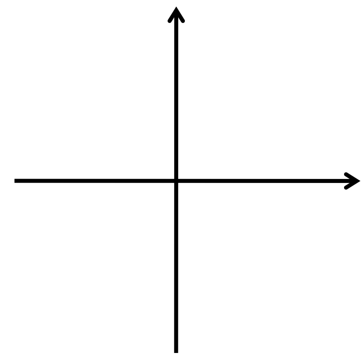
Objective: Students will understand what it means to describe, graph and write the equation of a parabola.

Parabolas

Parabola: collection of all points P in a plane that are the same distance from a fixed point, the focus F, and a fixed line, the directrix D

d(F, P) = d(P, D)



Equation of a Parabola w/ vertex @ (0, 0) & focus @ (a, 0), a > 0 is…

Vertex at (0, 0), a > 0

Opens up Focus: Directrix:	Opens down Focus: Directrix:
Opens right Focus: Directrix:	Opens left Focus: Directrix:

latus rectum - a segment that goes through the focus, and its endpoints are points on the parabola. The endpoints are a distance ±2a from the focus.

Ex 1 Discuss each equation. (So, find the vertex, focus and directrix.)

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

Ex 2 Find the equation of the parabola with vertex at (0, 0); axis of symmetry the x-axis; and contains the point (2, 3).

Vertex at (h, k)… Use patterns to describe the focus and directrix.

Opens up	Opens down
Opens right	Opens left

Ex 3 Find the equation of the parabola whose vertex is at (4, -2) and focus is at (6, -2).

Ex 4 Discuss the equation: $y^2 + 12y = -x + 1$

You've Got Problems:
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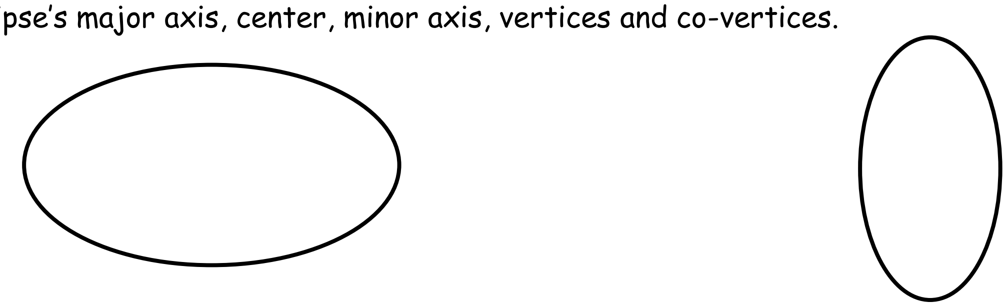
Objective: Students will be able to graph, write the equation, identify key elements and convert between forms.

Ellipses

Ellipse: the collection of all points in the plane the sum of whose distances from two fixed points, called foci, is a constant

- **Major axis** – the line containing the foci
- **Center** – the midpoint of the segment joining the foci
- **Minor axis** – the line that's through the center and perpendicular to the major axis
- **Vertices** – points at the intersection of the major axis and the ellipse
- **Co-vertices** – point at the intersection of the minor axis and the ellipse
- **Standard Form** - $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$
- **General form -** $ax^2 + by^2 + cx + dy + e = 0$.

<u>Ex 1</u> Label the ellipse's major axis, center, minor axis, vertices and co-vertices.



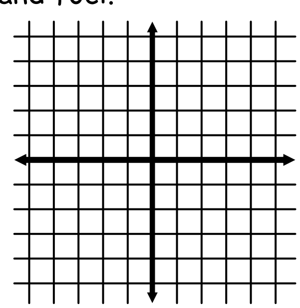
Equation of an Ellipse: center @ (0, 0)

Foci @ (±c, 0) & vertices @ (±a, 0)	Foci @ (0, ±c) & vertices @ (0, ±a)
$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	$\frac{x^2}{b^2}+\frac{y^2}{a^2}=1$
where $a > b > 0$ and $b^2 = a^2 - c^2$	where $a > b > 0$ and $b^2 = a^2 - c^2$

FYI: "Discuss the equation" in ellipses means find the center, major axis, foci, vertices and co-vertices.

<u>Ex 2</u> Graph the equation of the conic section. Find the vertices, co-vertices and foci.

$$4y^2 + 9x^2 = 36$$



Ex 3 Find an equation for each ellipse given…

a) Center at (0, 0); focus at (-1, 0); vertex at (-3, 0)	b) Foci at (0, ±2); major axis measures 8

Equation of an Ellipse: center @ (h, k)

Foci @ (h ± c, k) & vertices @ (h ± a, k)	Foci @ (h, k ± c) & vertices @ (h, k ± a)
$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
where $a > b > 0$ and $b^2 = a^2 - c^2$	where $a > b > 0$ and $b^2 = a^2 - c^2$

Ex 4 Find an equation of an ellipse whose foci are (1, 2) and (-3, 2) & whose vertex is (-4, 2).

Ex 5 Discuss each equation. (So, find the center, foci, vertices, co-vertices.)

a) $9(x-3)^2 + (y+2)^2 = 18$	b) $4x^2 + 3y^2 + 8x - 6y = 5$

How would you find the x-intercept of any given ellipse? How would you find the y-intercept of any ellipse?

You've Got Problems:
Page 633: 13-16,25,27,29,39,49,55

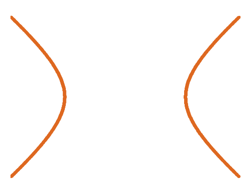
Objective: Students will be able to describe, write the equation of and graph hyperbolas.

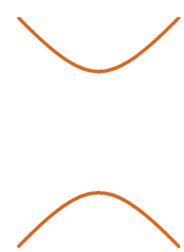
Hyperbolas

Hyperbola: the collection of all points in the plane the difference of whose distances from two fixed points, called foci, is a constant

- **Transverse axis** – the line containing the foci
- **Center** – the midpoint of the segment joining the foci
- **Conjugate axis** – the line through the center & perpendicular to the transverse axis
- **Branches** – two separate curves which make the hyperbola's graph. They are symmetrical with respect to the transverse axis.
- **Vertices** – points at the intersection of the major axis and the hyperbola

Ex 1 Label the axes, center, branches, and vertices of the hyperbola.





Equation of a Hyperbola: center @ (0, 0)

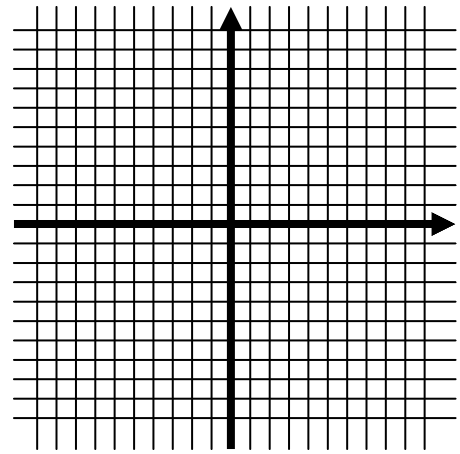
Foci @ (±c, 0) & vertices @ (±a, 0) Transverse axis parallel to x-axis $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ where $b^2 = c^2 - a^2$ Note: Asymptotes are $y = \pm\frac{b}{a}x$.	Foci @ (0, ±c) & vertices @ (0, ±a) Transverse axis parallel to y-axis $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ where $b^2 = c^2 - a^2$ Note: Asymptotes are $y = \pm\frac{a}{b}x$.

FYI: "Discuss the equation" for hyperbolas means that you'll find the center, transverse axis, foci, and vertices that hyperbola.

Remember: How would you find the x-intercepts and y-intercepts of a hyperbola?

<u>Ex 2</u> Graph the hyperbola. Then, find its center, foci, vertices and asymptotes.

$$\frac{x^2}{4} - \frac{y^2}{25} = 1$$



Equation of a Hyperbola: center @ (h, k)

Foci @ (h ± c, k) & vertices @ (h ± a, k) Transverse axis parallel to x-axis $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ where $b^2 = c^2 - a^2$ Note: Asymptotes are $(y-k) = \pm\frac{b}{a}(x-h)$.	Foci @ (h, k ± c) & vertices @ (h, k ± a) Transverse axis parallel to y-axis $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$ where $b^2 = c^2 - a^2$ Note: Asymptotes are $(y-k) = \pm\frac{a}{b}(x-h)$.

<u>Ex 4</u> Find an equation for a hyperbola whose vertices are (4, 0) and (-4, 0) and has an asymptote of y = 2x. Then state its foci

<u>Ex 5</u> Find an equation for a hyperbola whose center is at (-3, 1), focus is at (-3, 6) and whose vertex is at (-3, 4).

Ex 6 Find an equation for a hyperbola whose vertices are at (1, -3) and (1, 1) and whose asymptote is $y+1=\frac{3}{2}(x-1)$.

You've Got Problems:
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