TOPIC: PARABOLAS

Parabolas as Conic Sections

Circle	Ellipse	**Parabola**	Hyperbola

- As conic sections, parabolas have a focus (__________) & directrix (__________)
  - To find **focus**, start at vertex: if opens ↑, go **[↑ | ↓]** $|p|$ units; if opens ↓, go **[↑ | ↓]** $|p|$ units
  - To find **directrix**, start at vertex: if opens ↑, go **[↑ | ↓]** $|p|$ units; if opens ↓, go **[↑ | ↓]** $|p|$ units & draw line

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

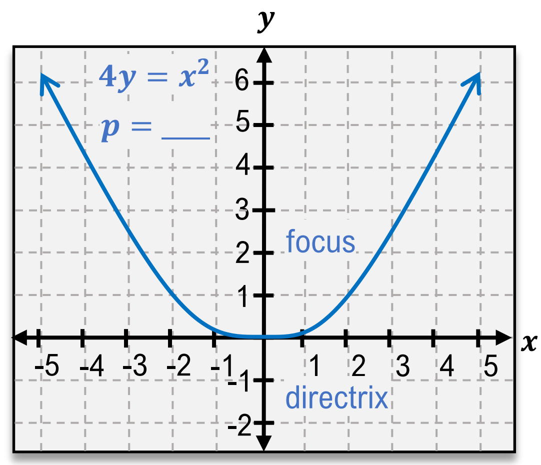
↓

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

↓

$$4py = x^2$$

(*Parabola At Origin*)



- When p → $+$ the parabola opens **[↑ | ↓]** and when p → $-$ the parabola opens **[↑ | ↓]**

EXAMPLE: Graph the following parabola.

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

TO GRAPH

1) Find the vertex (h, k): (__ , __)

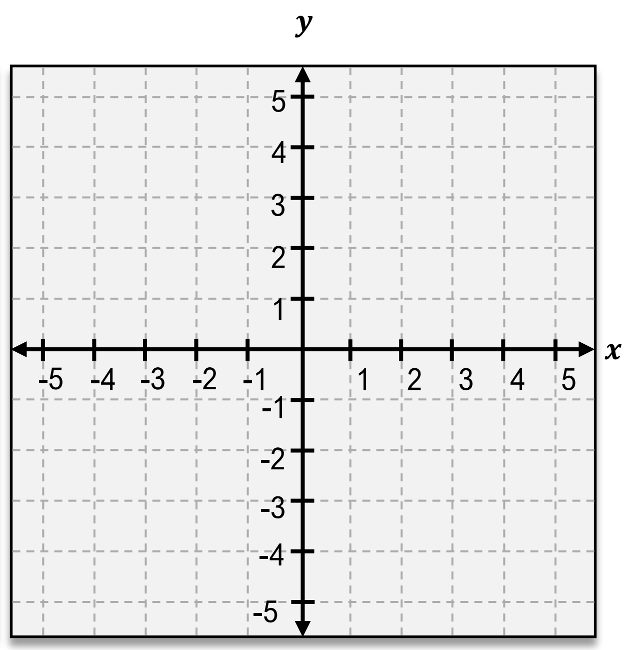
2) Calculate the p value: $p =$ ___

3) Find focus (go **[↑ | ↓]** $|p|$ units from vertex):
(__ , __)

4) From focus, go **left** & **right** $2|p|$ units:
(__ , __) & (__ , __)

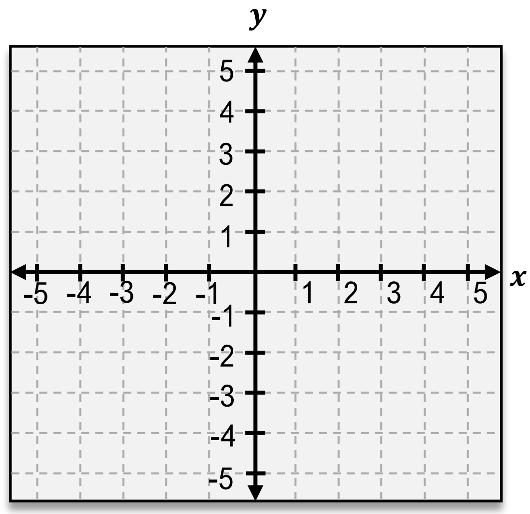
5) Connect outer points with smooth curve

6) Find directrix (go **[↑ | ↓]** $|p|$ units from vertex):
$y =$ ___

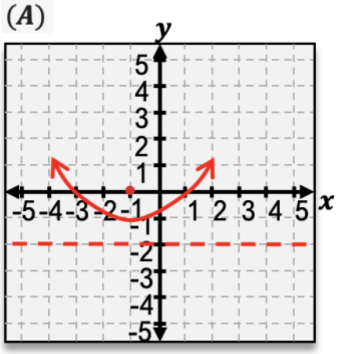


TOPIC: PARABOLAS

PRACTICE: Graph the parabola $-4(y+1) = (x+1)^2$, and find the focus point and directrix line.

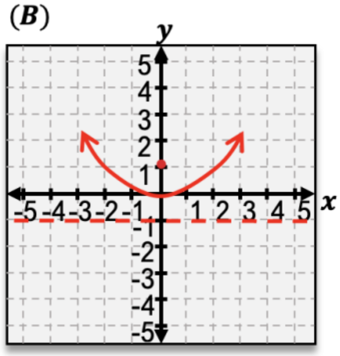


$(\boldsymbol{A})$



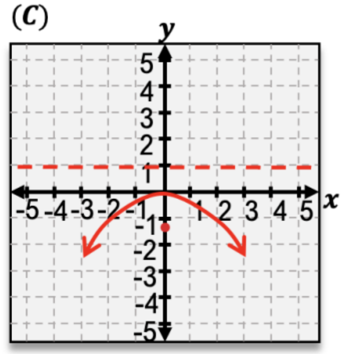
Focus: $(-1,0)$
Directrix: $y = -2$

$(\boldsymbol{B})$



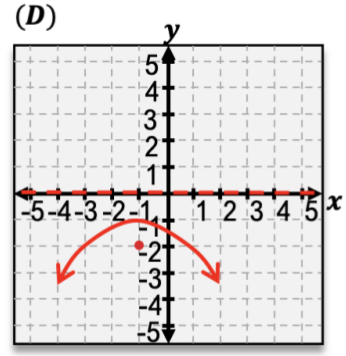
Focus: $(0,1)$
Directrix: $y = -1$

$(\boldsymbol{C})$



Focus: $(0,-1)$
Directrix: $y = 1$

$(\boldsymbol{D})$



Focus: $(-1,-2)$
Directrix: $y = 0$

PRACTICE: If a parabola has the focus at $(0,-1)$ and a directrix line $y = 1$, find the standard equation for the parabola.

$(\boldsymbol{A})$ $4y = x^2$
$(\boldsymbol{B})$ $4(y-1) = x^2$
$(\boldsymbol{C})$ $-4y = x^2$
$(\boldsymbol{D})$ $-4(y+1) = x^2$

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EXAMPLE**:** Identify the vertex, focus, & directrix of the parabola.

$(\boldsymbol{A})$

$16y = x^2$

$(\boldsymbol{B})$

$\frac{1}{3}y = x^2$

$(\boldsymbol{C})$

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

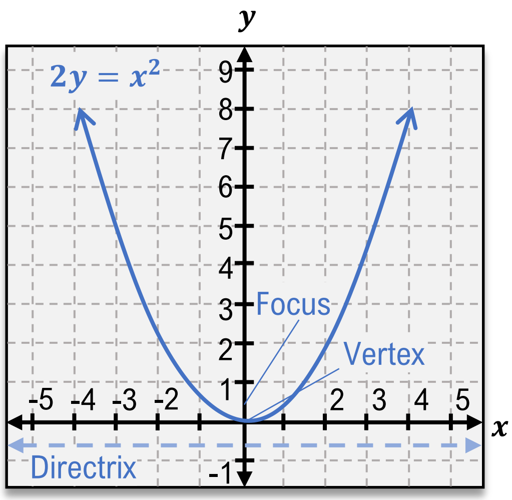
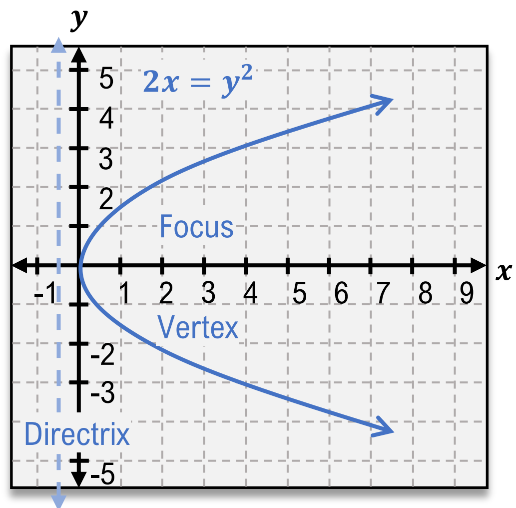
$(\boldsymbol{D})$

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

Circle	Ellipse	**Parabola**	Hyperbola

TOPIC: PARABOLAS
Horizontal Parabolas

- Horizontal parabolas are just like vertical ones, but with ___ & ___ switched (so they are ____________)
  - The directrix is always _______________ to the axis of symmetry

Vertical Parabola	Horizontal Parabola
	
$4py = x^2$	$4px = y^2$
If p is **pos**: parabola opens **[↑ | ↓ | → | ←]**	If p is **pos**: parabola opens **[↑ | ↓ | → | ←]**
If p is **neg**: parabola opens **[↑ | ↓ | → | ←]**	If p is **neg**: parabola opens **[↑ | ↓ | → | ←]**
Directrix is **[HORIZONTAL | VERTICAL]**	Directrix is **[HORIZONTAL | VERTICAL]**

EXAMPLE**:** Graph the parabola

TO GRAPH

$$8x = y^2$$

1) Find the vertex (h, k): (__ , __)

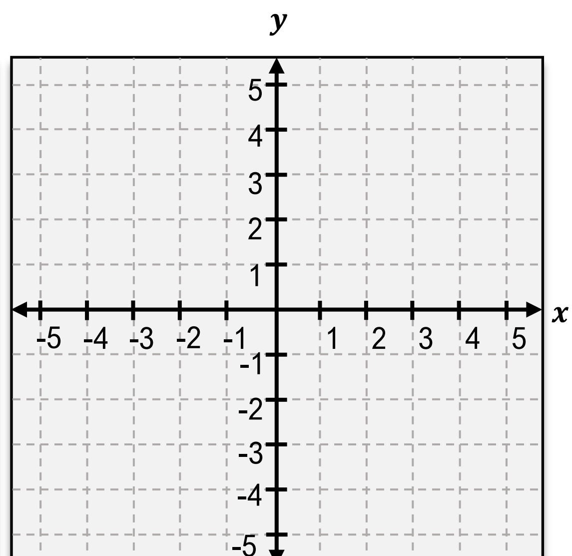
2) Calculate the p value: $|p| =$ ___

3) Find focus (go **[↑ | ↓ |→|←]** $|p|$ units from vertex):
(__ , __)

4) From focus, go **[Left & Right | Up & Down]** $|2p|$ units:
(__ , __) & (__ , __)

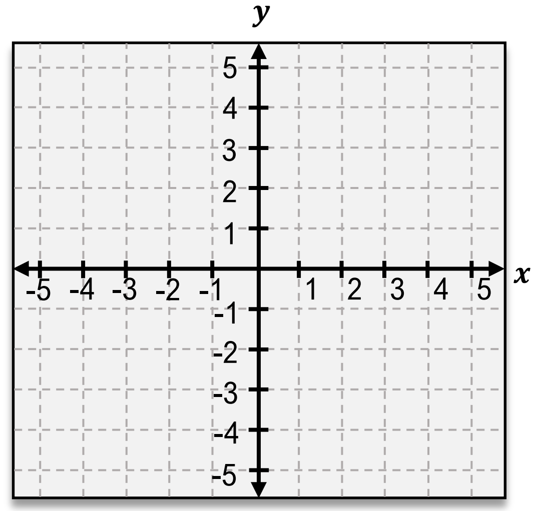
5) Connect outer points with smooth curve

6) Find directrix (go **[↑ | ↓ |→|←]** $|p|$ units from vertex):
[x | y] = _________

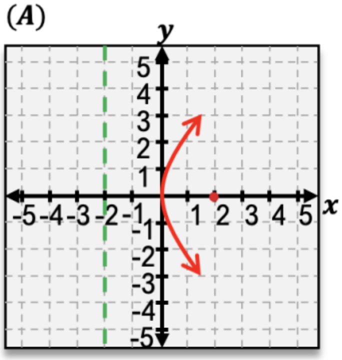


<u>TOPIC: PARABOLAS</u>

<u>PRACTICE</u>**:** Graph the parabola $8(x+1)=(y-2)^2$, and find the focus point and directrix line.

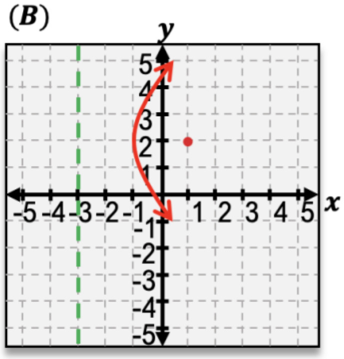


(A)



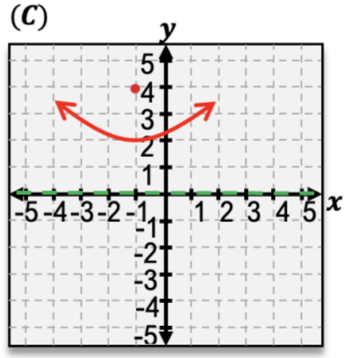
Focus: $(2,0)$
Directrix: $x=-2$

(B)



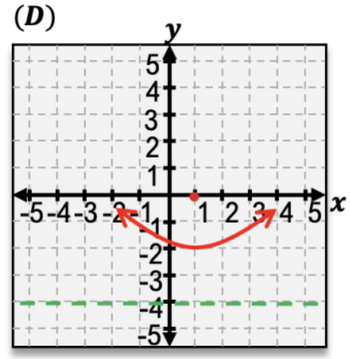
Focus: $(1,2)$
Directrix: $x=-3$

(C)



Focus: $(-1,4)$
Directrix: $y=0$

(D)



Focus: $(1,0)$
Directrix: $y=-4$

TOPIC: PARABOLAS

PRACTICE**:** If a parabola has the focus at $(2,4)$ and a directrix line $x = -4$, find the standard equation for the parabola.

$(\boldsymbol{A})$ $12(x+1) = (y-4)^2$
$(\boldsymbol{B})$ $-(x+1) = (y-4)^2$
$(\boldsymbol{C})$ $12x = y^2$
$(\boldsymbol{D})$ $4(x-1) = (y+4)^2$

EXAMPLE**:** Identify the vertex, focus, & directrix of the parabola.

$(\boldsymbol{A})$ $4x = y^2$

$(\boldsymbol{B})$ $9x = (y-2)^2$

$(\boldsymbol{C})$ $16(x-4) = (y+2)^2$

$(\boldsymbol{D})$ $-2(x-1) = y^2$