1. Write the code to make a 3-D lit surface plot (using meshgrid( )) with interpolated shading of the following function:
   \[ z = \cos(2\pi[3x - 4y]) \quad 0 \leq x \leq 1 \quad 0 \leq y \leq 0.5 \]

2. Add code to make a contour plot (as Figure 2) for the surface in Problem 1.

3. Add appropriate axis and title labels for the Figures 1 and 2 in Problems 1 and 2.

4. The inverse of the following rotation matrix, \( R_1 \), should be the same matrix but with \(-\theta\) substituted for \( \theta \):
   \[
   R_1 = \begin{bmatrix}
   \cos \theta & -\sin \theta \\
   \sin \theta & \cos \theta
   \end{bmatrix}
   \]
   a) Create \( R_1^{\text{inv}} \) by substituting \(-\theta\) for \( \theta \) in \( R_1 \) and simplifying the terms using \( \cos(-\theta) = \cos(\theta) \) and \( \sin(-\theta) = -\sin(\theta) \).
   b) Verify by hand that \( R_1 \times R_1^{\text{inv}} \) equals the identity matrix.
   c) Which of the following Matlab® command lines could represent a rotation of an initial vector by +30 degrees and then -60 degrees?
      i) \( \gg [1, 0] * [\sqrt{3}/2, 1/2; -1/2, \sqrt{3}/2] * [\sqrt{3}/2, 1/2; -1/2, \sqrt{3}/2]^{-2} \)
      ii) \( \gg [1/2, \sqrt{3}/2; -\sqrt{3}/2, 1/2] * [\sqrt{3}/2, -1/2; 1/2, \sqrt{3}/2] * [1; 0] \)
      iii) \( \gg 1./[\sqrt{3}/2, -1/2; 1/2, \sqrt{3}/2]^2 * [\sqrt{3}/2, -1/2; 1/2, \sqrt{3}/2] * [1; 0] \)

5. Write code to use a matrix, a vector, and the inv( ) function to solve each of the following sets of simultaneous equations:
   a) \( x + 2y = 1 \)
      \( 3x + 5y = -1 \)
   b) \( z = 4 \)
      \( -x + z = -2 \)
      \( \frac{1}{2}y - z = 1 \)

6. When using the Matlab® command for a pseudoinverse (that is used to solve least-squares problems involving rectangular matrices), what is the shape of the resulting matrix? (Hint: use the index of the Matlab Primer to look up pseudoinverse.)
7. Use the following array definitions for the question below:
   
   \[ A = \text{magic}(2) = [1,3;4,2]; \quad B = \text{eye}(2); \quad C = [1,2;3,5]; \]
   
   What is the result of the evaluation of each of the following logical expressions in Matlab®?
   a) \[ A == B \]
   b) \[ \text{all}(C - B > 0) \]
   c) \[ C <= A \]
   d) \[ A == B \quad \& \quad C <= A \]

8. Write Matlab® code that uses polyfit( ) to find linear and quadratic fits for the following data points. Store the coefficients in an array called \( a \) in each case.

   \[
   \begin{array}{c|cccc}
   x \text{ values} & 0 & 1 & 2 & 3 \\
   y \text{ values} & 1 & 2 & 3 & 6 \\
   \end{array}
   \]

9. Write a script file that plots the data for Problem 8 and superimposes a plot of the linear and quadratic fits from Problem 8. Hint: for the linear and quadratic fits, use \( x \) values from the data and create \( y \) values using the \( a \) arrays.

10. Write a single script file to do the following tasks (in sequence) for a predefined square matrix, \( A \):
   a) Compute \( d = \) determinant of \( A \)
   b) If \( d \) is negative, display a warning message and return to parent program
   c) Otherwise, compute the inverse of \( A \) and
   d) Display the value of the inverse of \( A \)