

Example 1 Parabolas p. 4 Ch 11

$$y^2 + 10y = -6x - 13$$

- 1st complete the square for the squared variable – y

$$\left(\frac{1}{2} \cdot 10\right)^2 = (5)^2 = 25$$

$$y^2 + 10y + 25 = -6x - 13 + 25$$

$$(y - (-5))^2 = -6x + 12$$

$$(y - (-5))^2 = -6(x - 2)$$

$$(y - (-5))^2 = -6(x - 2)$$

- Find p. You know that the coefficient of $(x - h)$ is $4p$, so use algebra

$$4p = -6$$

So, $4p \div 4 = -6 \div 4$

Therefore, $p = -6/4 \div 2/2 = -3/2$

a) Give the Vertex

- The vertex is (h, k) ; make sure you are reading the form correctly.

$$V(2, -5)$$

b) Find the Focus (p+h, k)

- Use p to give the focus. For a left/right facing parabola the focus will be (p+h, k).

So, $x = -\frac{3}{2} + 2 = -\frac{3}{2} + \frac{4}{2} = \frac{1}{2}$ and $y = -5$

$$F\left(\frac{1}{2}, -5\right)$$

c) Find Directrix

- Since this is an left facing parabola this is a vertical line p units to the right of the vertex, which is (h, k) in this case,

$$\text{So, } x = h - p = 2 - (-3/2) = 4/2 + -3/2 = 7/2 = 3 \frac{1}{2}$$

$$x = 7/2$$

d) Find the Focal Diameter

- The focal diameter is 4 times p 's distance (that means absolute value is used) or 2 times p 's distance on either side of the focus

$$|4 \cdot -\frac{3}{2}| = 6$$

and $|2 \cdot -\frac{3}{2}| = 3$ which is more helpful in finding
2 more points on the parabola

$(\frac{1}{2}, -5 + 3)$ & $(\frac{1}{2}, -5 - 3)$ are the pts on the parabola equidistant from the focus
which are $(\frac{1}{2}, -2)$ & $(\frac{1}{2}, -8)$

Y-Intercepts

- We could also make our parabola have an even more exact graph by finding the y - intercepts

Let $x = 0$ so, $y^2 + 10y = -6(0) - 13$, thus

$y^2 + 10y + 13 = 0$ and by the

quadratic formula $y = \frac{-(10) \pm \sqrt{(10)^2 - 4(1)(13)}}{2(1)}$

$$Y = \frac{-10 \pm 4\sqrt{3}}{2} = -5 \pm 2\sqrt{3} \quad (0, \approx -1.5) \text{ \& } (0, \approx -8.5)$$

X-intercept

- The x-intercept can also be found to help make a more accurate picture by letting $y = 0$

$$\text{Let } y = 0, \text{ so } (0)^2 + 10(0) = -6x - 13$$

$$\text{thus } 13 = -6x \quad \text{so} \quad x = \frac{-13}{6} = -2 \frac{1}{6}$$

$$\left(\frac{-13}{6}, 0\right)$$

e) Sketch the graph

- 1st Place the vertex
- 2nd Place the directrix
- 3rd Place the 2 points on the focal diameter
- 4th Optional to place x & y-intercepts
- 5th Draw the parabola

