AP Precalc

Write your questions and thoughts here!

4.6B Conic Sections: Ellipses

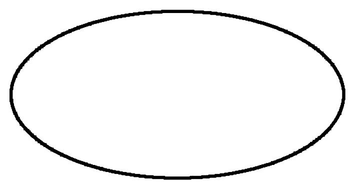
4.6B Notes

Equation of an Ellipse

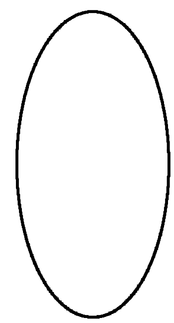
$$\frac{(\boldsymbol{x}-\boldsymbol{h})^2}{\quad} + \frac{(\boldsymbol{y}-\boldsymbol{k})^2}{\quad} =$$

An ellipse centered at (h, k) with horizontal radius a and vertical radius b can be represented analytically as the equation shown above. A circle is a special case of an ellipse where $a = b$.

Horizontal Ellipse
$a^2 > b^2$



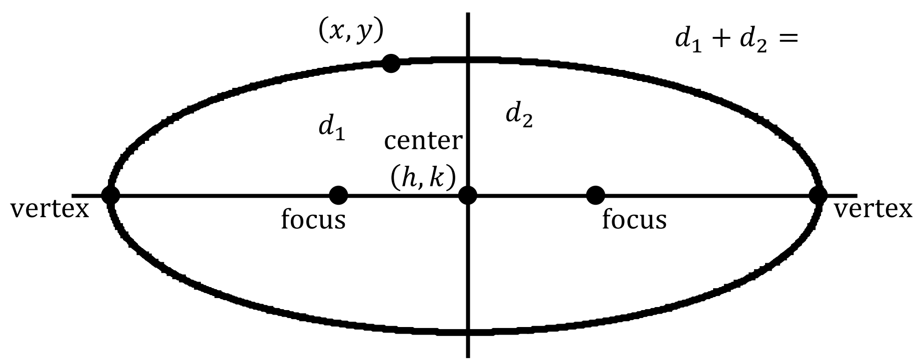
Vertical Ellipse
$b^2 > a^2$



Ask yourself: Where is the largest denominator? Under x means horizontal. Under y means vertical.

Definition of an Ellipse

For all points (x, y) on the curve, the sum of the two distances to the focal points (foci) is a constant.



The foci are located a distance of c from the center, where c is found using the following:

Horizontal Ellipse: $c^2 = a^2 - b^2$

Vertical Ellipse: $c^2 = b^2 - a^2$

The easiest way to remember this is $\boldsymbol{c^2} =$

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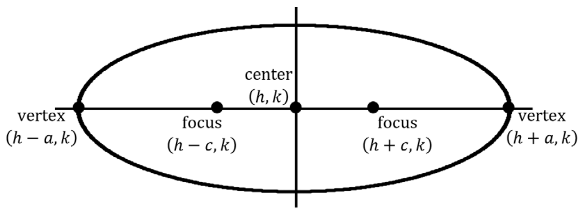
Horizontal Ellipse

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

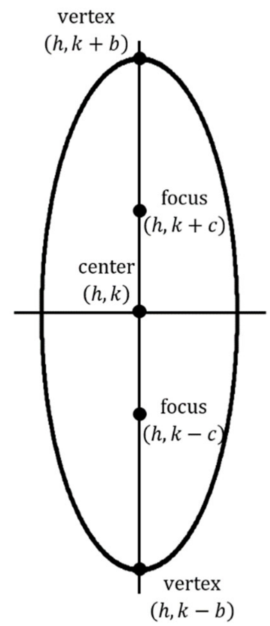
- $a^2 > b^2$ (large denominator under the x)
- Center (h, k)
- Foci: $(h \pm c, k)$
- Vertices: $(h \pm a, k)$
- $c^2 = a^2 - b^2$
- Major Axis: $2a$
- Minor Axis: $2b$



Vertical Ellipse

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$

- $b^2 > a^2$ (large denominator under the y)
- Center (h, k)
- Foci: $(h, k \pm c)$
- Vertices: $(h, k \pm b)$
- $c^2 = b^2 - a^2$
- Major Axis: $2b$
- Minor Axis: $2a$

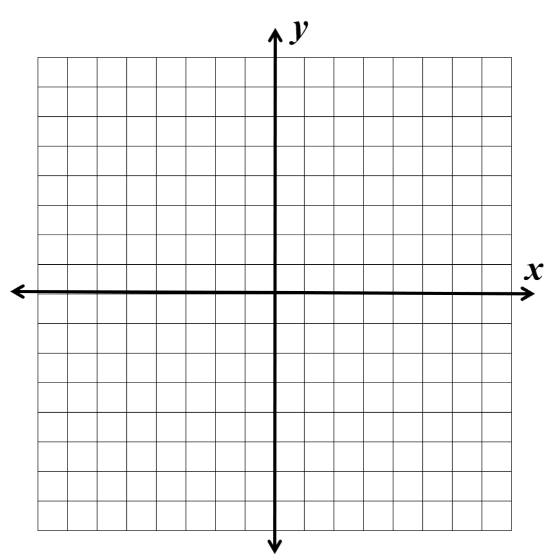


1. Sketch the graph of $\frac{(x-1)^2}{25} + \frac{(y+2)^2}{16} = 1$.

a. center	b. horizontal/vertical	c. vertices (ends of major axis)	d. ends of minor axis

e. foci

g. sketch the graph



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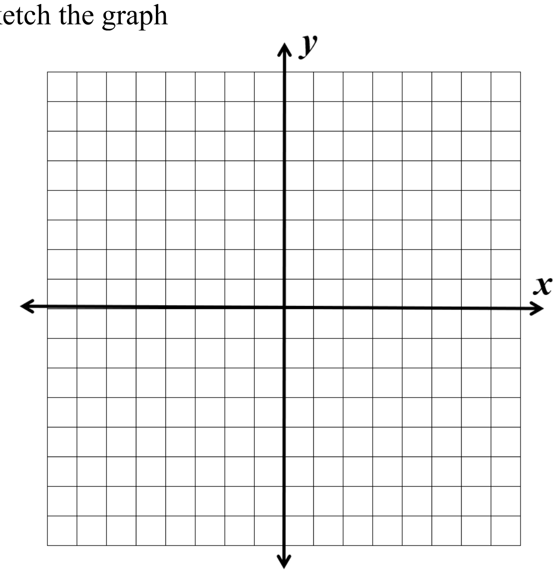
2. Sketch the graph of $\frac{(x+3)^2}{9} + \frac{(y-2)^2}{9} = 1$.

a. center	b. horizontal/vertical	c. vertices (ends of major axis)	d. ends of minor axis

e. foci

g. sketch the graph



3. Find the equation of the ellipse with a major axis along the x-axis and a length of 14, a minor axis with length of 10, and the center at the origin.

4. Given Foci at $(-2, 1)$ and $(-2, 5)$ with Major Axis endpoints at $(-2, -1)$ and $(-2, 7)$, find the equation of the ellipse.

5. Using the following equation, put the equation of the ellipse into proper form and identify the center and orientation. $3x^2 + 5y^2 - 12x + 30y + 42 = 0$

4.6B Conic Sections: Ellipses

AP Precalculus

4.6B Practice

1. Use the equation $\frac{(x+2)^2}{36}+\frac{(y-5)^2}{4}=1$ to find the following.

a. center

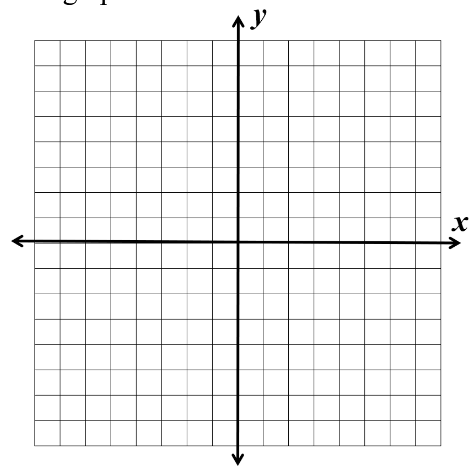
b. horizontal or vertical

c. vertices (ends of major axis)

d. ends of minor axis

e. foci

f. sketch the graph



2. Use the equation $\frac{(x+5)^2}{16}+\frac{y^2}{49}=1$ to find the following.

a. center

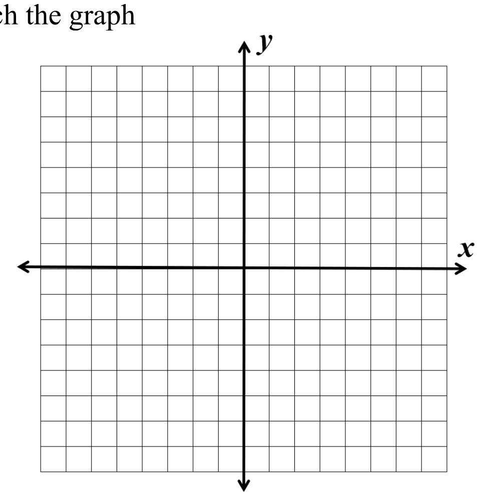
b. horizontal or vertical

c. vertices (ends of major axis)

d. ends of minor axis

e. foci

f. sketch the graph

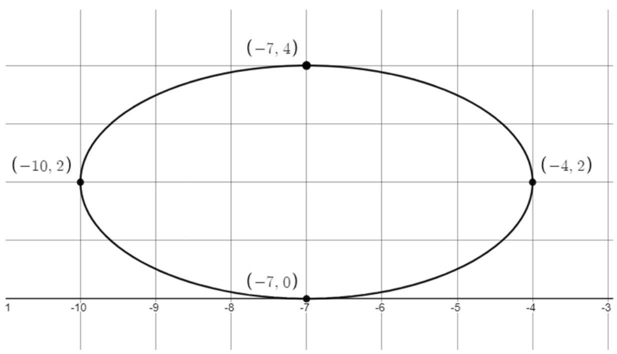


3. Find the equation of an ellipse, in standard form, with a vertical orientation, center at $(0,4)$, major axis length of 22 and a minor axis length of 14.

4. Find the equation of an ellipse, in standard form, with a vertical orientation, center at $(-1,-5)$, Foci at $(-1,-3),(-1,-7)$ and a minor axis length of 6.

Match the graph with its equation.

5.



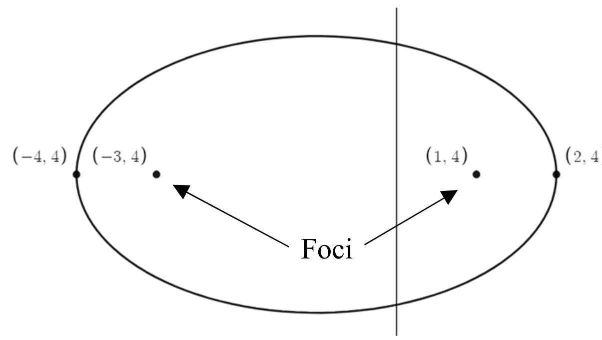
(A) $\frac{(x+7)^2}{9}+\frac{(y-2)^2}{4}=1$

(B) $\frac{(x+7)^2}{4}+\frac{(y-2)^2}{9}=1$

(C) $\frac{(x-7)^2}{4}+\frac{(y+2)^2}{9}=1$

(D) $\frac{(x-7)^2}{9}+\frac{(y+2)^2}{4}=1$

6.



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

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

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

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

Put the given equation of an ellipse into standard form. Then identify the center, foci, and orientation.

7. $x^2+3y^2+6x-12y+6=0$

8. $3x^2+y^2-18x-6=0$

9. Using the equation $4(x+9)^2+(y+2)^2=16$, find the center, foci and vertices of the ellipse.

10. Given the foci of an ellipse are located at $(2,5)$ and $(2,7)$ and the minor axis length is 10, find the equation of the ellipse in standard form.