# Math III Conics Reference

**standard form of the equation of a circle:**

$$(x - h)^2 + (y - k)^2 = r^2$$

**where (h,k) is the center of the circle and r is the radius**

## 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 ($y = 0$) |

## CHARACTERISTICS OF AN ELLIPSE (CENTER AT 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 $c^2 = a^2 - b^2$.

## 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 $c^2 = a^2 + b^2$.

## 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** $(x - h)^2 + (y - k)^2 = r^2$

| | Horizontal axis | Vertical axis |
|---|---|---|
| **PARABOLA** | $(y - k)^2 = 4p(x - h)$ | $(x - h)^2 = 4p(y - k)$ |
| **ELLIPSE** | $\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$ | $\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1$ |
| **HYPERBOLA** | $\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$ | $\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$ |

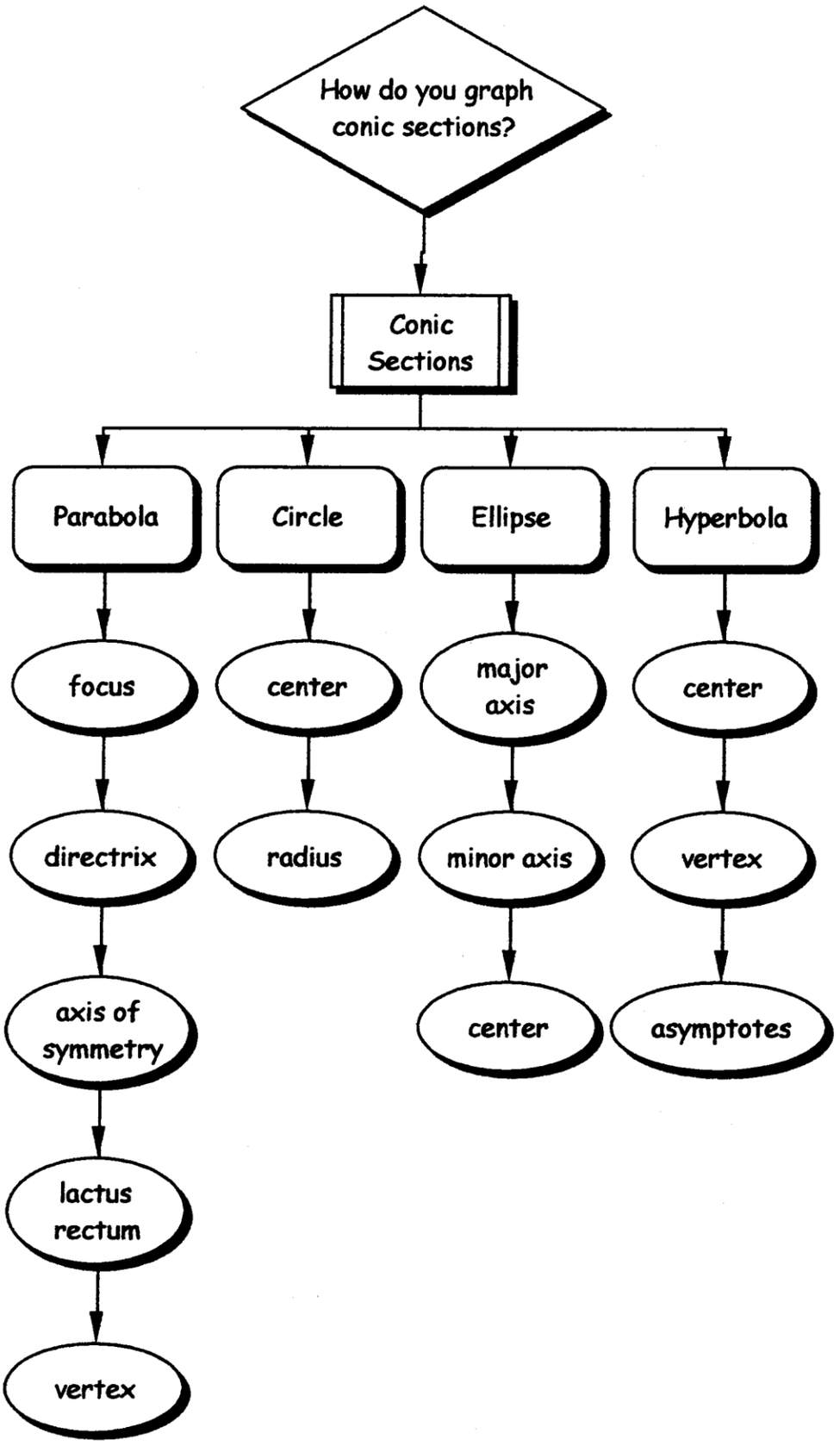
CONCEPT SUMMARY

## CLASSIFYING CONICS

If the graph of $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ is a conic, then the type of conic can be determined as follows.

| DISCRIMINANT | TYPE OF CONIC |
|---|---|
| $B^2 - 4AC < 0$, $B = 0$, and $A = C$ | Circle |
| $B^2 - 4AC < 0$ and either $B \neq 0$ or $A \neq C$ | Ellipse |
| $B^2 - 4AC = 0$ | Parabola |
| $B^2 - 4AC > 0$ | Hyperbola |

If $B = 0$, each axis of the conic is horizontal or vertical. If $B \neq 0$, the axes are neither horizontal nor vertical.


How do you graph conic sections?
Conic Sections
Parabola
Circle
Ellipse
Hyperbola
focus
center
major axis
center
directrix
radius
minor axis
vertex
axis of symmetry
center
asymptotes
lactus rectum
vertex

Circle



Parabola

Ellipse



Hyperbola

**Other**
**Helpful**
**Information**
**Just for Me!!**



Ellipse

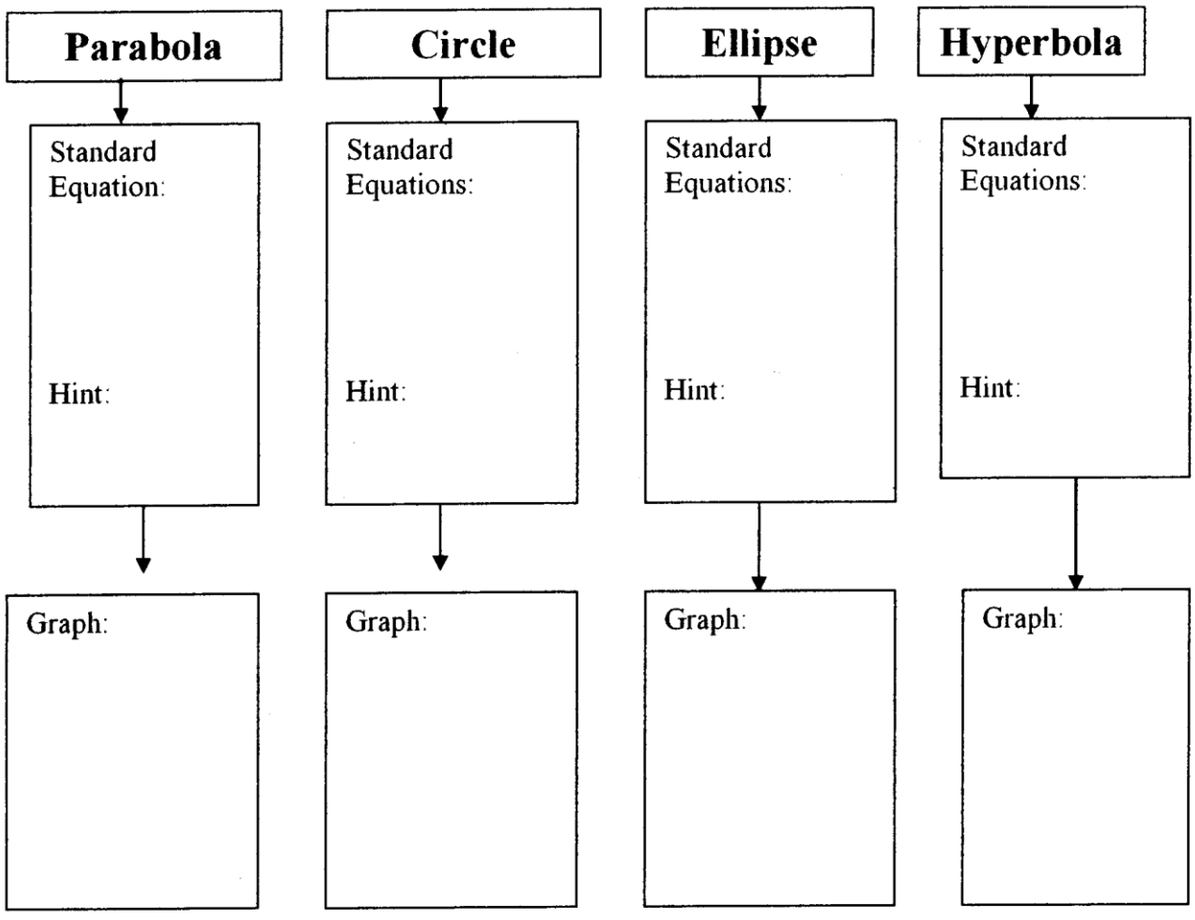
**Hyperbola**





Parabola

# Conic Sections



Worksheet  Figures in 3-Space

Draw a rectangular prism having a diagonal with the given endpoints.  Find the length of the diagonals.

1. (4, -5, 8) and (2, 2, 5) and (-2, 1, 0)
2. (9, 5, 1) and (12, 0, -1)
3. (0, 0, -8)

Graph the equation of the plane.

4. $2x - 4y - 3z = -15$
5. $3x + 7y - 3z + 42 = 0$

Write the equation of the sphere in standard form with the given center and radius.

6. center (8, -2, 0) r = 12
7. (10, -2, 3) $r = 3\sqrt{2}$
8. (-2, 7, 3) r = 7

Name: _____
Conic: _____

# Conic Celebration Lab

## **Procedure**:

1) Create a food item in the shape of your assigned conic. The food item itself can be in the shape of your conic or the decoration on the food can be in the shape of a conic.

2) Sketch your conic on a sheet of paper. Find the equation of your conic and give all the critical information about it.

3) Eat and enjoy!!

## **Grading Rubric**:

Mathematically complete and accurate: 7 points

- Sketch of conic (1) _____
- Equation (2) _____
- Critical Information (3) _____
- Food Item Present (1) _____

**Subtotal**: _____

Creativity (1) _____

Complexity (2) _____

**Subtotal**: _____

**Total Points**: _____

Name: _____

Write each of the following in standard form. List the important information and then graph.

**Parabolas**:

1) $3y^2 + x = 2$

2) $x - 5y^2 + 40y - 80 = 0$

3) $-5x^2 + 30x + y - 43 = 0$

4) $y^2 + 10y - 3x + 31 = 0$

5) $x^2 - 8x + 8y + 56 = 0$

**Circles**:

1) $x^2 + y^2 - 6x + 2y - 6 = 0$
2) $x^2 + y^2 + 4x - 27 = 0$

3) $x^2 + 12x + y^2 + 32 = 0$

4) $x^2 - 6x + y^2 + 2y = -9$

5) $4x^2 + 4y^2 + 40x + 24y + 55 = 0$

**Ellipse**:

1) $9x^2 + 49y^2 = 441$
2) $121x^2 + 25y^2 - 1936x + 4719 = 0$

3) $4x^2 + 16y^2 + 48x - 64y + 144 = 0$

4) $100x^2 + 81y^2 - 200x - 648y - 6704 = 0$

5) $4x^2 - 8x + 9y^2 + 36y + 4 = 0$

**Hyperbola**:

1) $4x^2 - 9y^2 - 40x + 64 = 0$
2) $25x^2 - y^2 - 4y = 29$

3) $49x^2 - 9y^2 - 490x + 784 = 0$

4) $-169x^2 + 64y^2 - 1690x + 26y - 14785 = 0$

5) $4y^2 - 36x^2 + 360x = 1044$

**Conics Video Project (Conic Project Part II)**

You will create a commercial for you conic. Your commercial needs to make everyone who wants to buy the conic.
You will work in groups of three. The groups will be arranged by the conic section you are assigned for your food part of the project.

Your video must contain the following;

- Facts about the topic
- Mathematician related to the topic
- At least two real – life uses/examples of topics
- Why the topic is important in life and in math.
- What is the most interesting thing about the topic?
- Explain one concept of the topic in detail.

Your video must be informative and entertaining. You should have a backdrop, props, etc. You can create your own backdrop or use something that already exists using the green screen option of windows movie maker, etc.

Make sure you video looks like a true commercial or news broadcast.

The rubric is a guideline for your project. You will be graded on you accuracy in the facts and math, your creativity, and your use of props, script, etc.
Your video must be submitted on CD, jumpdrive or email.
Make sure if you use windows movie maker you export it and that it will open on computers other than yours (saving as a jpeg ,etc. will help)

# Video- Preproduction : Conic Sections Project Part II

Teacher Name: **Mrs. Neal**

Student Name: _____

| CATEGORY | 4 | 3 | 2 | 1 | Score |
|---|---|---|---|---|---|
| **Script** | Script is complete and it is clear what each actor will say and do. Entries and exits are scripted as are important movements. Script is quite professional. | Script is mostly complete. It is clear what each actor will say and do. Script shows planning. | Script has a few major flaws. It is not always clear what the actors are to say and do. Script shows an attempt at planning, but seems incomplete. | There is no script. Actors are expected to invent what they say and do as they go along. | |
| **Concept** | Team has a clear picture of what they are trying to achieve. Each member can describe what they are trying to do and generally how his/her work will contribute to the final product. | Team has a fairly clear picture of what they are trying to achieve. Each member can describe what they are trying to do overall but has trouble describing how his/her work will contribute to the final product. | Team has brainstormed their concept, but no clear focus has emerged for the team. Team members may describe the goals/final product differently. | Team has spent little effort on brainstorming and refining a concept. Team members are unclear on the goals and how their contribution will help them reach the goal. | |
| **Research** | Note cards indicate that the group members developed questions about the assigned topic, consulted at least 3 reference sources, developed a position based on their sources, and correctly cited their sources. | Note cards indicate that the group members consulted at least 3 reference sources, developed a position based on their sources, and correctly cited their sources. | Note cards indicate that the group members consulted at least 2 reference sources, developed a position based on their sources, and correctly cited their sources. | There are fewer than two note cards OR sources are incorrectly cited. | |
| **All Parts** | Contains all required parts | Missing one minor component | Missing two minor components or one major component | Missing two or more components | |

| | | | | | |
|---|---|---|---|---|---|
| **Quality** | Excellent | Great | Good | Poor | |
| **Facts** | All facts and math is correct. No errors | Only minor errors with math or facts | Two minor errors in the math or facts. | Three minor or one major error with the math or factual information | |
| **Creativity** | Creativity demonstrated in script, video, backdrop etc | Some creativity | A little creativity | No creativity | |