1. Two views of a hyperbolic paraboloid are shown below; its equation is \( z + 16x + y^2 = 2x^2 + 30 + 6y \).

1a. Put this equation in the proper form to determine the coordinates of the saddlepoint \((a, b, c)\). (That is, find that equation and then use it to find \(a\), \(b\) and \(c\)).

1b. In the form \( z = \ldots \), what is the equation of the parabola at the intersection of the hyperbolic paraboloid and the plane \( y = b \) shown in the left hand figure?

1c. In the form \( z = \ldots \), what is the equation of the parabola at the intersection of the hyperbolic paraboloid and the plane \( x = a \) in the right hand figure?

1d. Find an equation of an elliptic paraboloid whose maximum is that same point \((a, b, c)\).

2A. By rewriting the equation \( 9x^2 + 208 + 36y^2 + 4z^2 = 40z + 72x \), verify that it is that of an ellipse. Find the center \((h, k, m)\) of this ellipse.

2B. What are the coordinates of the “north pole” \(NP\) on the ellipse in (2A)?

2C. What is the equation of the plane tangent to this ellipse at that point \(NP\)?

2D. What is the value of \(a\) for the point \((a, k, m)\) shown on the plot of the ellipse in (2A), which is shown below?

2E. What is the equation of the plane tangent to the ellipse at the point in 2D?

3. Let \( \mathbf{u} = (2, 4, 5) \) and \( \mathbf{v} = (3, 5, 8) \).

3A. Find the angle between \( \mathbf{u} \) and \( \mathbf{v} \), in degrees(!) to the nearest tenth of a degree.

3B. Find the projection \( \text{proj}_v(\mathbf{u}) \) of \( \mathbf{u} \) on \( \mathbf{v} \). Show all your work and computations.