Problem 1: Find the vertex, focus and directrix of the following parabolas and sketch its graph.

1. $3x^2 + 8y = 0$.
2. $y^2 + 6y + 2x + 1 = 0$.
3. $2x^2 - 16x - 3y + 38 = 0$.

Solution. 1. $3x^2 + 8y = 0 \Rightarrow x^2 = -\frac{8}{3}y$ □

Problem 2: Find the vertices and foci of the following ellipses and sketch its graph.

1. $x^2 + 9y^2 = 9$.
2. $9x^2 - 18x + 4y^2 = 27$.
3. $x^2 + 3y^2 + 2x - 12y + 10 = 0$.

Problem 3: Find the vertices, foci and asymptotes of the following hyperbolas and sketch its graph.

1. $y^2 - 16x^2 = 16$
2. $x^2 - y^2 + 2y = 2$
3. $9y^2 - 4x^2 - 36y - 8x = 4$.

Problem 4: Identify the type of conic whose equation is given and find the vertices and foci.

1. $x^2 = 4y - 2y^2$.
2. $3x^2 - 6x - 2y = 1$.
3. $x^2 - 2x + 2y^2 - 8y + 7 = 0$.

Problem 5: Find an equation for the conic that satisfies the following conditions.

1. Parabola with vertex $(2, 2)$ and focus $(3, 2)$.
2. Ellipse with center $(-1, 4)$, vertex $(-1, 0)$, focus $(-1, 6)$.
3. Hyperbola with foci $(2, 0)$, $(2, 8)$, asymptotes $y = 3 + \frac{1}{2}x$ and $y = 5 - \frac{1}{2}x$.