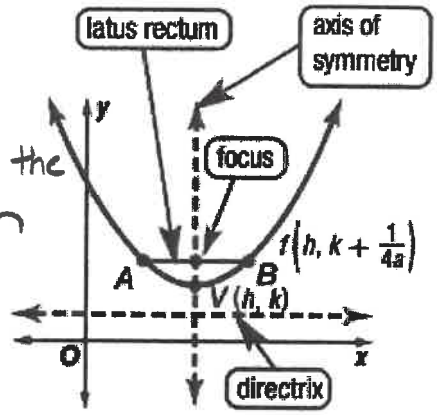
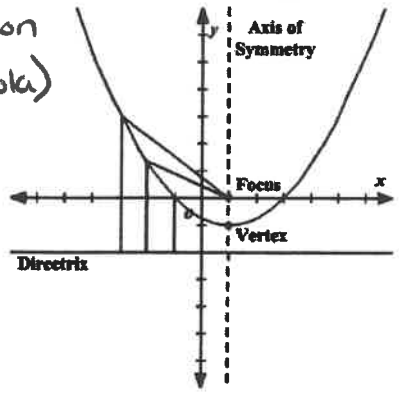
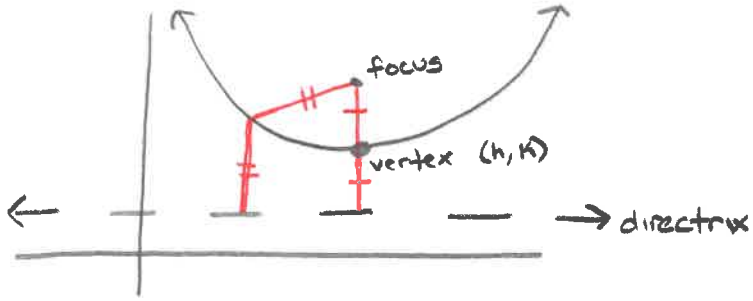
Parabola: the set of all points in a plane that are the same distance from a given point called the ① focus and a given line called the ② directrix



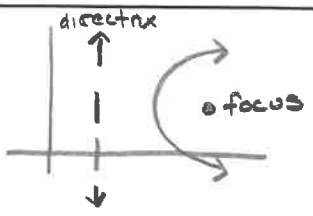
Latus Rectum: line segment through the focus and ⊥ to the axis of symmetry. (endpoints on the parabola)





Equations of Parabolas		
Form of Equation	$y = a(x-h)^2 + K$	$x = a(y-k)^2 + h$
Direction of Opening	$a > 0$ upward $a < 0$ downward	$a > 0$ right $a < 0$ left
Vertex	(h, K)	(h, K)
Axis of Symmetry	$x = h$	$y = K$
Focus	$(h, k+\frac{1}{4a})$	$(h+\frac{1}{4a}, k)$
Directrix	$y = k - \frac{1}{4a}$	$y = h - \frac{1}{4a}$
Length of Latus Rectum	$\left\|\frac{1}{a}\right\|$ units	$\left\|\frac{1}{a}\right\|$ units

full length from endpoint to endpoint on parabola



1. Write $y = 2x^2 - 12x + 6$ in standard form. Identify the vertex, axis of symmetry, and direction of opening of the parabola.

$y = 2x^2 - 12x + 6$

complete the square

$y = 2(x^2 - 6x \quad) + 6$

$y = 2(x^2 - 6x + 9) + 6 - 18$

$y = 2(x-3)^2 - 12$

vertex $(3, -12)$

AoS $x = 3$

opens up

2. Graph each equation in general form:
   a. $2x - y^2 = 4y + 10$

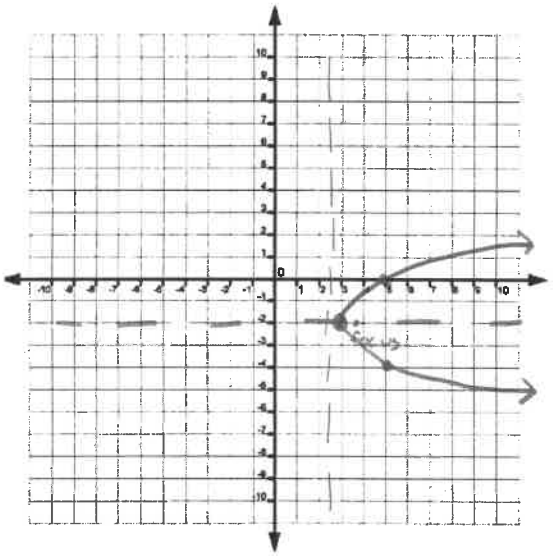
$2x = y^2 + 4y + 10$

$2x = (y^2 + 4y \quad) + 10$

$2x = (y^2 + 4y + 4) + 10 - 4$

$2x = (y+2)^2 + 6$

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



vertex $(3, -2)$

AoS $y = -2$

opens right

focus: $\left(3 + \frac{1}{4(1/2)}, -2\right)$ or $(3.5, -2)$

directrix $x = 3 - \frac{1}{4(1/2)} = 2.5$

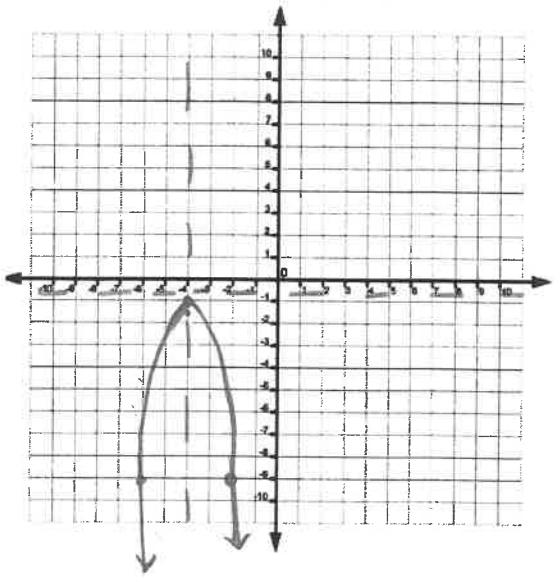
b. $y + 2x^2 + 32 = -16x - 1$

$y = -2x^2 - 16x - 33$

$y = -2(x^2 + 8x \quad) - 33$

$y = -2(x^2 + 8x + 16) - 33 + 32$

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



vertex $(-4, -1)$

AoS $x = -4$

opens down

focus $(-4, -1 + 1/4(-2))$

$= (-4, -9/8)$

directrx $y = -1 - 1/4(-2) = -7/8$

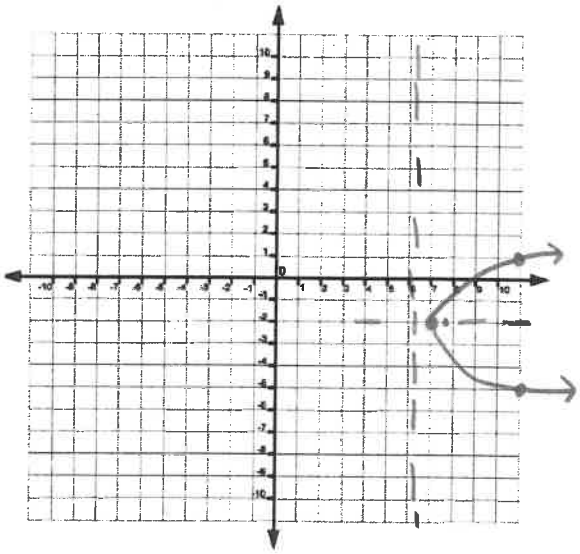
c. $3x - y^2 = 4y + 25$

$3x = y^2 + 4y + 25$

$3x = (y^2 + 4y + 4) + 25 - 4$

$3x = (y+2)^2 + 21$

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



vertex $(7, -2)$

opens right

AoS $y = -2$

focus $(7 + 1/4(1/3), -2)$

$= (7.75, -2)$

directrx $x = 7 - 1/4(1/3) = 6.25$

3. Write an equation for a parabola with vertex at $(-2,-3)$ and directrix $y = 1$. Then graph the equation.

$h = -2$

$k = -3$

$y = k - \frac{1}{4a}$

$1 = -3 - \frac{1}{4a}$

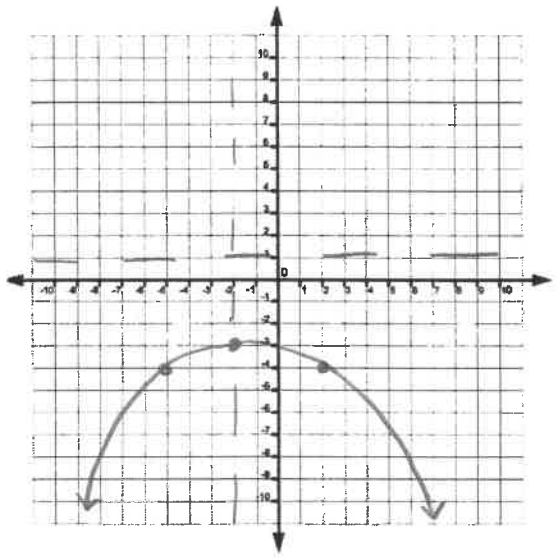
$4 = -\frac{1}{4a}$

$-\frac{1}{4} = 4a$

$-\frac{1}{16} = a$

$y = -\frac{1}{16}(x+2)^2 - 3$

opens down



4. Write an equation for a parabola with vertex at $(1, 3)$ and focus $(1, 5)$. Then graph the equation.

$h = 1$ $k = 3$

* know its $(h, k + \frac{1}{4a})$ b/c $h = 1$

$k + \frac{1}{4a} = 5$

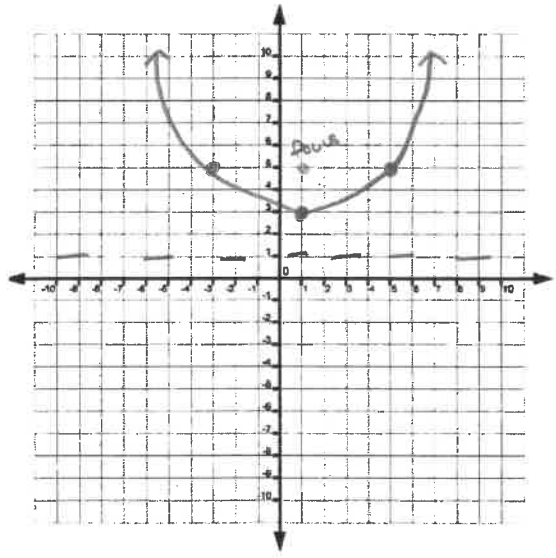
$3 + \frac{1}{4a} = 5$

$\frac{1}{4a} = 2$

$4a = \frac{1}{2}$

$a = \frac{1}{8}$

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

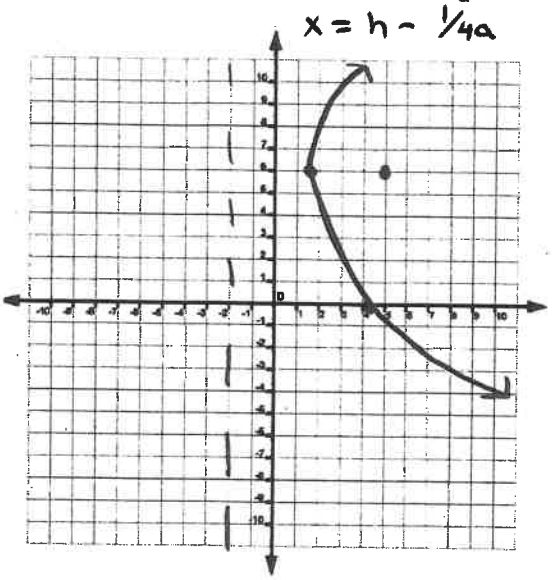


directrix $y = 1$ b/c focus 2 units away from vertex

5. Write an equation for a parabola with focus $(5, 6)$ and directrix $x = -2$. Then graph the equation.

$(h + \frac{1}{4a}, k)$ left or right opening

$x = h - 1/4a$



$k = 6$

$h + \frac{1}{4a} = 5$ $\quad -2 = h - \frac{1}{4a}$

$5 - h = \frac{1}{4a}$ $\quad 2 + h = \frac{1}{4a}$

$5 - h = 2 + h$

$3 = 2h$

$3/2 = h$

$\frac{3}{2} + \frac{1}{4a} = 5$

$\frac{1}{4a} = \frac{7}{2}$

$4a = \frac{2}{7}$

$a = \frac{1}{14}$

$x = \frac{1}{14}(y - 6)^2 + \frac{3}{2}$