Please show all work as neatly as possible to receive credit! Do NOT use a computer program UNLESS instructed to do so! Do not return this paper with answers on it! When turning in MATLAB problems, provide both the script (code) and sample output (graphs and/or numerical results) generated.

1. (5 pt) Reduce the following rational function to a form
   \[ f(x) = R(x) + \frac{P(x)}{Q(x)} \]
   where \( \deg P(x) < \deg Q(x) \):
   \[ \frac{x^5 + 2x^4 + x^3 - 4x^2 + 2}{x^2 - 2x + 5} \]

2. (5 pt) Decompose \( \frac{4x + 6}{x^2 - 4} \) into partial fractions

3. (5pt) Use the trigonometric identities:
   \[ \sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta \]
   \[ \cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta \]
   \[ 1 = \cos^2(\theta) + \sin^2(\theta) \]
   to show the following:
   \[ \sin \left( \frac{\theta}{2} \right) = \pm \sqrt{\frac{1 - \cos \theta}{2}} \quad \text{and} \quad \cos \left( \frac{\theta}{2} \right) = \pm \sqrt{\frac{1 + \cos \theta}{2}} \]

4. (10 pt) Write a MATLAB script that reads a collection of data and does the following:
   a. Reorders the numbers in descending order (largest to smallest).
   b. Finds the average and root mean square (rms) value of the data:
      \[ \langle x \rangle = \frac{1}{N} \sum_{i=1}^{N} x_i \]
      \[ \text{rms} = \sqrt{\langle x^2 \rangle} = \sqrt{\frac{1}{N} \sum_{i=1}^{N} x_i^2} \]
   c. Finds the standard deviation of the data:
      \[ \sigma_x = \sqrt{\frac{1}{N} \sum_{i=1}^{N} (x_i - \langle x \rangle)^2} \]
   d. Finds the number of data points (i.e. frequency of occurrence) that fall within the ranges:
      \[ 100 \leq x \leq 90, \ 90 < x \leq 80, \ 80 < x \leq 70, \ 70 < x \leq 60, \ \text{and} \ x < 60 \]
DO NOT USE the built in statistical functions of MATLAB to do any of these calculations (e.g. the \texttt{std} function). You will need to use do-loops and the if-then-else constructions.

The data you should use are the same as the ones we used in class for our example, i.e.:

\begin{verbatim}
78, 71, 82, 95, 69, 71, 81, 89, 84, 78, 82, 88, 99, 82, 63, 89, 41, 57, 84, 82, 64, 69,
80, 98, 80, 67, 62, 77, 79, 87, 79, 62, 84, 97, 80, 97, 69, 68, 68, 72, 70, 92, 16, 80,
95, 64, 91, 96, 60, 74, 82, 59, 82, 77, 65, 73, 50, 84, 90, 71, 76, 84, 74, 80, 84, 85,
88, 75, 85, 83, 76, 82, 82, 76, 91, 66, 85, 81, 61, 67, 90, 91, 92, 90, 72, 92, 73, 66,
66, 76, 74, 85, 93, 87, 55, 86, 65, 79, 78, 78, 77, 80, 91, 52, 85, 95, 64, 70, 96, 82,
71, 73, 82, 55, 29, 74
\end{verbatim}