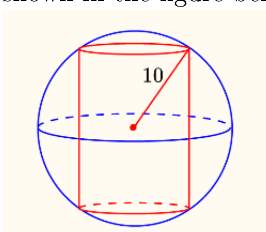
Summer 2014 MATLAB Assignment 5

Work the following problems (NOTE: these are RELATED TO the corresponding page and problem number from Gilat. Do NOT work the actual problems from the Lab Manual, or you will receive NO CREDIT!)

1. **g287x05** (Polynomials as vectors: pp261-262 and polynomial division: pp265-266):
   Divide the polynomial $12x^6 + 21x^5 - 11x^4 - 14x^3 + 18x^2 + 28x - 4$ by the polynomial $4x^2 + 7x - 1$.

2. **g289x16** (evaluating polynomials: pp262-263; roots of polynomials: pp263-264; and polynomial derivatives: pp266-267):
   A cylinder of radius r and height h is constructed inside a sphere with radius $R = 10$ in., as shown in the figure below.

   (a) Create a polynomial expression for the volume V of the cylinder in terms of h. (You may do this step on paper if you wish).

   (b) Make a plot of V versus h.

   (c) Determine h if the volume of the cylinder is 1000 in^3.

   (d) Determine the value of h that corresponds to the cylinder with the largest possible volume, and determine that volume.

3. **g290x21** (Polynomial curve-fitting: pp267-271; Fitting of other functions: pp271-274):
   The population of India from the year 1940 to the year 2000 is given in the following table:

Year	1910	1930	1940	1950	1960	1970	1980	1990	2000
Population(millions)	249	277	316	350	431	539	689	833	1014

   (a) Determine the exponential function that best fits the data. Use the function to estimate the population in 2012.

   (b) Curve fit the data with a quadratic equation (second-order polynomial). Use the function to estimate the population in 2012.
   (NOTE: The official estimated population in India in 2012 is 1.22 billion, or 1,220 million).

4. **g294x31** (Polynomial curve-fitting: pp267-271):
Viscosity is a property of gases and fluids that characterizes their resistance to flow. For most materials viscosity is highly sensitive to temperature. For gases, the variation of viscosity with temperature is frequently modeled by an equation which has the form: $\mu = \frac{CT^{3/2}}{T+S}$, where μ is the viscosity, T is the absolute temperature (in ^oK), and C and S are empirical constants. Below is a table that gives the viscosity of air at different temperatures (data from B.R. Munson, D.F. Young, and T.H. Okiishi, "Fundamental of Fluid Mechanics," 4th edition, John Wiley and Sons, 2002).

T $(^\circ C)$	-20	0	40	100	200	300	400	500	1000
μ $(\times 10^{-5}\ N \cdot s/m^2)$	1.63	1.71	1.87	2.17	2.53	2.98	3.32	3.64	5.04

Determine the constants C and S by curve fitting the equation to the data points. Make a plot of viscosity versus temperature (in $^\circ K$). In the plot show the data points with markers and the curve-fitted equation with a solid line. The curve fitting can be done by rewriting the equation in the form

$$\frac{T^{3/2}}{\mu} = \frac{1}{C}T + \frac{S}{C}$$

and using a first-order polynomial.