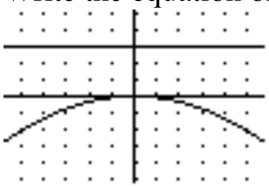
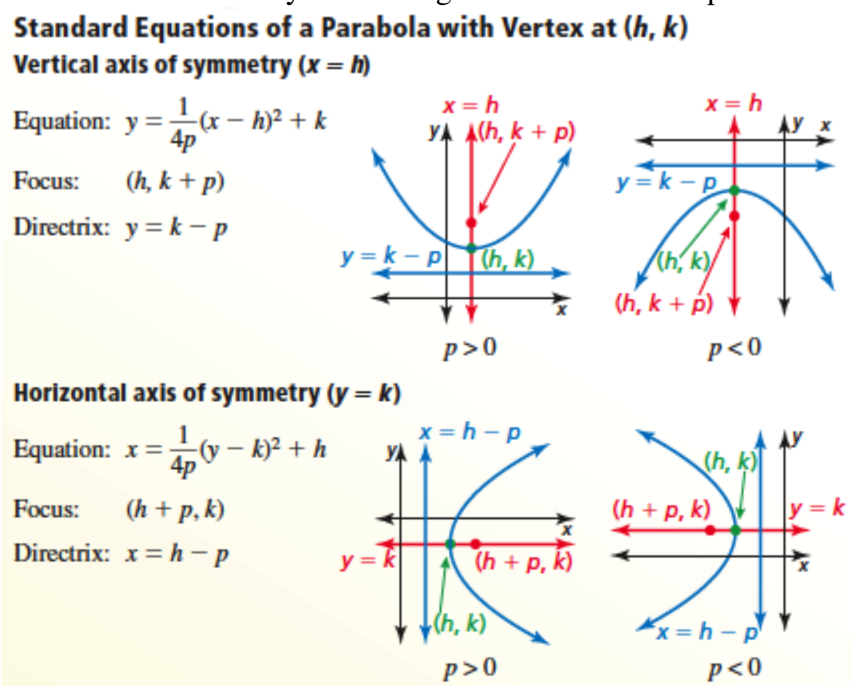
1. Write the equation of the parabola below where the directrix is also shown.



Solution:
Since the Directed Distance from the Vertex to the Directrix is $-p$, and the directed distance is 3, then we have $-p = 3$ and $p = -3$ The Vertex is at $(0,0)$. The Equation is: $y = \frac{1}{4p}x^2 \rightarrow \boxed{y = -\frac{1}{12}x^2}$.

The vertex is not always at the origin. We can use our prior knowledge of transformations.



2. Write the equation for a parabola with Vertex at $(6,2)$ and Focus at $(10,2)$.

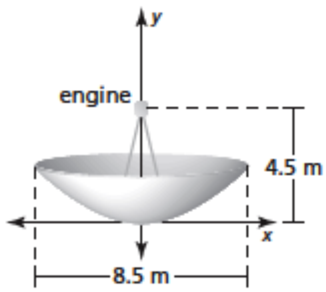
Solution:
The Focus is 4 units to the right of the Vertex. Therefore $p = 4$. This parabola opens to the right. Therefore the square term includes y. Considering the transformation of the Vertex from $(0,0)$ to $(6,2)$.

The equation: $\boxed{x = \frac{1}{16}(y-2)^2 + 6}$.

3. Write the equation for a parabola with Focus at (4, 6) and Directrix: $y = -2$.

Solution:
The Vertex is midway between the Focus and the Directrix. Therefore the Vertex is at (4, 2). The Directed Distance from the Vertex to the Focus is 4 so $p = 4$. Since the Focus is above the Vertex, the parabola opens Upward, so the square term contains x. The Equation: $\boxed{y = \frac{1}{16}(x-4)^2 + 2}$.

4. An electricity-generating dish uses a parabolic reflector to concentrate sunlight onto a high-frequency engine located at the focus of the reflector. The sunlight heats helium to $650°C$ to power the engine. Write an equation that represents the cross section of the dish shown with its vertex at (0, 0). What is the depth of the dish?



Solution:
From the figure, we can see that $p = 4.5$. The equation of the cross section is: $y = \frac{1}{18}x^2$. The depth of the dish is the y value at the dish's outside edge which is 4.25m from the axis of symmetry. Therefore we compute: $y(4.25) = \frac{1}{18}(4.25)^2 = \boxed{1.003 \text{ meters}}$.

Assignment 118
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