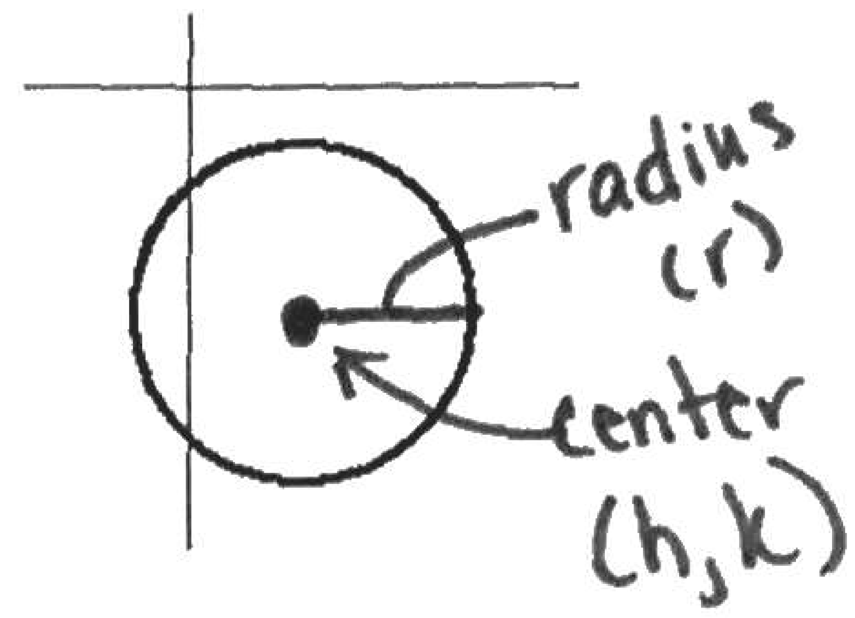
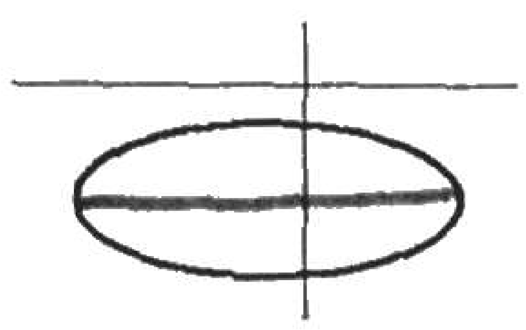
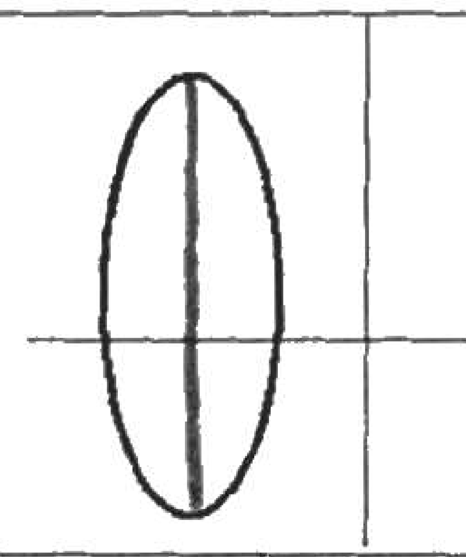
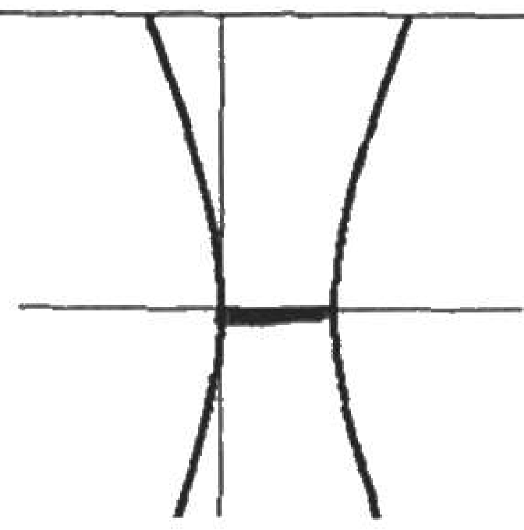
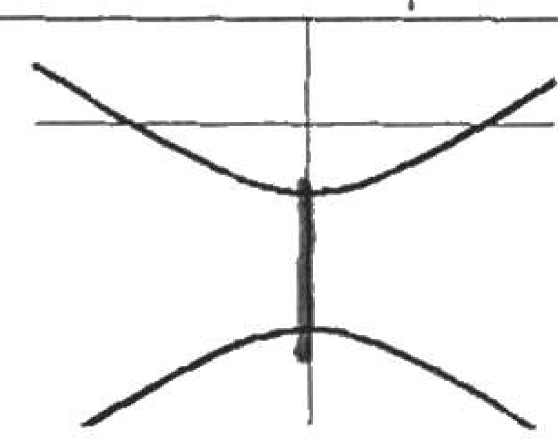
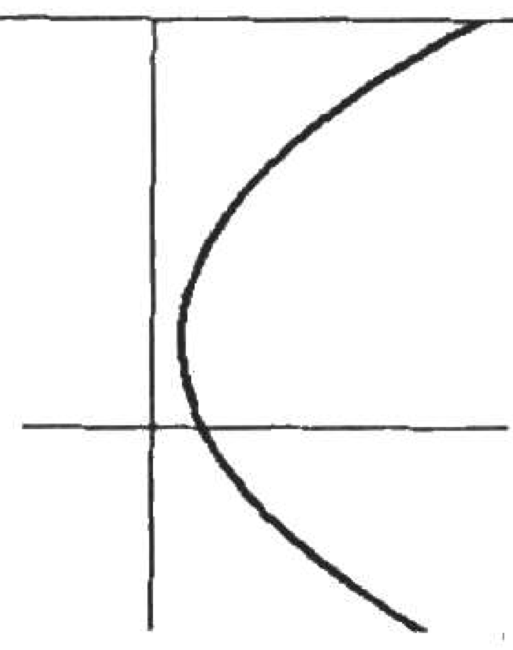
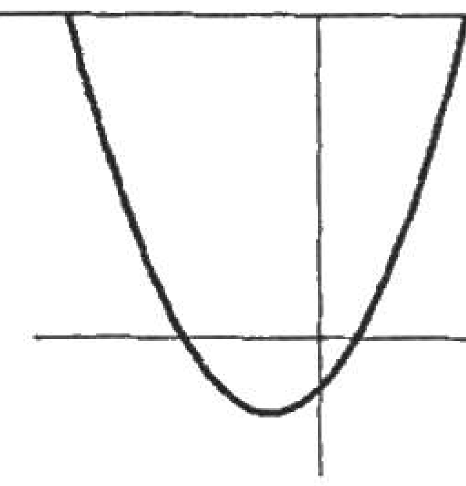
IDENTIFYING CONICS SECTIONS

CONIC	EQUATION IN STANDARD FORM			
CIRCLE	$(x-h)^2+(y-k)^2=r^2$			
	HORIZONTAL AXIS		VERTICAL AXIS	
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	$\frac{(x-h)^2}{a^2}-\frac{(y-k)^2}{b^2}=1$		$\frac{(x-h)^2}{b^2}-\frac{(y-k)^2}{a^2}=1$	
PARABOLA	$(y-k)^2=4p(x-h)$		$(x-h)^2=4p(y-k)$	

Identify the conic section that each equation represents.

a. $\frac{x^2}{7^2}+\frac{y^2}{8^2}=1$ Ellipse	b. $y^2=8(x+2)$ Parabola	c. $\frac{(x-2)^2}{5^2}-\frac{(y-3)^2}{2^2}=1$ Hyperbola
d. $(x+1)^2+(y-2)^2=3^2$ Circle	e. $\frac{(y+3)^2}{4}-\frac{(x-1)^2}{9}=1$ Hyperbola	f. $(x+5)^2=-4(y-2)$ Parabola

GLUE HERE

WHEN NOT GIVEN THE STANDARD FORM, LOOK FOR GENERALIZATIONS IN EQUATION

Conic	Example	Generalization
CIRCLE	$\underbrace{4x^2+4y^2}-3x+2y-12=0$	Sum of x^2 + y^2 w/ Same Coefficient
ELLIPSE	$\underbrace{5x^2+4y^2}-2x=0$ OR $\underbrace{3x^2+10y^2}-x+y-10=0$	Sum of x^2 + y^2 w/ different Coeffiaent
HYBERBOLA	$\underbrace{x^2-y^2}+2x-4y-2=0$ OR $\underbrace{4y^2-7x^2}-3x-2y-15=0$	Difference of x^2 + y^2
PARABOLA	$x^2-3x+4y+1=0$ OR $y^2+5x-6=0$	Only x^2 or y^2 not Both

Identify each conic section. Justify your answer. (Set = 0 + combine like terms)

a. $\underbrace{4x^2-9y^2}-18y+27=0$ Hyperbola	b. $\underbrace{x^2+y^2}-4x+6y-36=0$ Circle
c. $\underbrace{x^2+3y^2}+4x+6y+4=0$ Ellipse	d. $y^2+2y-3x-8=0$ Parabola
e. $(2x)^2+4y^2=36$ $4x^2+4y^2=36$ Circle	f. $3x^2+6x+10=3y^2-2y$ $\underbrace{3x^2-3y^2}+6x+2y+10=0$ Hyperbola
g. $x^2+\cancel{2y^2}-4x-6y+4=\cancel{2y^2}$ Parabola	h. $5x^2+5y^2-2x^2-25=0$ $\underbrace{3x^2+5y^2}-25=0$ Ellipse

(Generalizations)

Classifying Conic Sections

Are both variables being squared?
x^2 y^2

Yes

No

Parabola

Are the squared variables being subtracted? $-$

Hyperbola

No

Yes

Ellipse

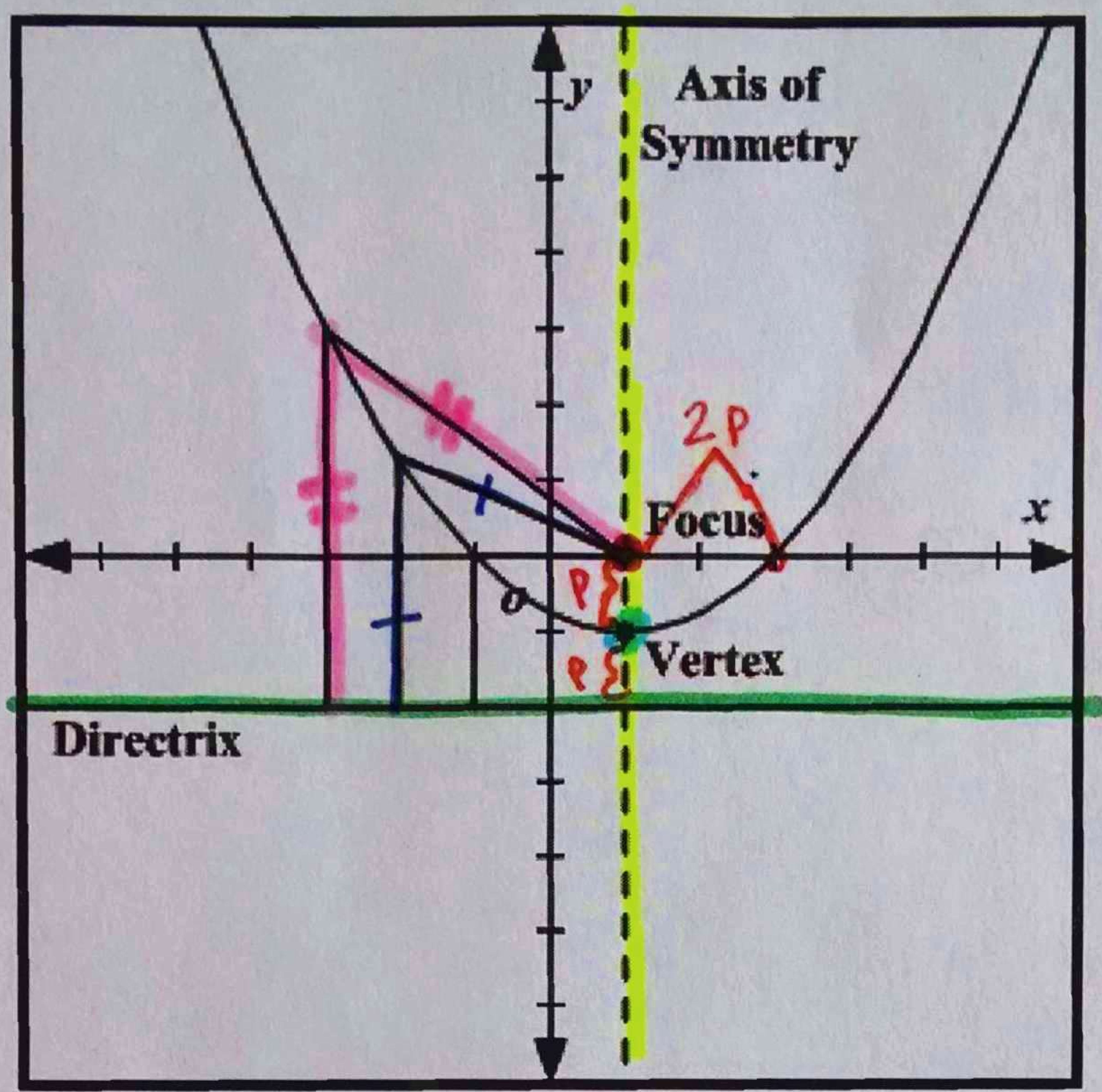
Added

Are the Coefficients of the squared terms the same?
$3x^2$ $3y^2$ $5x^2$ $5y^2$

No

Yes

Circle



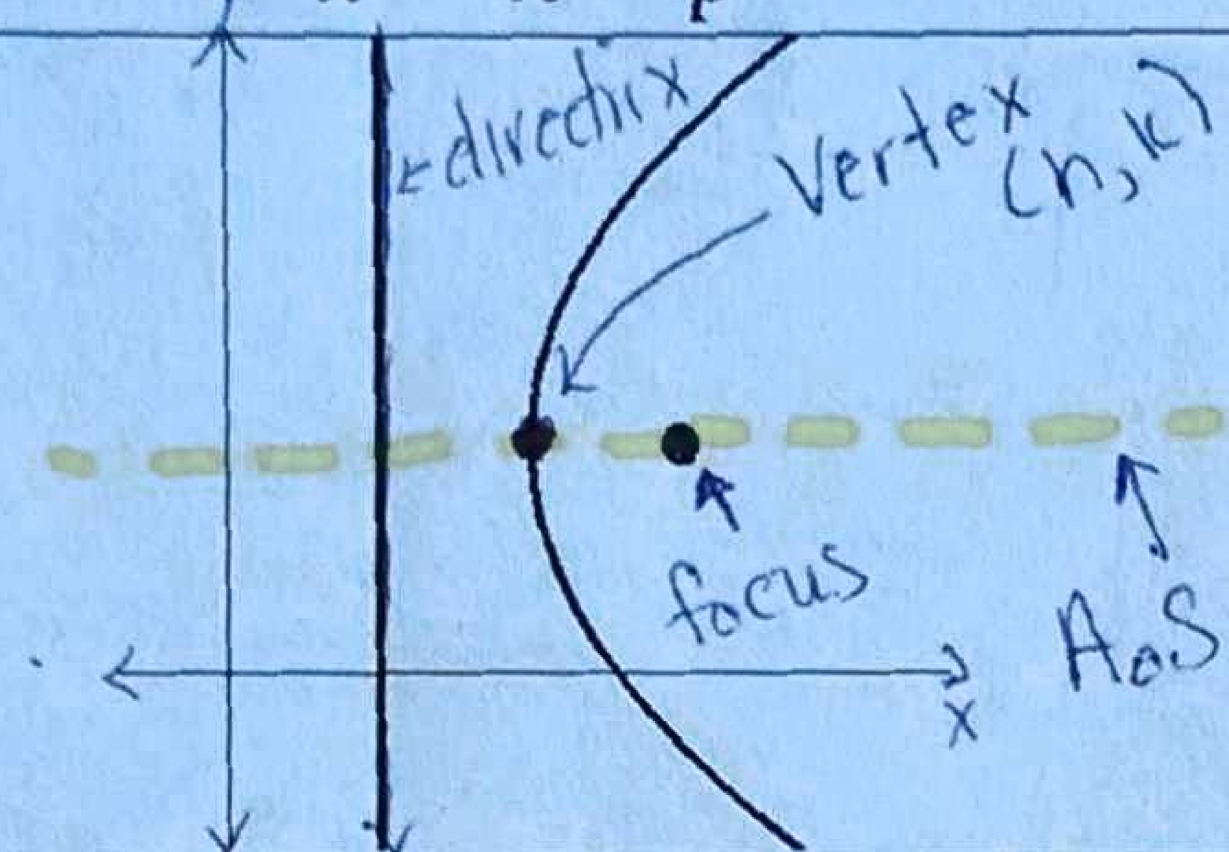
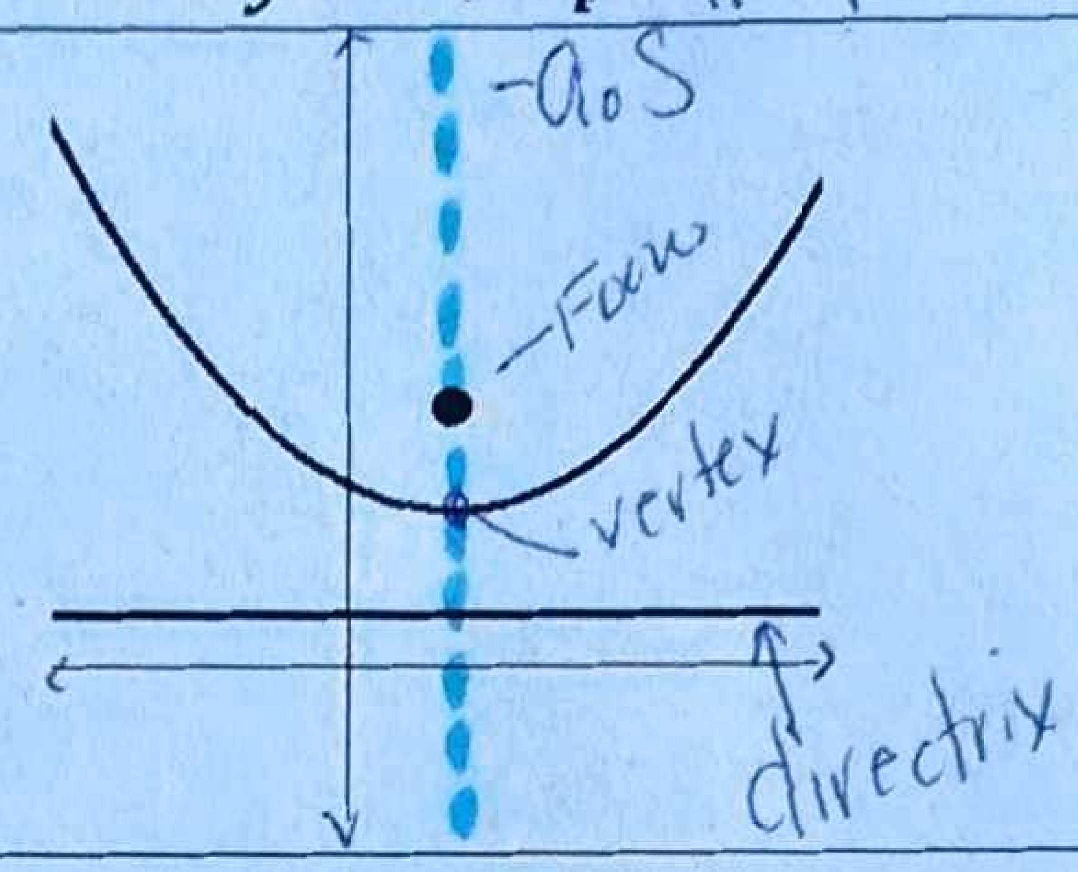
Vertex: highest or lowest point (where it changes direction)
(midpoint of focus and directrix)

Axis of Symmetry: passes through the vertex

Focus: Fixed point on the axis of symmetry

Directrix: Fixed Line, $\perp$ to A.S

"p": |p|: distance from the vertex to the focus and directrix

Standard Form for the Equation of a Parabola With a Vertex at (h, k)		
Axis of Symmetry	Horizontal $y = k$	Vertical $x = h$
Equation	$(y-k)^2 = 4p(x-h)$	$(x-h)^2 = 4p(y-k)$
Direction	Opens right if $p > 0$ (+) Opens left if $p < 0$ (-)	Opens up if $p > 0$ (+) Opens down if $p < 0$ (-)
Focus	$(h+p, k)$	$(h, k+p)$
Directrix	$x = h - p$	$y =$ ~~4kp~~ $k - p$
Graph		

Find the requested information for each parabola. Then graph.

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

a. $(x-1)^2 = 4(y-0)$

Direction it opens: up

Vertex: (1 , 0)

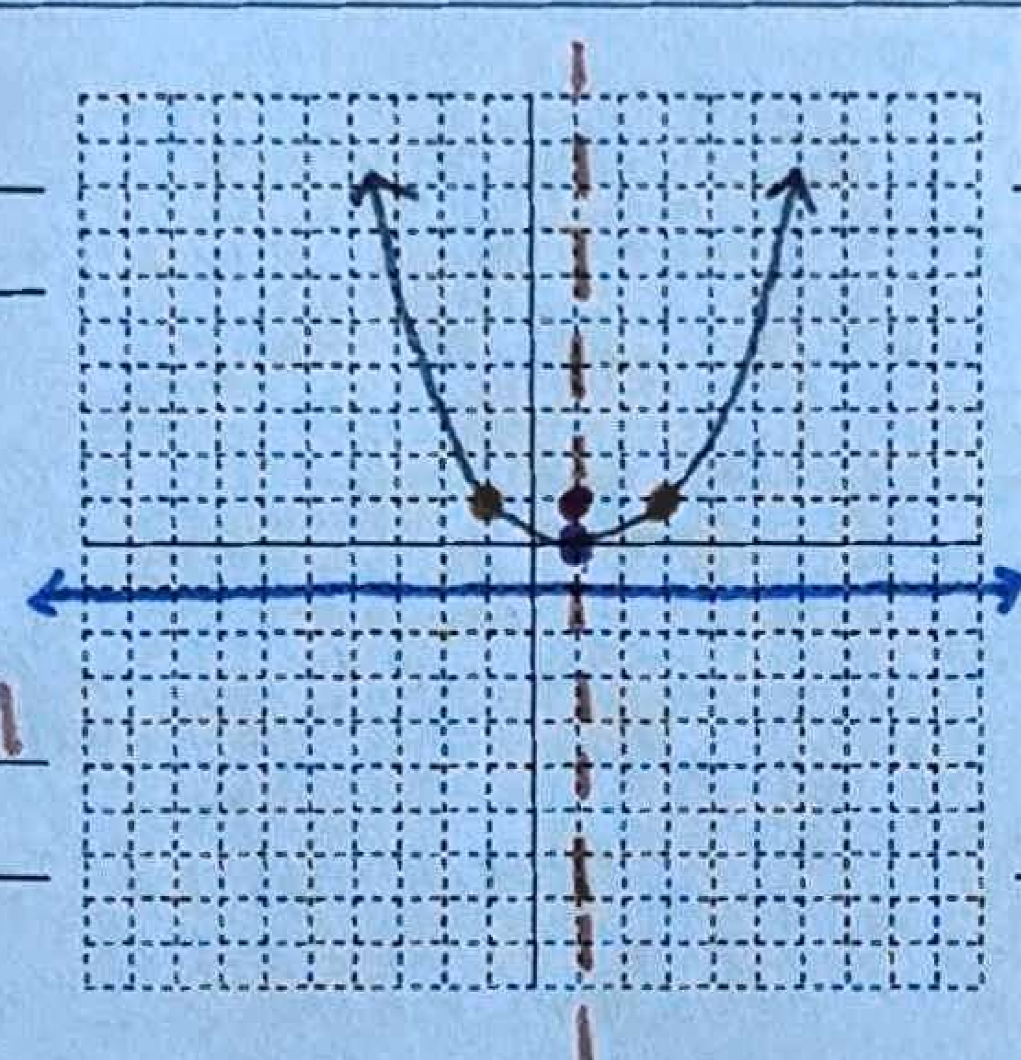
Value of p: +1

$4p = 4$

Axis of Symmetry: x = 1

Focus: (1, 1)

Directrix: y = -1



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

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

$y - -2$

Direction it opens: left

Vertex: (3 , -2)

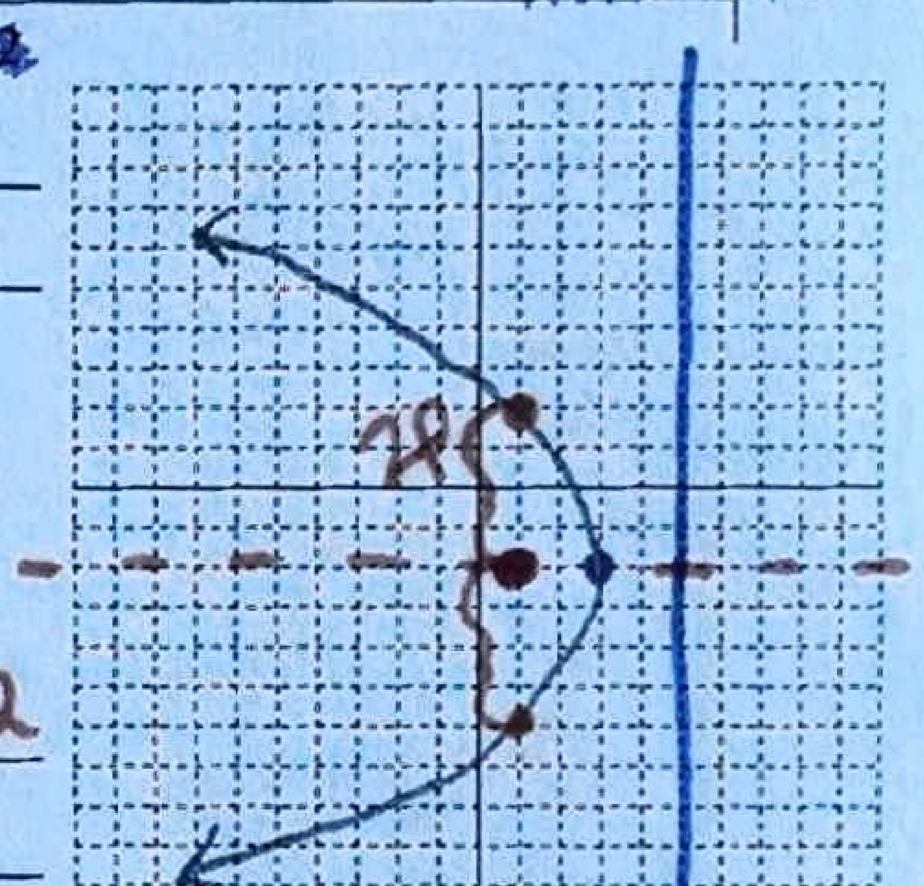
Value of p: -2

$4p = -8$

Axis of Symmetry: y = -2

Focus: (1, -2)

Directrix: x = 5



Find the requested information. Then use it to write the parabola's equation in standard form.

Direction open: down

Vertex: (2, 5)
(h, k)

Value of p: -1

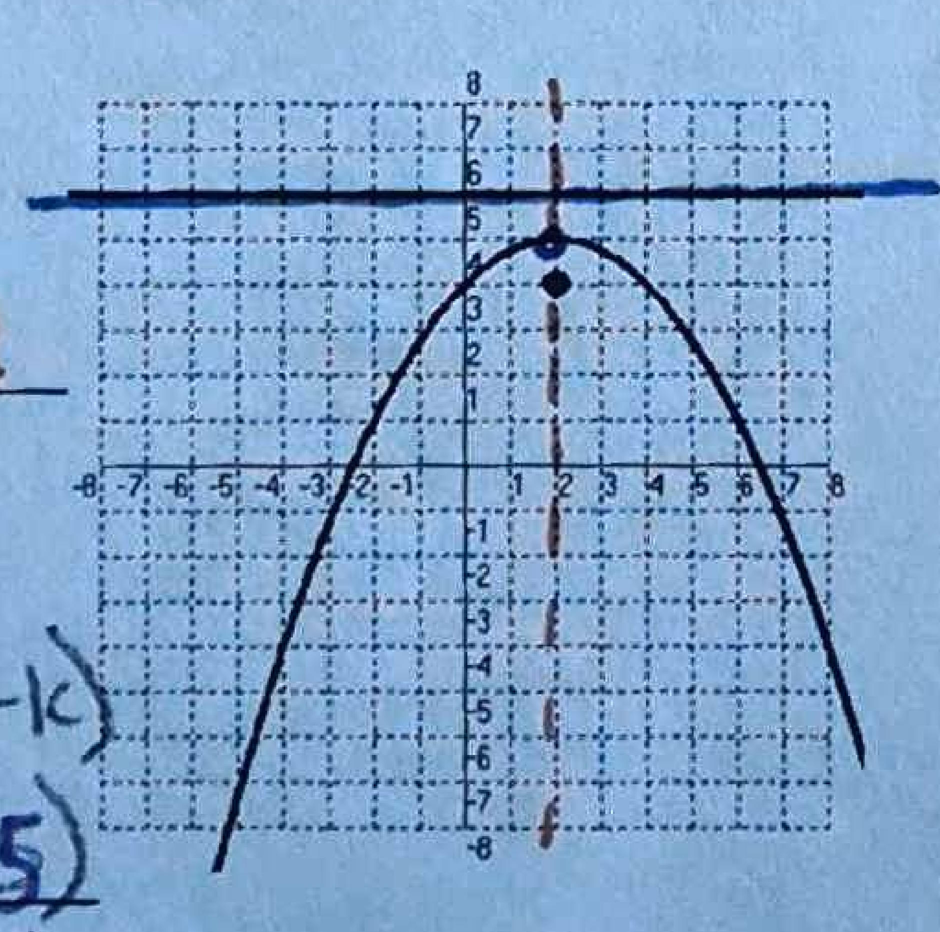
Axis of Symmetry: x = 2

Directrix: y = 6

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

$(x-2)^2 = 4(-1)(y-5)$

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



Direction open: Right

Vertex: (-4, -1)

Value of p: +4

Axis of Symmetry: y = -1

Directrix: x = -8

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

$(y - -1)^2 = 4(4)(x - -4)$

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