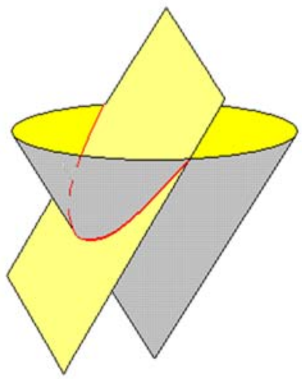
Name: ______________________________________ Date: ____________

PCH: Conic Sections: Parabolas Ms. Loughran

Do Now:
On Google Classroom (8 minutes)

A **parabola** is the curve formed by the intersection of a plane and a cone, when the plane is at the same slant as the side of the cone.



The latus rectum of a parabola is the chord that is passing through the focus of the parabola $\perp$ to the axis of symmetry of the parabola. ($\parallel$ to the directrix)

has a length of $4p$

p = focus y value − vertex y value

A parabola can also be defined as the set of all points in a plane which are an equal distance away from a given point (called the focus of the parabola) and a given line (called the directrix of the parabola).

$|p|$ = distance b/w focus y value and the vertex y-value

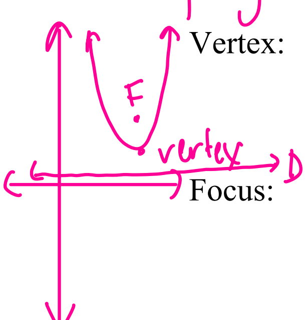
p = focus x value − vertex x value

Parabola with vertical axis of symmetry:

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

$$y - k = \frac{1}{4p}(x-h)^2$$

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



Vertex: (h, k)

Focus: $(h, k+p)$

Directrix: $y = k - p$

Axis of symmetry: $x = h$

If $p > 0$ opens up

If $p < 0$ opens down

Parabola with horizontal axis of symmetry:

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

$$x - h = \frac{1}{4p}(y-k)^2$$

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

Vertex: (h, k)

Focus: $(h+p, k)$

Directrix: $x = h - p$

Axis of symmetry: $y = k$

If $p > 0$ opens right

If $p < 0$ open left

Directions for #s 1-6: For each of the following, state the coordinates of the vertex and the focus and the equation of the directrix of the parabola defined by each equation. Then sketch a graph containing a minimum of 3 points.

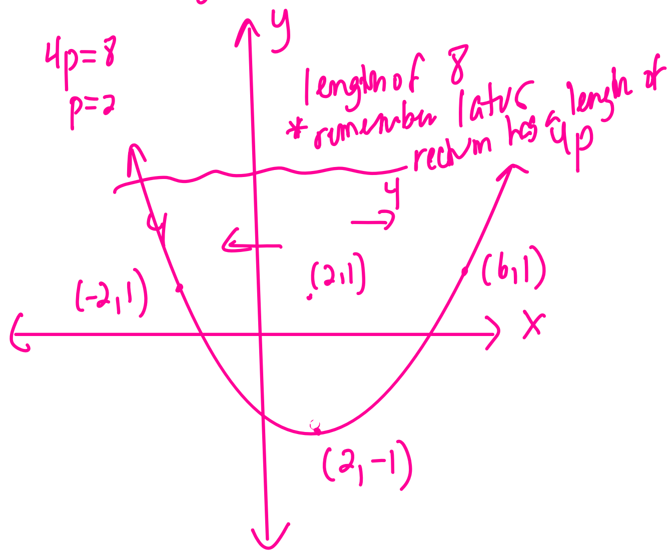
1. $\boxed{(x-2)^2 = \underset{4p}{8}(y+1)}$

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

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

$4p = 8$

$p = 2$



Vertex: $(2, -1)$

Focus: $(2, 1)$

Directrix: $y = -3$

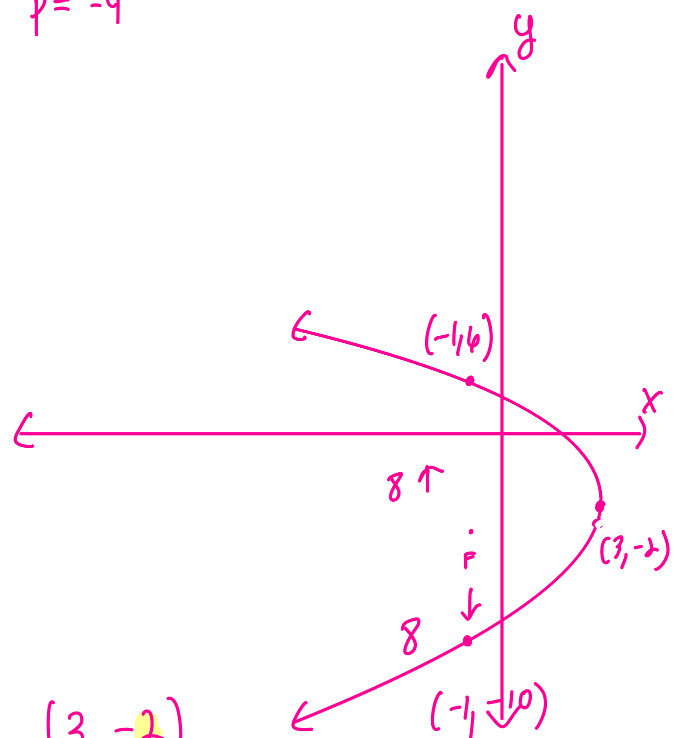
Axis of symmetry: $x = 2$

2. $(y+2)^2 = -16(x-3)$

opens left

$4p = -16$

$p = -4$



Vertex: $(3, -2)$

Focus: $(-1, -2)$

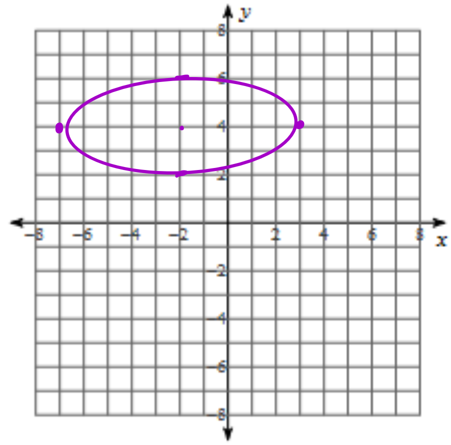
Directrix: $x = 7$

Axis of symmetry: $y = -2$

Conic Sections Review Worksheet 1

1. Find the required information and graph the conic section:

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



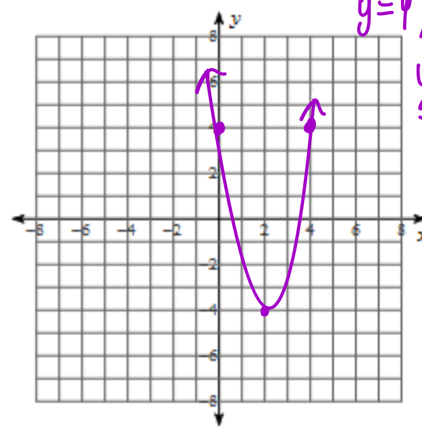
$a=5$ $\quad b=2$ $\quad c=\sqrt{21}$

HMA $\rightleftarrows$

Classify the conic section: ellipse **Center:** $(-2,4)$

Vertices: $(-7,4)$, $(3,4)$ **Foci:** $(-2\pm\sqrt{21}, 4)$

2. Find the required information and graph the conic section: $y=2x^2-8x+4$



plug in an x-value
when $x=0$
$y=4$,
use symmetry to get third point

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

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

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

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

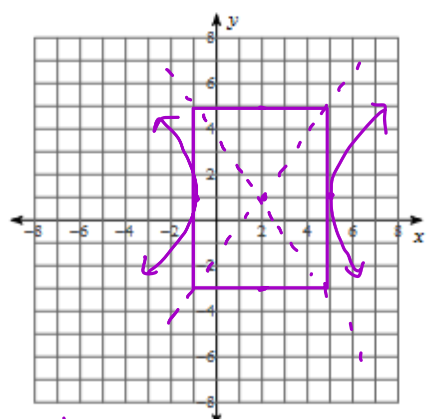
$2=\frac{1}{4p}$ $\quad 1=8p$ $\quad p=\frac{1}{8}$

Classify the conic section: parabola **Vertex:** $(2,-4)$

Focus: $(2,-4+\frac{1}{8})$ $(2,-31/8)$ **Directrix:** $y=-4-\frac{1}{8}=-\frac{33}{8}$

3. Find the required information. Then graph the conic section.

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



center: $(2,1)$

$a=3$ $\rightleftarrows$

$b=4$

$c=5$ $\rightleftarrows$

Classify the conic section: hyperbola **Foci:** $(-3,1)$, $(7,1)$

Vertices: $(-1,1)$, $(5,1)$ **Asymptotes:** $y-1=\pm\frac{4}{3}(x-2)$ **Center:** $(2,1)$

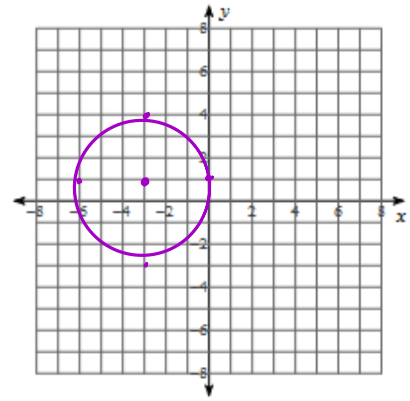
4. Find the equation of the circle that is tangent to the line x = 8 that has a center at (-5, 10).

$r=8-(-5)$

$$(x+5)^2+(y-10)^2=13^2$$

$$(x+5)^2+(y-10)^2=169$$

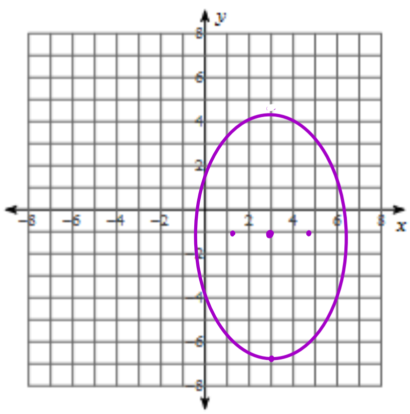
5. Find the required information and graph: $(x+3)^2+(y-1)^2=9$



Classify the conic section: circle **Center:** (-3,1) **Radius:** 3

6. Write the equation of the parabola in vertex form that has a the following information:
Vertex: (2, -8) **Directrix:** $x = 3$

7. Find the required information and graph: $7x^2+3y^2-42x+6y-39=0$



$7(x^2-6x+9)+3(y^2+2y+1)=39+63+3$

$7(x-3)^2+3(y+1)^2=105$

$\frac{(x-3)^2}{15}+\frac{(y+1)^2}{35}=1$

VMA

$a=\sqrt{15}$

$b=\sqrt{7}$

$c=\sqrt{20}$

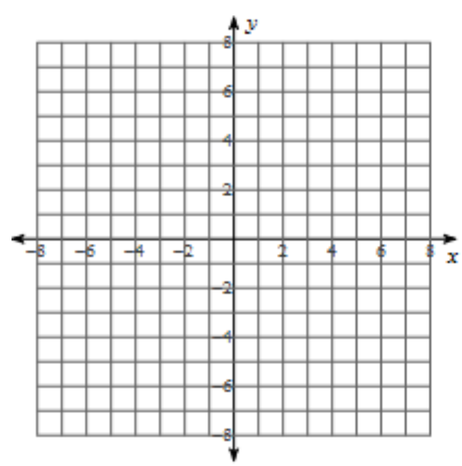
Classify the conic section: ellipse **Center:** (3,-1)

Vertices: $(3,-1\pm\sqrt{35})$ **Foci:** $(3,-1\pm2\sqrt{5})$

8. Find the required information and graph the conic section:

parabola

$4y^2+x-32y+68=0$



Classify the conic section: ______________ **Vertex:** ______________

Focus: ______________ **Directrix:** ______________

$r=12-(-2)$

9. Find the equation of the circle that is tangent to equation y = (-2) that has a center at (-6, 12).

$(x+6)^2+(y-12)^2=14^2$

$(x+6)^2+(y-12)^2=196$

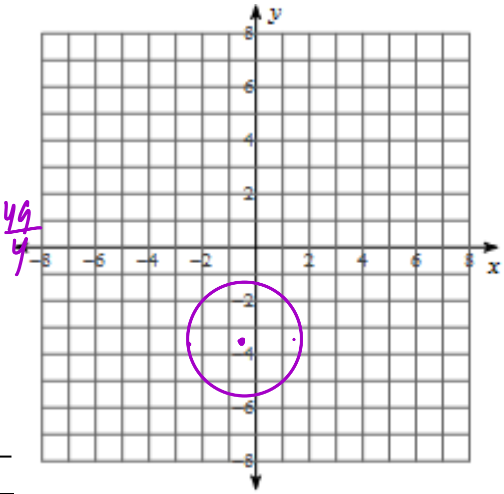
10. Find the required information and graph:

$$2x^2 + 2y^2 + 2x + 14y + 17 = 0$$

$x^2 + y^2 + x + 7y = -\frac{17}{2}$

$x^2 + x + \frac{1}{4} + y^2 + 7y + \frac{49}{4} = -\frac{17}{2} + \frac{1}{4} + \frac{49}{4}$

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



Classify the conic section: circle **Center:** $(-\frac{1}{2}, -\frac{7}{2})$

11. Find the required information. Then graph the conic section.

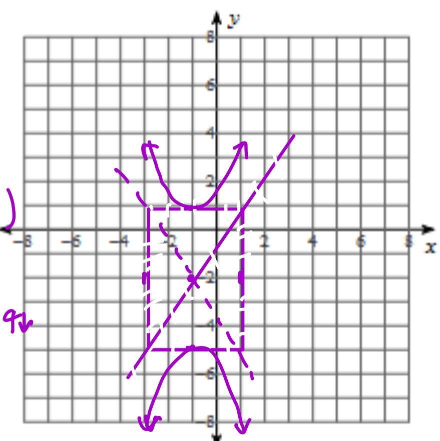
$$-9x^2 + 4y^2 - 18x + 16y - 29 = 0$$

$-9(x^2+2x+1) + 4(y^2+4y+4) = 29 - 9 + 16$

$-9(x+1)^2 + 4(y+2)^2 = 36$

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

center: $(-1,-2)$
$a=3$ ↑↓
$b=2$
$c=\sqrt{13}$ 9+4



Classify the conic section: hyperbola **Foci:** $(-1, -2 \pm \sqrt{13})$

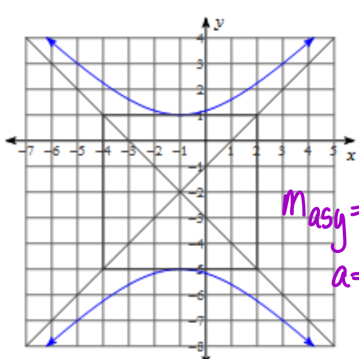
Vertices: $(-1, -2 \pm 3)$ **Asymptotes:** $y+2 = \pm\frac{3}{2}(x+1)$ **Center:** $(-1,-2)$

$(-1,1)$, $(-1,-5)$

12. Write the equation of the hyperbola shown.

center $(-1,-2)$

VTA



$m_{asy} = \pm 1$

$a=b=3$

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

13. Write the equation of the hyperbola in vertex form that has a the following information:

Vertices: (9, 12) and (9, -18) VTA center: $(9,-3)$

Foci: $(9, -3 + \sqrt{229})$ *and* $(9, -3 - \sqrt{229})$ $a = 15$

$c = \sqrt{229}$

$c^2 = a^2 + b^2$
$229 = 225 + b^2$
$4 = b^2$

$\frac{(y+3)^2}{225} - \frac{(x-9)^2}{4} = 1$

14. Write the equation of the circle in standard form given the endpoints of the diameter: (-12, 10) and (-18, 12).

Center: (midpt) $(-15, 11)$

radius: (distance) $\sqrt{(-15-(-12))^2 + (11-10)^2}$

$r = \sqrt{9+1}$ $r = \sqrt{10}$

$(x+15)^2 + (y-11)^2 = 10$

15. Use the information provided to write the equation of the ellipse in standard form.

Center: (-9, -5)   **Vertex:** (-9, -16)   **Focus:** $(-9, -5+6\sqrt{2})$

$a = 11$ VMA

$\frac{(x+9)^2}{49} + \frac{(y+5)^2}{121} = 1$

$c = 6\sqrt{2}$ or $\sqrt{72}$

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

$72 = 121 - b^2$

$49 = b^2$

$b = 7$

Part III: Find the equation for 16-20: { Hint: Graph to help find the equation }

16) Center (7, 3)   Vertex (7, 9)   Focus (7, -2)

$a = 6$ VMA $(7,-3)$ ellipse   ← foci fall inside vertices

$c = 3-(-2) = 5$

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

$25 = 36 - b^2$

$11 = b^2$

$\frac{(x-7)^2}{11} + \frac{(y-3)^2}{36} = 1$

17) Asymptotes: $y = -\frac{5}{4}x + 1$ $y = \frac{5}{4}x - 9$ Focus $(4, -4+\sqrt{41})$

$5 \to a$, $4 \to b$

VTA   y term (+)   "yab"

$c = \sqrt{41}$

center: $(4,-4)$

$\frac{(y+4)^2}{25} - \frac{(x-4)^2}{16} = 1$

18) Focus (12, 8)   Directrix: x = -2

parabola

19) Ellipse with Center(1,2), vertex at (4,2) and contains the point (1,3)

$a = 3$ HMA

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

plug in (1,3)

$0 + \frac{1}{b^2} = 1$

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

20) Ellipse with Foci(2,7) and (-2,7) and the length of the major axis is 6.

center: (0, 7)

$c = 2$

HMA

$2a = 6$

$a = 3$

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

$4 = 9 - b^2$

$5 = b^2$

$\frac{x^2}{9} + \frac{(y-7)^2}{5} = 1$

Conic Sections Card Match Activity

NAME ______________________________ DATE ______________

PARABOLAS	CIRCLES
A E M P	F B H D
ELLIPSES	**HYPERBOLAS**
G J C N	I K L O