1. Text exercises 1, 3 and 5 on page 5.

2. Consider the polynomial

\[ P(x) = c_1 + c_2(x - b)^2 + c_3(x - b)^4 + c_4(x - b)^6 \]

where \( c_1, c_2, c_3, c_4 \) and \( b \) are constants. Write a Matlab function that evaluates \( P(x) \) for a given input value \( x \) using nested iteration (discussed in text Section 0.1). You may base your code on the example in the text, but your code should exploit the fact that \( P \) is a polynomial in \((x - b)^2\). Run your code to find the values of \( P(x) \) for the three cases in the table below.

<table>
<thead>
<tr>
<th></th>
<th>( c_1 )</th>
<th>( c_2 )</th>
<th>( c_3 )</th>
<th>( c_4 )</th>
<th>( b )</th>
<th>( x )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>0.82</td>
<td>0.41</td>
<td>-1.3</td>
<td>2.6</td>
<td>-4.2</td>
<td>0.33</td>
</tr>
<tr>
<td>Case 2</td>
<td>2.2</td>
<td>0.55</td>
<td>5.5</td>
<td>-9.3</td>
<td>0.0</td>
<td>0.62</td>
</tr>
<tr>
<td>Case 3</td>
<td>-4.2</td>
<td>-1.1</td>
<td>2.0</td>
<td>7.2</td>
<td>2.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>

3. Text exercise 1, page 19. (Note that you may not be able to “find an alternate form that avoids the problem” in part (c) for all cases.)

4. The roots \( x_1 \) and \( x_2 \) of the quadratic equation \( x^2 + 2bx + c = 0 \) may be computed using the results of the usual quadratic formula

\[ x_1 = -b - \sqrt{b^2 - c}, \quad x_2 = -b + \sqrt{b^2 - c}. \]

(a) Use 6-digit, base 10, floating-point arithmetic to compute the two roots using the formulas above for the cases (i) \( b = 1.23456 \times 10^6, \) \( c = 9.87654 \times 10^8 \) and (ii) \( b = -2.46864 \times 10^{-2}, \) \( c = 1.35753 \times 10^{-8} \). Compute the “exact” values using full precision on a calculator or using Matlab. Determine the relative error in the roots computed using 6-digit arithmetic. Are the 6-digit roots accurate? Explain the results in terms of round-off error.

(b) Write a Matlab function, called \( \text{myRoots} \) say, that takes as input the values of \( b \) and \( c \) in the quadratic equation above and returns \( x_1 \) and \( x_2 \) computed accurately. Base the calculation of the roots in your Matlab function on the formulas for \( x_1 \) and \( x_2 \) above, or the alternate forms

\[ x_1 = \frac{c}{-b + \sqrt{b^2 - c}}, \quad x_2 = \frac{c}{-b - \sqrt{b^2 - c}}. \]

Your Matlab function should check the input values and decide which formulas give the most accurate results. Run your code for the two cases given in part (a).

Notes:

1. For pencil and paper problems make sure you justify your answers clearly and legibly.

2. For computing problems, include (i) print outs of any Matlab functions or scripts that you write, (ii) a “diary” of your Matlab session, and (iii) results and/or plots (as indicated in the problem description). Basically, you need to provide documentation of Matlab codes that you write, how they are used, and what the results are.

3. I suggest that you get started on the Problem Set right away, especially if you are new to Matlab. Don’t be afraid to ask for help to get started with Matlab.