1. This was the honor code statement.

2. We are told \( \det(A) = -1 \) and asked to find \( \det(A^{-1}) \).
   \[ \det(A^{-1}) = \frac{1}{\det(A)} = \frac{1}{-1} = -1. \]

3. We need the area of the triangle in \( \mathbb{R}^2 \) with vertices \((1, 2), (4, 3), \) and \((2, 5)\). The vector from the first vertex to the second is \( v_1 = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \), and the vector from the first vertex to the third is \( v_2 = \begin{pmatrix} 1 \\ 3 \end{pmatrix} \). The triangle has half the area of the parallelogram naturally determined by \( v_1 \) and \( v_2 \), so
   \[ \text{Area of triangle} = \frac{1}{2} \left| \det \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix} \right| = \frac{1}{2} (8) = 4. \]

4. To find \( \det \begin{pmatrix} 1 & 2 & 0 \\ 2 & 3 & 0 \\ 5 & 4 & 1 \end{pmatrix} \), we can use the cofactor expansion along the third column.
   \[ \det \begin{pmatrix} 1 & 2 & 0 \\ 2 & 3 & 0 \\ 5 & 4 & 1 \end{pmatrix} = (-1)^{3+3}(1) \det \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix} = (1)(1)(-1) = -1. \]

5. If \( A \) is a \( 3 \times 3 \) matrix with the first row the same as the second row, then the RREF of \( A \) will have a row of zeros. Therefore, \( A \) must not be invertible, which means that 0 must be an eigenvalue of \( A \).

6. We need to find the value of \( m \) so that \( \begin{pmatrix} 1 \\ 1 \end{pmatrix} \) is an eigenvector of \( A = \begin{pmatrix} 1 & m \\ 2 & 3 \end{pmatrix} \). Note
   \[ A \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 & m \\ 2 & 3 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 + m \\ 5 \end{pmatrix}. \]
   From the second entry we see that if \( A \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \lambda \begin{pmatrix} 1 \\ 1 \end{pmatrix} \) then \( \lambda = 5 \), in which case
   \[ A \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix} = \begin{pmatrix} 1 + m \\ 5 \end{pmatrix}, \]
   so \( m = 4 \). We can check to verify that indeed
   \[ \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 5 \\ 5 \end{pmatrix}. \]