis
8	4

$4x^2+y^2-8x+4y-8=0$

$(4x^2-8x)+(y^2+4y)=8$

$4(x^2-2x+1)+(y^2+4y+4)=8+4+4$

$\frac{4(x-1)^2}{16}+\frac{(y+2)^2}{16}=\frac{16}{16}$

$\boxed{\frac{(x-1)^2}{4}+\frac{(y+2)^2}{16}=1}$

*Vertical major axis

$a^2=16 \quad a=4$

$b^2=4 \quad b=2$

$c^2=16-4=12$

$c=\sqrt{12}=2\sqrt{3}\approx 3.47$