Homework M4:

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1. Write the code to make a 3-D lit surface plot (using meshgrid( )) with interpolated shading of the following function:
   $z = \cos(2\pi[3x - 4y])$ $\quad 0 \le x \le 1$ (24 pts) $\quad 0 \le y \le 0.5$ (20 pts)

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, *R1*, should be the same matrix but with –θ substituted for θ:
   $$R1 = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$
   a) Create *R*1inv by substituting –θ for θ in *R*1 and simplifying the terms using cos(–θ) = cos(θ) and sin(–θ) = –sin(θ).
   b) Verify by hand that *R*1 times *R*1inv 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) >> [1, 0] * [sqrt(3)/2, -1/2; 1/2, sqrt(3)/2] * [sqrt(3)/2, -1/2; 1/2, sqrt(3)/2]^-2
      ii) >> [1/2, sqrt(3)/2; -sqrt(3)/2, 1/2] * [sqrt(3)/2, -1/2; 1/2, sqrt(3)/2] * [1; 0]
      iii) >> 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*.)

7. Use the following array definitions for the question below:

   A = magic(2) = [1,3;4,2]; B = eye(2); 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) >> all(C - B > 0) c) >> C <= A d) >> A == B | 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.

x values:	0	1	2	3
y values:	1	2	3	6

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*

REF: [1] The Mathworks, Inc, *Matlab® Primer,* Natick, MA: The Mathworks, Inc, 2012.