This homework is due Monday, November 24

For all problems, show all steps in the required computation!

1. **Problems for Presentation:** You should prepare the solutions to to problems for presentation in class next Monday, November 24. Select two of the parts, a) through j), from Exercise 1 on page 158. Solutions to the problems are given in the back of the book. The two problem solutions should use different techniques.

2. **Final Presentation Topic:** You should meet with me this week to select your topic for a final presentation. On Monday, as part of this homework assignment, you should turn in a statement of the topic, including a short plan for what you will include in the presentation.

3. Use residues to show that $\displaystyle\int_0^{2\pi} \frac{d\theta}{5+4\sin(\theta)} = \frac{2\pi}{3}$

4. Use residues to show that $\displaystyle\int_{-\infty}^{\infty} \frac{dx}{(x^2+1)^2} = \frac{\pi}{4}$

5. Use residues to show that for any $a > 0$, $\displaystyle\int_{-\infty}^{\infty} \frac{x^3\sin(ax)}{x^4+1} = \pi e^{-a}\cos(a)$

6. Use residues and the Laurent series for $\csc(z)$ to find $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n^4}$

7. Find $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^6}$ and $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^8}$ using the additional terms of the Laurent series for $\cot(z)$ as given here:

$$\cot(x) = \frac{1}{z} - \frac{1}{3}z - \frac{1}{45}z^3 - \frac{2}{945}z^5 - \frac{1}{4725}z^7 - \cdots$$

8. We used the contour shown in Exercise 3 on page 158 to show $\displaystyle\int_0^{\infty} \frac{dx}{1+x^n} = \frac{\pi/n}{\sin(\pi/n)}$ for $n \geq 2$.

   Use the same contour to show that $\displaystyle\int_0^{\infty} \frac{x^m dx}{1+x^n} = \frac{\pi/n}{\sin((m+1)\cdot\pi/n)}$, for $n \geq m+2$, $m \geq 0$.