

Identify each of the following conics. Then give the center/vertex. And the direction (unless it is a circle, because circles don't have a direction. Doh.)

1)  $\frac{2x^2}{8} + \frac{4y^2}{8} = \frac{8}{8}$   $\frac{x^2}{4} + \frac{y^2}{2} = 1$

Conic? ellipse,  $b^2 - 4ac < 0$   
 $A \neq 0$

Center/Vertex?

(0,0)

Direction?

horizontal

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

Conic? ellipse

Center/Vertex?

(0,0)

Direction?

horizontal

3)  $(x-1)^2 = -24y$

Conic? parabola

Center/Vertex?

(1,0)

Direction?

down

4)  $\frac{7x^2}{28} - \frac{7y^2}{28} = \frac{28}{28}$

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

5)  $(x-4)^2 + (y+25)^2 = 49$

Conic? circle

$\frac{(y-4)^2}{14} - \frac{(x+1)^2}{2} = 1$

6)  $\frac{(y-4)^2}{14} - \frac{7(x+1)^2}{14} = \frac{14}{14}$

Conic? Hyperbola

Center/Vertex?

(-1,4)

Direction? vertical

Branches: up + down

Center/Vertex? (0,0)

Direction? horizontal

Branches: left + right



Center/Vertex? (4,-5)

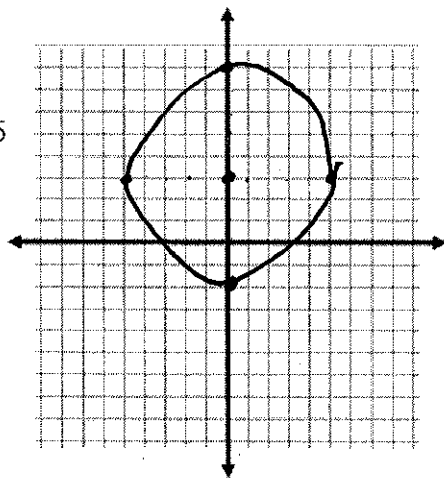
Direction?

Graph:

3)  $x^2 + (y-3)^2 = 25$

Center:  
(0,3)

Radius:  
5



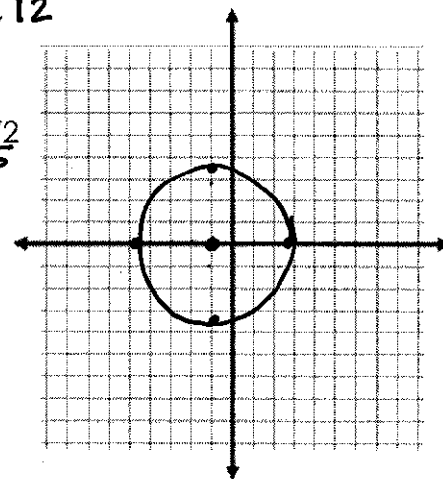
$(x+1)^2 + y^2 = 12$

Graph:

4)  $\frac{6(x+1)^2}{6} + \frac{6y^2}{6} = \frac{72}{6}$

Center:  
(-1,0)

Radius:  
 $\sqrt{12} = 2\sqrt{3}$



# Circles

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A **Hyperbola** is the set of all points  $P$  in a plane such that the difference of the distances from  $P$  to two fixed points, called the foci, is constant.

Horizontal Transverse Axis

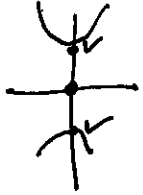
$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

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

Vertical Transverse Axis

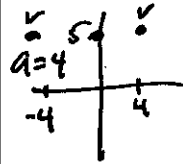
$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

1) Write the equation of the hyperbola with vertices at  $(0, \pm 3)$  and asymptotes of  $y = \pm \frac{3}{4}x$ .



$$\frac{y^2}{9} - \frac{x^2}{16} = 1$$

2) Write the equation of the hyperbola with vertices at  $(\pm 4, 5)$  and foci at  $(\pm 2\sqrt{5}, 5)$



$$\frac{x^2}{16} - \frac{(y-5)^2}{4} = 1$$

$$\begin{aligned} c &= 2\sqrt{5} \\ c^2 &= 20 \\ c^2 &= a^2 + b^2 \\ 20 &= 16 + b^2 \\ 4 &= b^2 \end{aligned}$$

For a hyperbola, the important characteristics are the **Center**, **Vertices**, **Co-vertices**, and the **Foci**. Remember that "a" is always in the first denominator. The transverse axis will be horizontal if x is first and vertical if y is first.

Also, you can write the equation of the asymptotes with the following formulas:

Horizontal:  $y = \pm \frac{b}{a}x$

Vertical:  $y = \pm \frac{a}{b}x$

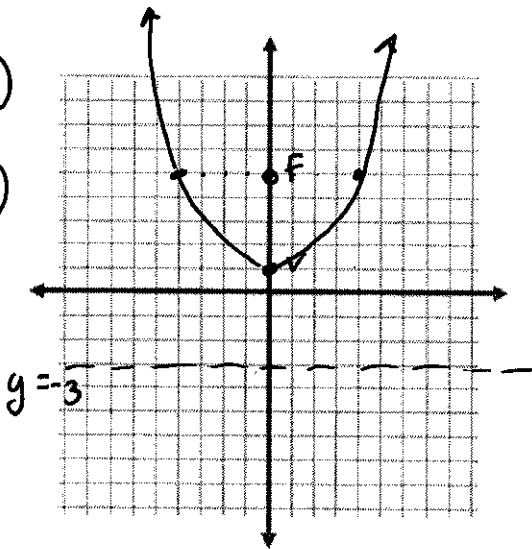
**(THE FORMULAS ONLY WORK IF THE CENTER IS AT THE ORIGIN!)**

3)  $x^2 = 16(y-1)$   $p=4$

Vertex:  $(0, 1)$

Focus:  $(0, 5)$

Directrix:  $y = -3$



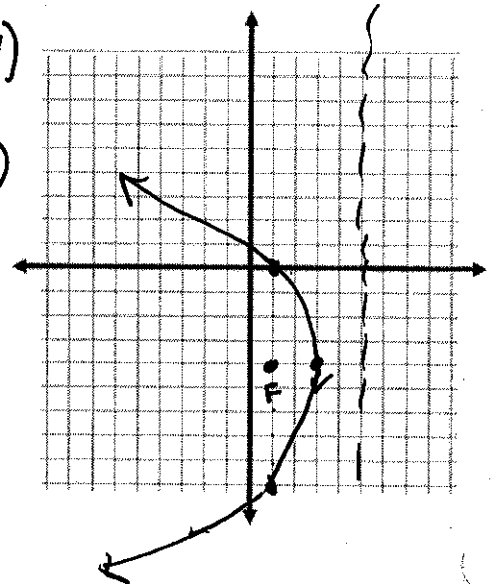
4)  $(y+4)^2 = -8(x-3)$

$$\begin{aligned} 4p &= -8 \\ p &= -2 \end{aligned}$$

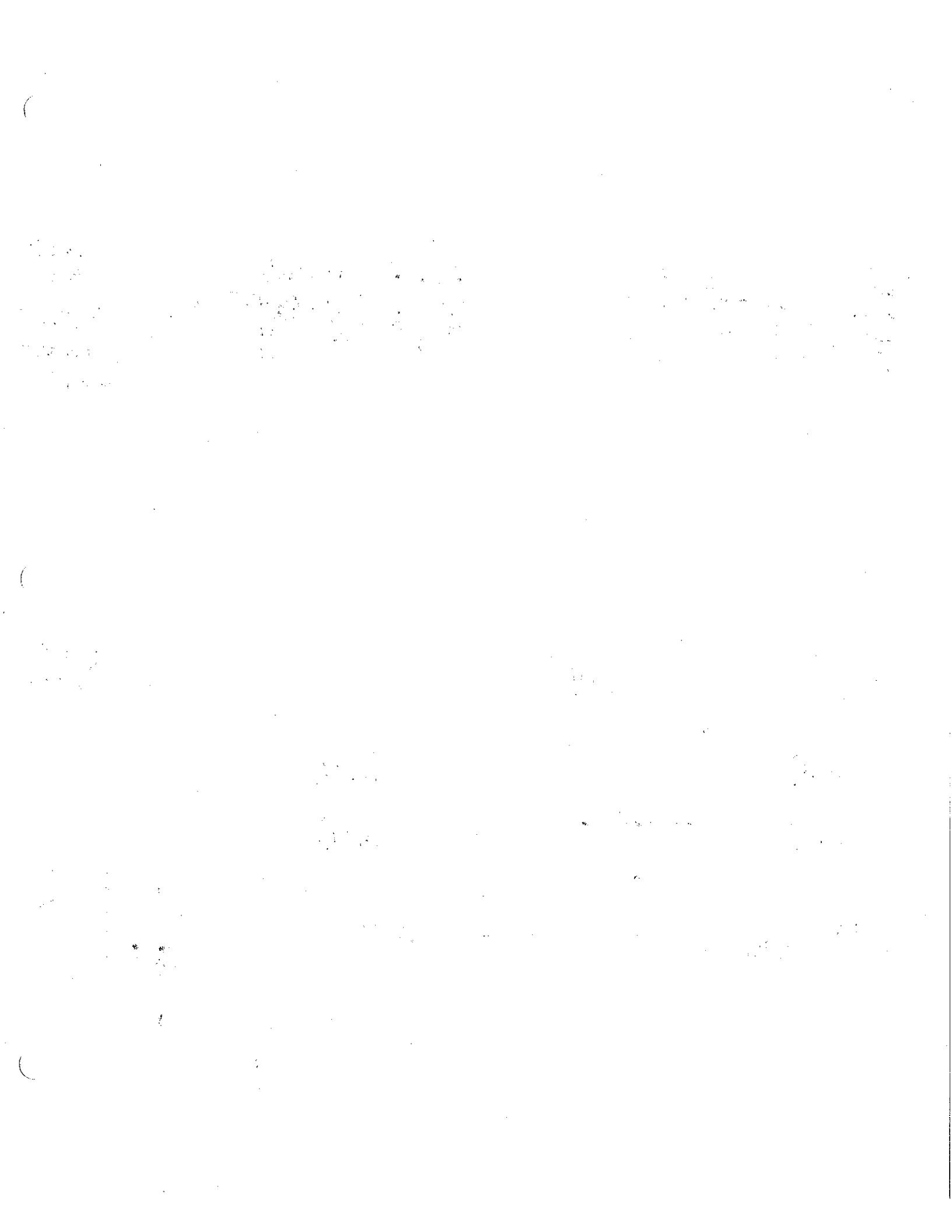
Vertex:  $(3, -4)$

Focus:  $(1, -4)$

Directrix:  $x = 5$



# Parabolas



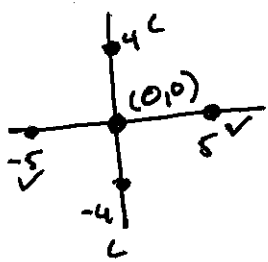
An **Ellipse** is the set of all points  $P$  in a plane such that the sum of the distances from  $P$  and two fixed points, called the foci, is constant.

Horizontal

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

$$c^2 = a^2 - b^2$$

1. Write the equation of the ellipse with center at the origin, vertices at  $(-5,0)$  &  $(5,0)$  and co-vertices at  $(0,4)$  and  $(0,-4)$



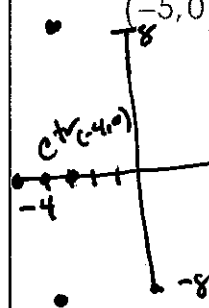
Center  $(0,0)$   
 $a=5$   $b=4$

$$\frac{x^2}{25} + \frac{y^2}{16} = 1$$

Vertical

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

2. Write the equation of the ellipse with vertices at  $(-4, \pm 8)$  and co-vertices at  $(-5,0)$  and  $(-3,0)$



$b=1$   $a=8$

$$\frac{(x+4)^2}{1} + \frac{y^2}{64} = 1$$

For an Ellipse, the important characteristics are the **Center**, **Vertices**, **Co-vertices**, and the **Foci**.

Remember that "a" is the larger number and the ellipse will be horizontal if a is beneath x, vertical if a is beneath y

Identify the important characteristics for each of the following parabola and graph it

3)  $\frac{(x-2)^2}{9} + \frac{(y+1)^2}{49} = 1$   
 $b=3$   $a=7$

Center:  
 $(2, -1)$

Vertices:  
 $(2, 6)$   $(2, -8)$

Co-vertices:  
 $(-1, -1)$   $(5, -1)$

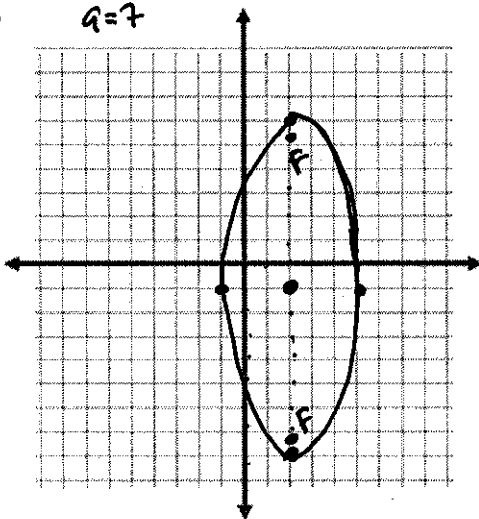
Foci:  
 $c^2 = a^2 - b^2$

$$c^2 = 49 - 9$$

$$\sqrt{c^2} = \sqrt{40}$$

$$c = 2\sqrt{10}$$

$(2, -1 + 2\sqrt{10})$   
 $(2, -1 - 2\sqrt{10})$



4)  $\frac{x^2}{64} + \frac{(y-4)^2}{9} = 1$

Center:  
 $(0, 4)$

Vertices:  
 $(8, 4)$   $(-8, 4)$

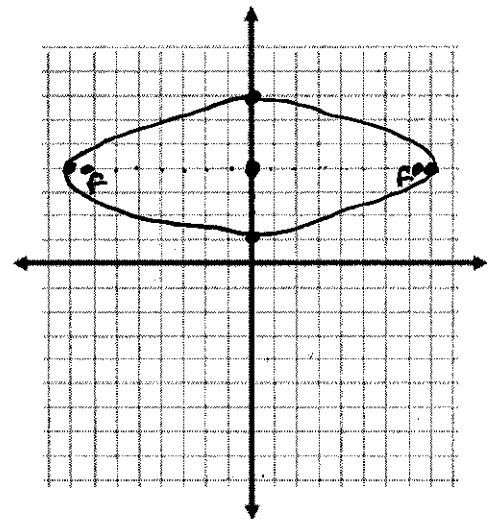
Co-vertices:  
 $(0, 1)$   $(0, 7)$

Foci:  
 $c^2 = a^2 - b^2$

$$c^2 = 64 - 9$$

$$c^2 = 55$$

$(\sqrt{55}, 4)$   $(-\sqrt{55}, 4)$



Ellipses

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

2. The second part of the document outlines the various methods used to collect and analyze data. It includes a detailed description of the sampling process, which was designed to be representative of the entire population. The analysis then focuses on identifying trends and patterns within the data set.

3. The final part of the document provides a summary of the findings and offers recommendations for future research. It suggests that further studies should be conducted to explore the underlying causes of the observed trends and to test the effectiveness of the proposed interventions.

4. The data collected over the course of the study shows a clear upward trend in the number of transactions. This increase is attributed to several factors, including improved marketing strategies and a growing customer base. The analysis also reveals that the majority of transactions are concentrated in the first half of the year.

5. The findings indicate that there is a strong correlation between the amount spent and the frequency of purchases. This suggests that customers who spend more are also more likely to return to the store. This insight is valuable for developing targeted marketing campaigns and loyalty programs.

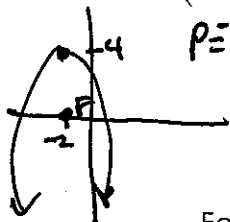
6. The document concludes by highlighting the need for continuous monitoring and evaluation of the data. It stresses that the information gathered should be used to inform decision-making and to optimize business operations. Regular updates to the data collection process will ensure that the organization remains competitive in a dynamic market.

A **Parabola** is the set of all points equidistant from a point called the focus and a line called the directrix.

$$(x-h)^2 = 4p(y-k)$$

$$(y-k)^2 = 4p(x-h)$$

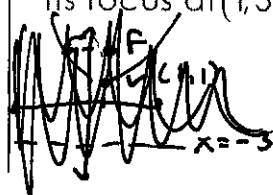
1) Write the equation of the parabola with vertex at  $(-2, 4)$  and focus at  $(-2, 0)$ .



$$p=4$$

$$(x+2)^2 = -16(y-4)$$

2) Write the equation of the parabola with its focus at  $(1, 5)$  and directrix of  $x = -3$ .



$$p=2$$

$$(y-5)^2 = 8(x+1)$$

For a Parabola, the important characteristics are the **Vertex**, **Focus**, and the **Directrix**. Remember that the Directrix is a line!

Identify the important characteristics for each of the following parabola and graph it

For the following hyperbolas, write the equations of the asymptotes..

$$3) \frac{x^2}{81} - \frac{y^2}{9} = 1$$

$$a=9 \quad b=3$$

$$m = \frac{3}{9} = \frac{1}{3}$$

$$y = \pm \frac{1}{3}x$$

$$4) \frac{y^2}{25} - \frac{x^2}{36} = 1$$

$$a=5 \quad b=6$$

$$m = \frac{5}{6}$$

$$y = \pm \frac{5}{6}x$$

Identify the important characteristics for each of the following hyperbolas and graph them.

$$5) \frac{(y+3)^2}{9} - \frac{(x+1)^2}{49} = 1$$

Center:

$$(-1, -3)$$

Vertices:

$$(-1, 0) \quad (-1, -6)$$

Co-vertices:

$$(-1, -3) \quad (-8, -3)$$

Foci:

$$(-1, -3 + \sqrt{58})$$

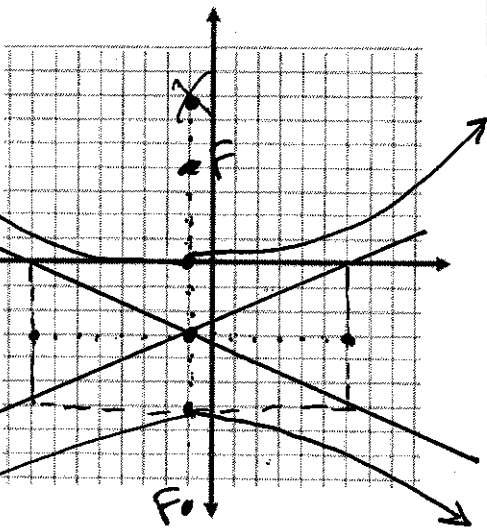
$$(-1, -3 - \sqrt{58})$$

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

$$9 + 49$$

$$c^2 = 58$$

$$c = \sqrt{58}$$



$$6) \frac{(x+1)^2}{16} - \frac{(y-5)^2}{4} = 1$$

Center:  $(-1, 5)$

Vertices:

$$(3, 5), \quad (-5, 5)$$

Co-vertices:

$$(-1, 7) \quad (-1, 3)$$

Foci:

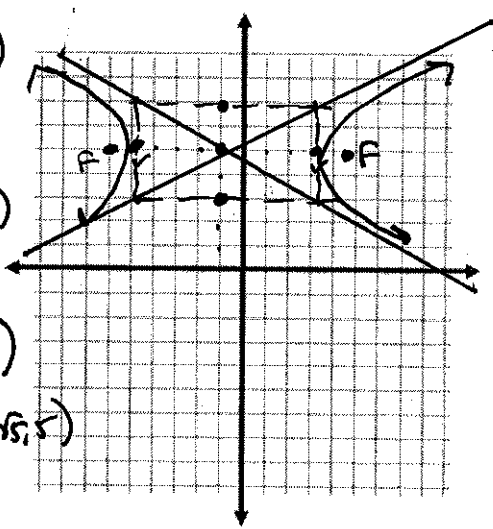
$$(-1 + \sqrt{17}, 5) \quad (-1 - \sqrt{17}, 5)$$

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

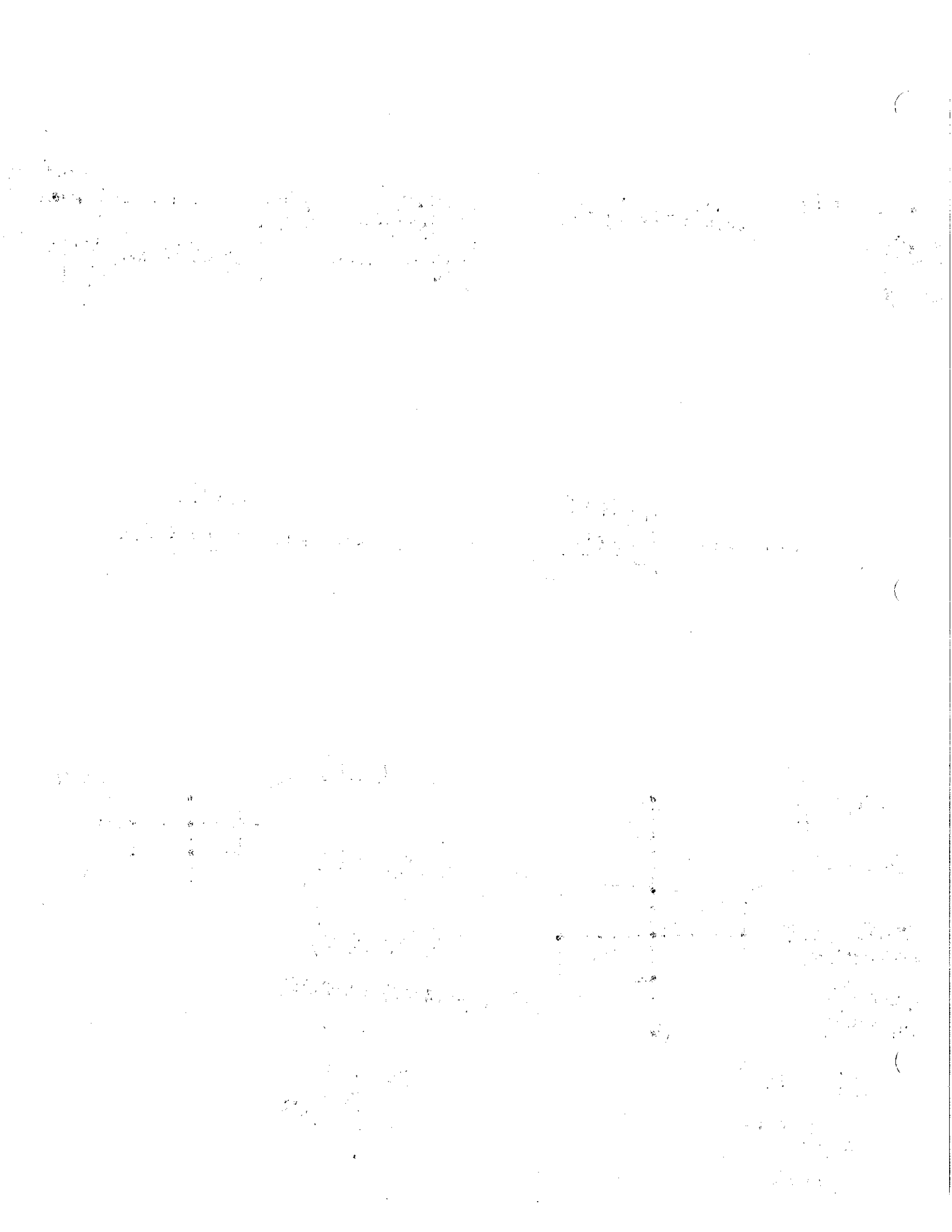
$$16 + 4$$

$$c^2 = 20$$

$$c = 2\sqrt{5}$$



# Hyperbolas





A **Circle** is the set of all points in a plane that are of distance  $r$  from a fixed point, called the center.

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

1) Write the equation of the circle with center at (8,7) and radius of 4

$$(x-8)^2 + (y-7)^2 = 16$$

2) Write the equation of the circle with center at (2,-3) and that goes through the point (-6, 8)

$$(x-2)^2 + (y+3)^2 = 185$$

$$r = \sqrt{(2-(-6))^2 + (-3-8)^2}$$

$$= \sqrt{64 + 121}$$

$$r = \sqrt{185}$$

$$\left(\frac{-6}{2}\right)^2$$

$$\left(\frac{-4}{2}\right)^2$$

7)  $4x^2 + 4y^2 - 24x - 16y = -8$

Conic? Circle

Center/Vertex?

(3, 2)  $r = \sqrt{11}$

Direction?

$$(4x^2 - 24x) + (4y^2 - 16y) = -8$$

$$4(x^2 - 6x + 9) + 4(y^2 - 4y + 4) - 8 - 16 = -8$$

$$4(x-3)^2 + 4(y-2)^2 = 44$$

$$(x-3)^2 + (y-2)^2 = 11$$

8)  $y^2 - 10y - 8x + 21 = 0$

Conic? Parabola

Center/Vertex?

(-1/2, 5)

Direction?

Right

$$y^2 - 10y = 8x - 21$$

$$y^2 - 10y + 25 = 8x - 21 + 25$$

$$(y-5)^2 = 8x + 4$$

$$(y-5)^2 = 8(x + 1/2)$$

$$\left(\frac{-6}{2}\right)^2$$

$$\left(\frac{-2}{2}\right)^2$$

9)  $16x^2 - 96x + 9y^2 + 36y = 78$

Conic? ellipse

Center/Vertex?

(3, -2)

Direction?

Vertical

$$(16x^2 - 96x) + (9y^2 + 36y) = 78$$

$$16(x^2 - 6x + 9) + 9(y^2 + 4y + 4) - 72 - 36 = 78$$

$$\frac{16(x-3)^2}{258} + \frac{9(y+2)^2}{258} = \frac{258}{258}$$

10)  $-2x^2 + 5y^2 + 24x - 20y - 102 = 0$

Conic? hyperbola

Center/Vertex?

(6, 2)

Direction?

Vertical

$$5(y^2 - 20y) - 2(x^2 - 24x) = 102$$

$$5(y^2 - 20y + 20) - 2(x^2 - 24x + 36) = 102 + 100 - 72$$

$$\frac{5(y-10)^2}{50} - \frac{2(x-12)^2}{50} = \frac{28}{50}$$

$$\left(\frac{-6}{2}\right)^2$$

$$\left(\frac{-2}{2}\right)^2$$

11)  $x^2 - 4y^2 - 6x + 8y - 3 = 0$

Conic? Hyperbola

Center/Vertex?

(3, 1)

Direction?

horizontal

$$(x^2 - 6x) - 4(y^2 - 2y) = 3$$

$$(x^2 - 6x + 9) - 4(y^2 - 2y + 1) = 3 + 9 - 4$$

$$\frac{(x-3)^2}{8} - \frac{4(y-1)^2}{8} = \frac{8}{8}$$

$$\frac{(x-3)^2}{8} - \frac{(y-1)^2}{2} = 1$$

12)  $9x^2 + 4y^2 + 36x - 24y + 36 = 0$

Conic? Ellipse

Center/Vertex?

(-2, 3)

Direction?

Vertical

$$9(x^2 + 36x) + 4(y^2 - 24y) = -36$$

$$9(x^2 + 36x + 36) + 4(y^2 - 24y + 36) = -36 + 324 + 144$$

$$\frac{9(x+12)^2}{36} + \frac{4(y-12)^2}{36} = \frac{232}{36}$$

$$\frac{(x+12)^2}{4} + \frac{(y-12)^2}{9} = 1$$

Which is it?

