## Pre-Calculus

Notes 7.5

## PARABOLAS

Let $F$ be a point in the plane and $d$ be a line not containing $F$. A parabola is the set of all points equidistant from $F$ and $d$. The point $F$ is called the focus of the parabola abd the line $d$ is called the directrix of the parabola.


|  | Vertical | Horizontal |
| :---: | :---: | :---: |
| Standard Form of <br> Parabola | $(x-h)^{2}=4 p(y-k)$ | $(y-k)^{2}=4 p(x-h)$ |
| Vertex Form | $(y-k)=\frac{1}{4 p}(x-h)^{2}$ | $(x-h)=\frac{1}{4 p}(y-k)^{2}$ |
| vertex | $(h, k)$ | $(h, k)$ |
| Axis of Symmetry | $x=h$ | $y=k$ |
| $p>0$ | opens up | opens right |
| $p<0$ | opens down | opens left |
| Focus | $(h, k \pm p)$ | $(h \pm p, k)$ |
| directrix | $y=k \pm p$ | $(h \pm p, k)$ |
| Focal Length | p | $p$ |
| Focal Width | $\|4 p\|$ | $\|4 p\|$ |

Ex 1) Write each function in standard form of a quadratic by completing the square method.
a) $y=x^{2}-6 x+3$
b) $y=-x^{2}-8 x-11$
c) $y=-2 x^{2}-8 x-1$
d) $y=3 x^{2}-9 x+6$

Ex 2) Find the vertex, focus and directrix of the parabola $y=-\frac{1}{2} x^{2}$

Ex 3) Find the equation of the parabola with the focus at $(-2,0)$ and the directrix is $x=2$.

Ex 4) Find the equation of the parabola with the focus at $(5,4)$ and the vertex at $(3,4)$.

Ex 5) Put the equation $y^{2}-6 x+2 y+13=0$ in vertex form. Find the vertex, focus and directrix of the parabola. Sketch the graph.

Ex 6) Find the equation in standard form and vertex form of a porabola:
a) $F(-4,0)$ and directrix $x=4$.
b) Opens upward, $V(0,0)$, and focal width of 3.
c) $F(-5,3)$ and $V(-5,6)$.
d) $3 x^{2}-6 x-6 y+10=0$

Ex 7) Graph: $x+1=4 y-y^{2}$

horizontal/vertical $\qquad$
c $\qquad$
vertex $\qquad$
focus $\qquad$ directrix equation $\qquad$

Ex 8) Graph: $x^{2}-8 x-y+18=0$

horizontal/vertical $\qquad$
c $\qquad$ vertex $\qquad$
focus $\qquad$
directrix equation $\qquad$

Ex 9) Write an equation for the parabola with a focus at $(-1,7)$, the length from the focus to the vertex is 2 units, and has a minimum.

