Chapter 9 – Topics in Analytic Geometry, Part I

Section 1	Circles and Parabolas
Section 2	Ellipses
Section 3	Hyperbolas

Vocabulary

Conic (section)	Circle
Ellipse	Parabola
Hyperbola	Focus
Vertex	Directrix
Axis (of symmetry)	Center
Radius	Major axis
Minor axis	Center
Foci	Eccentricity
Vertices	Transverse axis
Conjugate axis	Asymptotes

Section 9.1 Circles and Parabolas

Objective: In this lesson you learned how to recognize conics, write equations of circles in standard form, write equations of parabolas in standard form, and use the reflective property of parabolas to solve problems.

Important Vocabulary				
Conic (Section)	**Circle**	**Ellipse**	**Parabola**	**Hyperbola**
Focus	**Vertex**	**Directrix**	**Axis (of Symmetry)**	**Center**
Radius				

I. Conics

A **conic section,** or **conic**, is:

What you should learn:

How to recognize a conic as the intersection of a plane and a double-napped cone

Name the four basic conic sections:

In the formation of the four basic conics, the intersecting plane does not pass through the vertex of the cone. When the plane does pass through the vertex, the resulting figure is a(n)

_________________________________, such as ____________________

____

II. Parabolas

A **parabola** is:

What you should learn:

How to write equations of parabolas in standard form

The midpoint between the focus and the directrix is the __________________ of a parabola. The line passing through the focus and the vertex is the _________________________________ of the parabola.

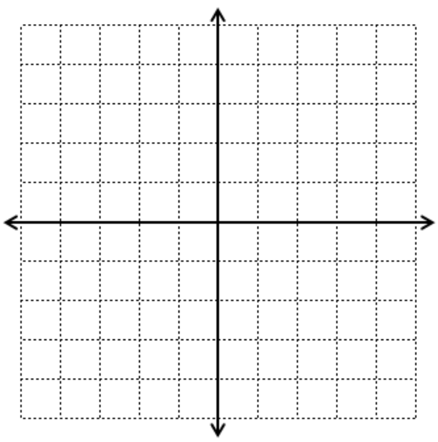
The standard form of the equation of a parabola with a vertical axis having a vertex at (h, k) and directrix $y = k - p$ is _______________________________________.

The standard form of the equation of a parabola with a horizontal axis having a vertex at (h, k) and a directrix $x = h - p$ is _______________________________________.

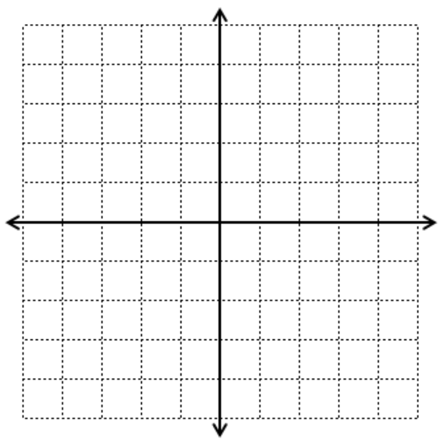
The focus lies on the axis p units (directed distance) from the vertex. If the vertex is at the origin $(0, 0)$, the equation takes one of the following forms:

_________________________________ or _________________________________.

Vertical Parabola



Horizontal Parabola



III. Reflective Properties of Parabolas

A **focal chord** is:

What you should learn:

How to use the reflexive property of parabolas to solve real-life problems.

The specific focal chord perpendicular to the axis of a parabola is called the

______________________.

The reflexive property of a parabola states that the tangent line to a parabola at point P makes equal angles with the following two lines:

1)

2)

IV. Circles

What you should learn:

How to write equations of circles in standard form

A **circle** is the set of all points (x, y) in a plane that are

________________________ from a fixed point (h, k), called the

__________________ of the circle. The distance r between the

center and any point (x, y) on the circle is the ___________________.

The **standard form of the equation of a circle** with center (h, k) and radius r is

___________________________________.

The standard form of the equation of a circle with radius r and whose center is the origin is

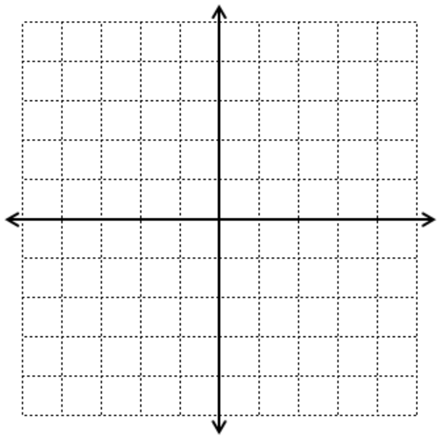
___________________________________.

Section 9.1 Examples – Circles and Parabolas

(1) Find the standard form of the equation of the parabola with vertex at the origin and focus at $(1, 0)$.

(2) Find the vertex, focus, and directrix of the parabola and sketch its graph.

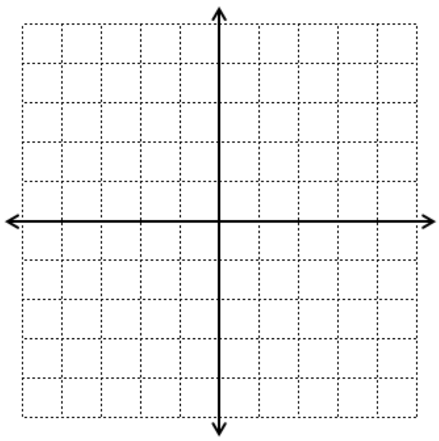
$y = -\frac{1}{2}x^2 - x + \frac{1}{2}$



(3) The point $(0, 1)$ is on a circle whose center is at $(-2, 1)$. Write the standard form of the equation of the circle.

(4) Sketch the circle. Identify its center, radius, and x- and y-intercepts.

$(x + 5)^2 + (y - 4)^2 = 25$



Section 9.2 Ellipses

Objective: In this lesson you learned how to write the standard form of the equation of an ellipse, and analyze and sketch the graphs of ellipses.

Important Vocabulary			
Ellipse	**Major Axis**	**Minor Axis**	**Center**
Foci	**Eccentricity**		

I. Introduction

An **ellipse** is:

What you should learn:

How to write equations of ellipses in standard form

The standard form of the equation of an ellipse with center (h, k) and a horizontal **major axis** of length $2a$ and a **minor axis** of length $2b$, where $0 < b < a$, is

__________________________________.

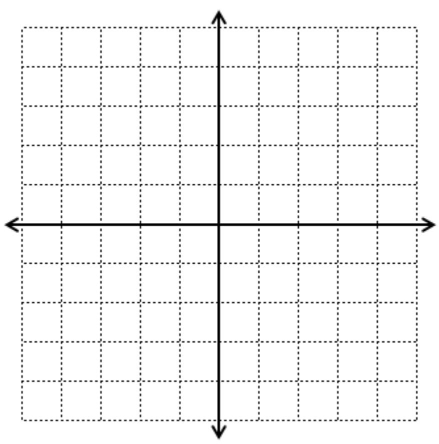
The standard form of an equation of an ellipse with center (h, k) and a vertical **major axis** of length $2a$ and a **minor axis** of length $2b$, where $0 < b < a$, is __________________________________.

In both cases, the foci lie on the major axis, c units from the center, with $c^2 =$________________.

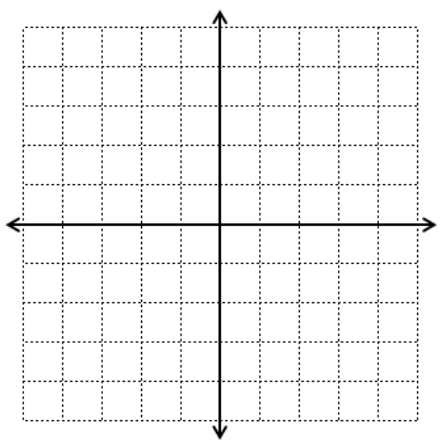
If the center is at the origin $(0, 0)$, the equation takes one of the following forms:

__________________________________ or __________________________________.

Vertical Ellipse



Horizontal Ellipse



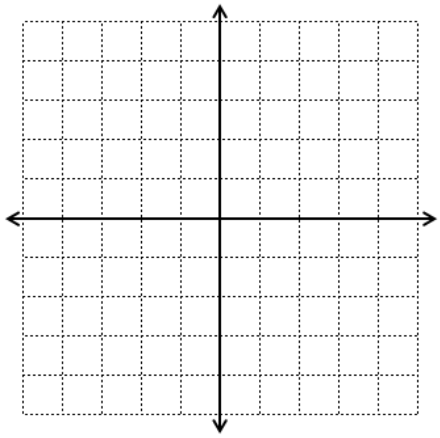
II. Eccentricity

What you should learn:
How to find eccentricities of ellipses

__________________________________ measures the ovalness of an ellipse. It is given by the ratio $e =$________. For every ellipse, the value of e lies between __________ and __________ For an elongated ellipse, the value of e is close to__________.

Section 9.2 Examples – Ellipses

(1) Sketch the ellipse given by $4x^2 + 25y^2 = 100$.



(2) Find the standard form of the equation of an ellipse having foci at $(0, 1)$ and $(4, 1)$ and a major axis of length 6.

(3) Find the standard form of the equation of an ellipse given by the equation
$9x^2 + 4y^2 - 54x + 40y + 37 = 0$.

Section 9.3 Hyperbolas

Objective: In this lesson you learned how to write the standard form of the equation of a hyperbola, and analyze and sketch the graphs of hyperbolas.

Important Vocabulary			
Hyperbola	**Vertices**	**Center**	**Transverse Axis**
Conjugate Axis	**Asymptotes**		

What you should learn:

How to write equations of hyperbolas in standard form

I. Introduction

A **hyperbola** is:

The line through a hyperbola's two foci intersects the hyperbola at two points called ___________________.

The midpoint of a hyperbola's **transverse axis** is the ________________ of the hyperbola.

The standard form of the equation of a hyperbola centered at (h, k) and having a horizontal **transverse axis** is ___________________________________.

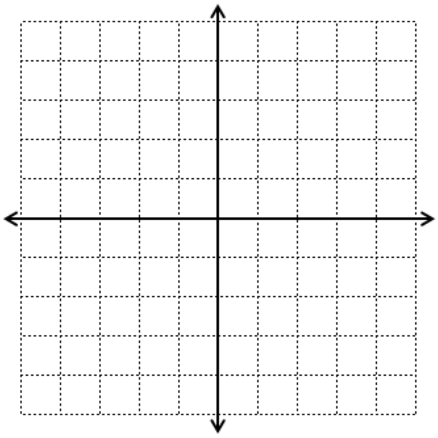
The standard form of the equation of a hyperbola centered at (h, k) and having a vertical **transverse axis** is ___________________________________.

In each case, the vertices and foci are, respectively, a and c units from the center. Moreover, a, b, and c are related by the equation ________________________________.

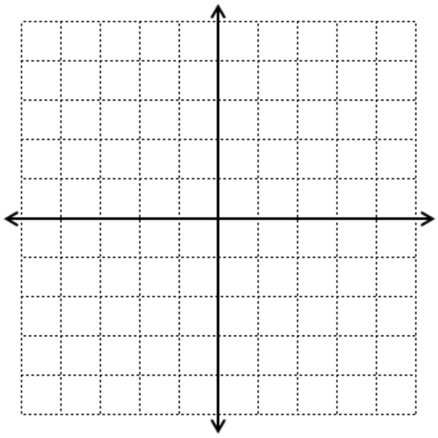
If the center of the hyperbola is at the origin $(0, 0)$, the equation takes one of the following forms:

__________________________________ or __________________________________

Vertical Hyperbola



Horizontal Hyperbola



II. Asymptotes of a Hyperbola

The **asymptotes** of a hyperbola with a horizontal transverse axis are ______________________________.

The **asymptotes** of a hyperbola with a vertical transverse axis are __________________________.

The **eccentricity** of a hyperbola is $e =$ __________, where the values of e are ______________________.

> What you should learn:
>
> How to find asymptotes of and graph hyperbolas

III. General Equations of Conics

The graph of $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ is one of the following:

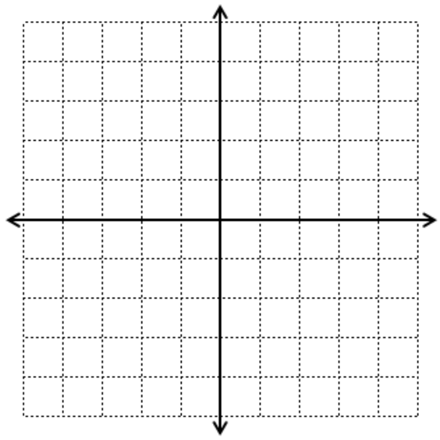
1) Circle if _______________
2) Parabola if _______________
3) Ellipse if _______________
4) Hyperbola if _______________

> What you should learn:
>
> How to classify conics from their general equations

Section 9.3 Examples – Hyperbolas

(1) Classify the equation $9x^2 + y^2 - 18x - 4y + 4 = 0$ as a circle, a parabola, an ellipse, or a hyperbola.

(2) Sketch the graph of the hyperbola given by $4x^2 - 3y^2 + 8x + 16 = 0$.



(3) Find the standard form of the equation of the hyperbola. Identify the center, vertices, foci and asymptotes of the hyperbola.

$$x^2 - 9y^2 + 36y - 72 = 0$$