1

The corresponding program appears in the script files section.

2

Gaussian elimination may be applied to solve the matrix inverse problem $\mathbf{A}\vec{x} = \vec{b}$. All linear systems of equations, where one has some linear combination of variables equal to a constant in each of the eqations, may be written as a problem of this form. Classify the use of Gaussian elimination to find that a system is over- or underdetermined as "solving" the system of equations (otherwise, one would need to actualy solve the system to determine if a well-defined solution were possible).

2.1

This one can be reduced to a linear system by setting $x = \cos(\alpha)$ and $y = \tan^2(\phi)$. Gaussian elimination becomes directly applicable.

2.2

Expanding $(u - 2v)^2 = u^2 - 4uv + 4v^2$, it becomes evident we may linearize the system by setting $x = u^2$, $y = v^2$. Gaussian elimination becomes directly applicable.

2.3

Gaussian elimination is applicable here without modification.

2.4

Once again, Gaussian elimination is directly applicable.

2.5

In this case, it is impossible to write e^z as a linear function of z (stated without proof—technically follows from a polynomial-ring-over-field proof of it being a trancendental function, which is highly nontrivial). Therefore, this cannot be reduced to a linear system, and Gaussian elimination is impossible to apply.

3

The first print statement outputs

$$\begin{bmatrix} 1 & 8 & 10 \\ 2 & 1 & 11 \\ 5 & -50 & -14 \end{bmatrix}$$

The second print statement outputs the superposed version of the matrix from the in-place decomposition algorithm (the "Hadamard sum," I suppose):

$$\begin{bmatrix} 1 & 8 & 10 \\ 2 & -15 & -9 \\ 5 & 6 & -10 \end{bmatrix}$$

Script Files