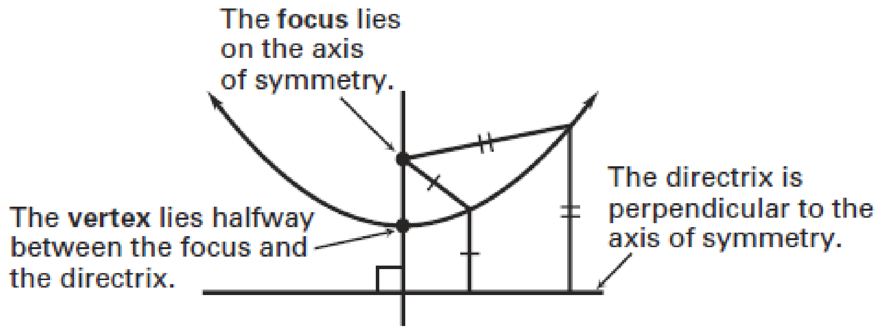
10.1	The Distance and Midpoint Formulas
Objectives	1. Find the distance between two points and find the midpoint of the line segment joining two points. 2. Use the distance and midpoint formula in real life situations.
The Distance Formula	The distance between the points $(x_1, y_1)\ and (x_2, y_2)$. $\boldsymbol{d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}}$
Find the distance between the points.	$(4, -5)\ and (-2, 7)$
Classifying the triangle as equilateral, isosceles or equilateral.	$(4,1)\ ,\ (1, -2),\ (6, -4)$
Midpoint	The midpoint is the mean of the two points. $(\boldsymbol{x_1},\ \boldsymbol{y_1}), (\boldsymbol{x_2},\ \boldsymbol{y_2})$ $M\ (\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$
Find the midpoint of the segment.	$(1, -4)\ and\ (-3, 5)$

Finding the perpendicular bisector.	Write and equation for the perpendicular bisector of the line segment joining $A\ (-2,\ 3)\ and\ B\ (2,\ 5)$

10.2	**Parabolas**
Objectives	1. Graph and write equations of parabolas.

Parabola – Every point on a parabola is equidistant from a point called the **focus** and a line called the **directrix.**



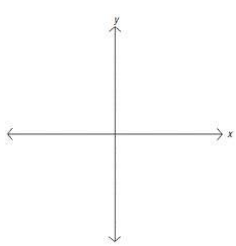
STANDARD EQUATION OF A PARABOLA (VERTEX AT ORIGIN)

The **standard form of the equation of a parabola** with vertex at (0, 0) is as follows.

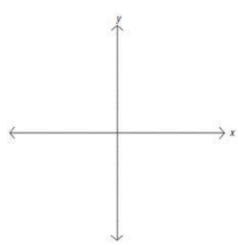
Equation	Focus	Directrix	Axis of Symmetry
$x^2 = 4py$	$(0, p)$	$y = -p$	Vertical ($x = 0$)
$y^2 = 4px$	$(p, 0)$	$x = -p$	Horizontal ($y = 0$)

Four Types of Parabolas

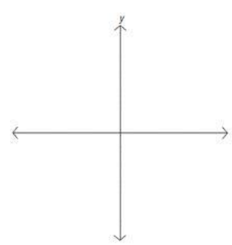
$x^2 = 4py, p > 0$



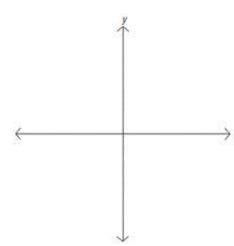
$x^2 = 4py, p < 0$

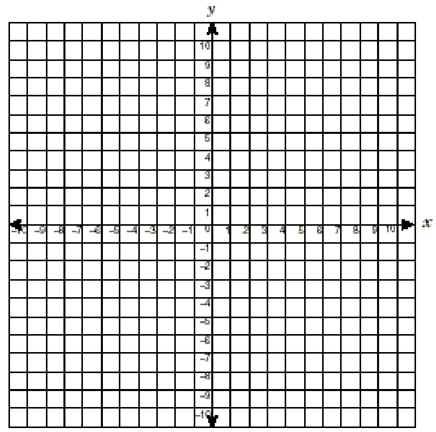
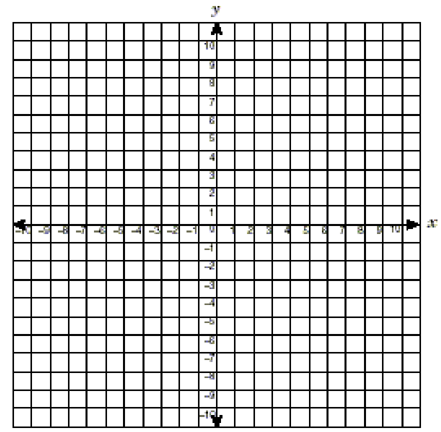


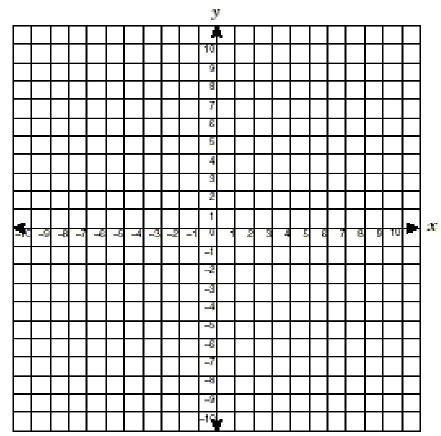
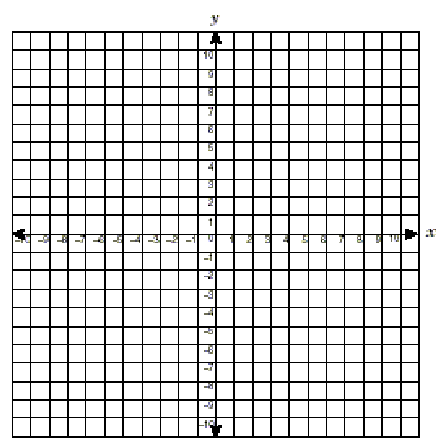
$y^2 = 4px, p > 0$



$y^2 = 4px, p < 0$

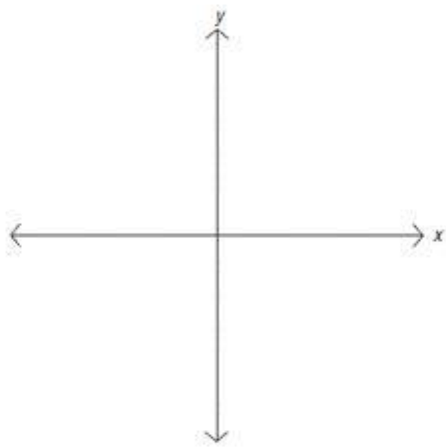


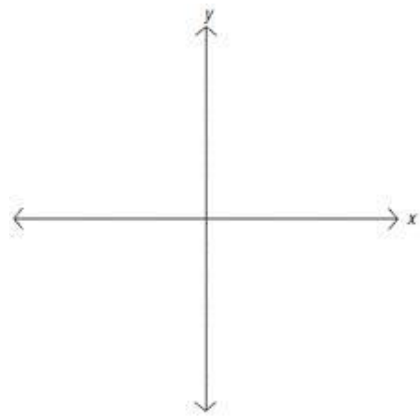
Graph the parabola. Identify the focus and directrix.	$x^2 = 4y$ $y^2 = -12x$  
Write an equation of the parabola with the given focus and a vertex at (0, 0).	$(-2, 0)$ $(0, -3)$
Write an equation of the parabola with the given directrix and a vertex at (0, 0).	$x = 2$ $y = -3$

10.3	**Circles**
Objectives	1. Graph and write equations of circles. 2. Use circles to solve real life problems.
	A **circle** the set of all points (x, y) that are equidistant from a fixed point, called the **center** of the circle. The distance **r** between the center and any point (x, y) on the circle called the **radius**. The **standard form of the equation of a circle** with center at (0, 0) and the radius r is as follows: $$x^2 + y^2 = r^2$$
Draw the circle.	$y^2 = 36 - x^2$  $x^2 = 20 - y^2$ 

Write the equation of the circle.	The point $(3, -4)$ is on the circle whose center is at the origin. Write the standard form of the equation of the circle. The point $(-2,\ 5)$ is on the circle whose center is at the origin. Write the standard form of the equation of the circle.
Writing the Equation of the line tangent to the circle.	Write an equation of the line that is tangent to $x^2 + y^2 = 13$ at the point $(2,\ 3)$.
The beam of a lighthouse can be seen for up to 20 miles. You are a ship that is 13 miles west and 16 miles north of the lighthouse. Can you see the light beam?	

10.4	**Ellipses**
Objectives	1. Graph and write equations of ellipses. 2. Use ellipses in real life situations.
Key Terms	Ellipse



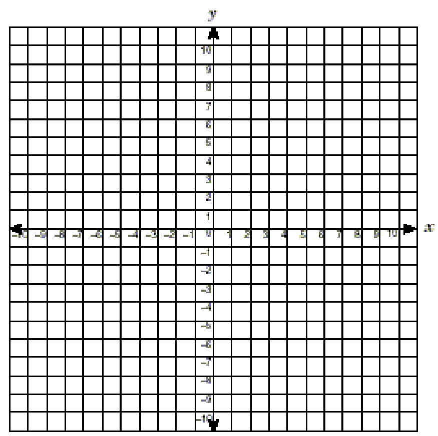


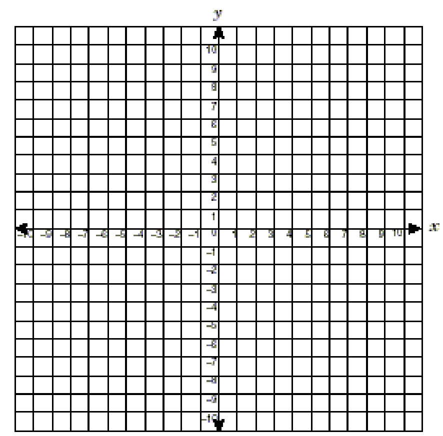
CHARACTERISTICS OF AN ELLIPSE (CENTER AT THE ORIGIN)

The **standard form of the equation of an ellipse** with center at (0, 0) and major and minor axes of lengths $2a$ and $2b$, where $a > b > 0$, is as follows.

Equation	Major Axis	Vertices	Co-vertices
$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	Horizontal	$(\pm a, 0)$	$(0, \pm b)$
$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$	Vertical	$(0, \pm a)$	$(\pm b, 0)$

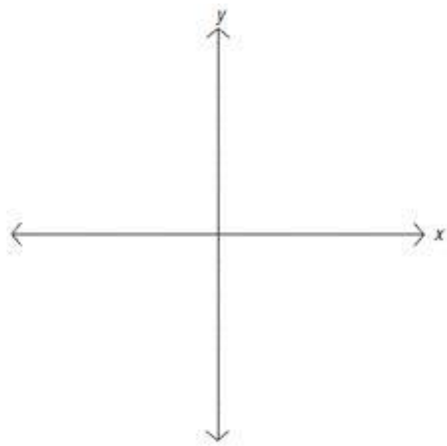
The foci of the ellipse lie on the major axis, c units from the center where $c^2 = a^2 - b^2$.

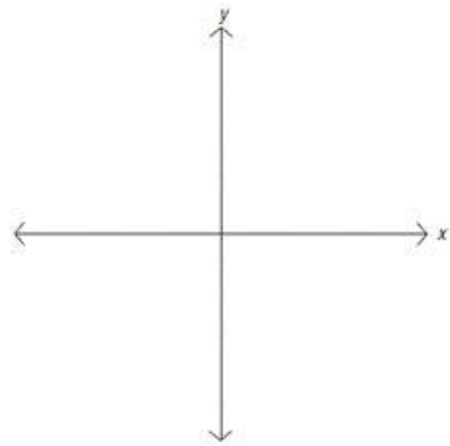
<table>
<tr>
<td>Draw the ellipse. Find the vertices and the foci.</td>
<td>$x^2 + 4y^2 = 36$
Vertices__________
Co-Vertices__________
Foci__________


$25x^2 + 4y^2 = 100$
Vertices__________
Co-Vertices__________
Foci__________
</td>
</tr>
<tr>
<td>Write the equation of the ellipse.</td>
<td>Vertex (0, 12)
Co-vertex (4, 0)

Vertex (-9, 0)
Focus (5, 0)</td>
</tr>
<tr>
<td>A putting surface at a golf course is in the shape of an ellipse. It is 20 yards long and 14 yards wide. Write an equation of the ellipse and find its area (A= πab).</td>
<td></td>
</tr>
</table>

10.5	**Hyperbolas**
Objective	1. Graph and write equations of hyperbolas.
Key Terms	Hyperbola



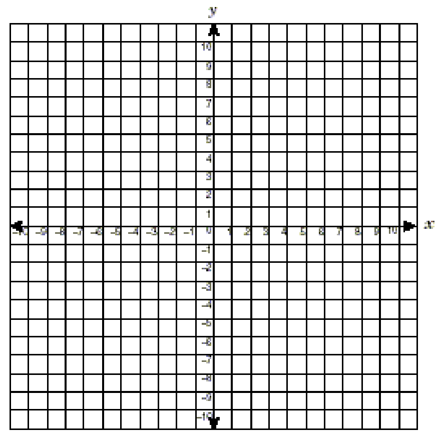
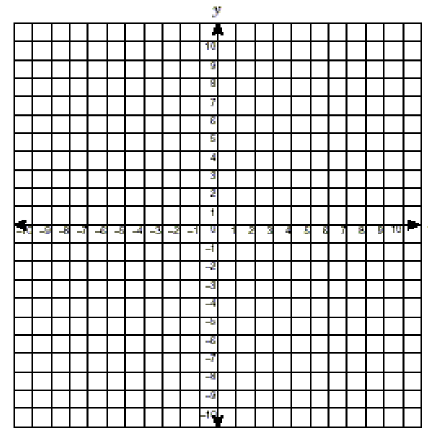


CHARACTERISTICS OF A HYPERBOLA (CENTER AT ORIGIN)

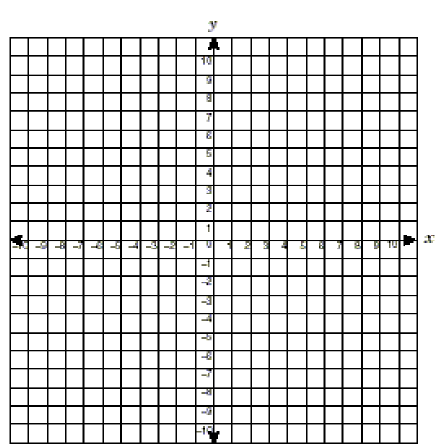
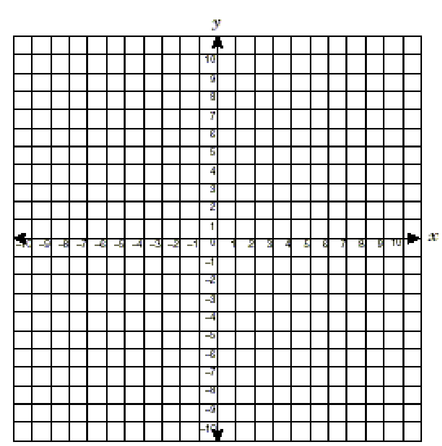
The **standard form of the equation of a hyperbola** with center at (0, 0) is as follows.

Equation	Transverse Axis	Asymptotes	Vertices
$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	Horizontal	$y = \pm\frac{b}{a}x$	$(\pm a, 0)$
$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$	Vertical	$y = \pm\frac{a}{b}x$	$(0, \pm a)$

The foci of the hyperbola lie on the transverse axis, c units from the center where $c^2 = a^2 + b^2$.

Graph the given hyperbola. Identify the vertices, foci and asymptotes.	$9x^2 - 16y^2 = 144$ Vertices________ Foci___________ Asymptotes_________  $\frac{y^2}{25} - \frac{x^2}{49} = 1$ Vertices_________ Foci_____________ Asymptotes__________ 
Write the equation of the hyperbola. With the following given information.	Foci (-2, 0) and (2, 0) Vertices (-1, 0) and (1, 0) Foci (0, -9) and (0, 9) Vertices (0, -8) and (0, 8)

10.6	Graphing and Classifying Conics
Objectives	1. Write and graph an equation of a parabola with its vertex at (h, k) and equations of a circle, ellipse or hyperbola with its center at (h, k). 2. Classify a conic using its equation.
Key Terms	Translated Conics
	STANDARD FORM OF EQUATIONS OF TRANSLATED CONICS In the following equations the point (h, k) is the vertex of the parabola and the center of the other conics. **Circle:** $(x-h)^2+(y-k)^2=r^2$ **Parabola: Horizontal axis** $(y-k)^2=4p(x-h)$ **Vertical axis** $(x-h)^2=4p(y-k)$ **Ellipse: Horizontal axis** $\frac{(x-h)^2}{a^2}+\frac{(y-k)^2}{b^2}=1$ **Vertical axis** $\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$ **Hyperbola: Horizontal axis** $\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$ **Vertical axis** $\frac{(y-k)^2}{a^2}-\frac{(x-h)^2}{b^2}=1$
Write the equation of the circle	With a center (4, -1) and a radius of 7

Write the equation of the parabola.	With a vertex at (3, 2) and a focus at (4, 2)
Write the equation of the ellipse.	With vertices at (4, 4) and (4, -8) and foci at (4, 2) and (4, -6)
Graph the following translated conic.	$(x+1)^2 + (y-4)^2 = 9$ $\frac{(x-3)^2}{25} + \frac{(y-2)^2}{16} = 1$  

Classifying a Conic	**General Second Degree Equation** $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ **Find the Discriminant:** $b^2 - 4ac$ IF $b^2 - 4ac < 0$, B = 0 and A = C, then the conic section is a ____________. IF $b^2 - 4ac < 0$, and either B ≠ 0 or A ≠ C, then the conic section is a ____________. IF $b^2 - 4ac = 0$, then the conic section is a ____________. IF $b^2 - 4ac > 0$, then the conic section is a ____________.
Classify the conic.	$x^2 + y^2 - 2x + 4y - 11 = 0$ $y^2 - 18x + 84 = 0$ $2x^2 + y^2 - 4x - 4 = 0$ $4x^2 - y^2 + 16x + 6y - 3 = 0$

10.7	Solving Quadratic Systems
Objectives	1. Solve systems of quadratic equations.
Solve by substitution. Find the points of intersection of the graphs.	$x^2 + y^2 = 5 \;\; and \;\; y = 2x$ $3x^2 - 3y^2 = 0 \;\; and \;\; 3y^2 + x = 0$
Solve by combination. Find the points of intersections of the graphs.	$x^2 + y^2 - 20x + 64 = 0 \;\; and \;\; x^2 - y^2 - 16 = 0$