Homework Assignment for Chapter 08

1. Section 8.2: Problems 5, 11, 15, 23, 25, 27, 29, 33, 35, 43, 45, 51, 63, 71, 75, 76.
2. Section 8.3: Problems 11, 17, 27, 28, 33, 34, 35, 37, 45, 57, 63, 65, 67.
3. Section 8.3: Derive formula 75 76 of 'A brief table of integrals' near the end of the textbook (take $a = 1$ for simplicity). Then derive similar formula for $\displaystyle\int (\tan^m x)(\sec^n x)\ dx$.
4. Section 8.4: Problems 3, 5, 13, 23, 35, 37, 45, 47, 48, 54, 57.

   Some hints:

   $\int e^{ax}\cos(bx)dx$ or $\int e^{ax}\sin(bx)dx$: integration by part twice.

   $\int \frac{f(x)}{g(x)}dx$ where $f(x)$ and $g(x)$ are polynomials: if $\deg f \geq \deg g$, carry out the division, find the quotient and ratio, make sure that $\deg f < \deg g$ afterwards.

   computations involving antiderivative of $\tan^2 x$: try $\tan^2 x = \sec^2 x - 1$

   $\int f(x)\ln x dx$: try $y = \ln x$, $x = e^y$ and proceed.

   $\displaystyle\int \frac{\sin^{2l} x}{\cos^{2k+1}}dx$: multiply the factor $\dfrac{\cos x}{\cos x}$ and proceed. May need the technique of partial fraction (section 8.5) in the end.

   Similarly for $\displaystyle\int \frac{\cos^{2k} x}{\sin^{2l+1}}dx\ (\times\frac{\sin x}{\sin x})$, $\displaystyle\int \frac{\tan^{2k+1} x}{\sec^n x}dx\ (\times\frac{\sec x}{\sec x})$, $\displaystyle\int \frac{\sec^n x}{\tan^{2k+1} x}dx\ (\times\frac{\tan x}{\tan x})$, or $\displaystyle\int \frac{\tan^m x}{\sec^{2l}}dx\ (\times\frac{\sec^2 x}{\sec^2 x})$.
5. Section 8.5: Problems 1, 3, 21, 23, 27, 29, 32, 35, 37, 39, 41, 43, 45, 47, 49.
6. Chap 8, Additional and Advanced Exercises: Problems 41, 43, 45, 47, 49.
7. Chap 8, Practice Exercises: (Important) As time permits, do as many as you can in odd-numbered problems in 69-115. They contain all the integration techniques and you have to figure out which one(s) to use for each problem.
8. Section 8.1: Problems 9, 11, 13, 15, 19, 25, 33, 39, 48.
9. Section 8.8:

   Verify the convergence of the improper integrals $\displaystyle\int_0^1 x^{-p}dx$ and $\displaystyle\int_1^\infty x^{-p}dx$ for $p > 1$, $p = 1$ and $0 < p < 1$, respectively by direct evaluation. Then memorize the results.

10. Section 8.8:

    Problems: 7, 13, 19, 21, 25, 31, 35, 39, 42, 45, 46, 55, 65, 66, 77, 81, 83.

    Note: For problem 66, just read it. All other problems, need not find the values of the integrals (unless you find it convenient). Just determine whether each of them converges or not.

    You may find it convenient to use Theorem 2 and Theorem 3 for almost all of the problems. In most (but not all) problems, you can compare the integrand with one of the cases in Problem 9 above.

    (a) Hint for problem 42: For what values of q does $\lim_{t\to 0^+} \frac{t - \sin t}{t^q} = L$ satisfy $0 < L < \infty$?

    (b) Revision for problem 77: Skip part (a) and change part (b) to

        "Explore the convergence of $\int_0^1 \frac{\sin t}{t} dt$."

        Hint: For what values of q does $\lim_{t\to 0^+} \frac{\frac{\sin t}{t}}{t^q} = L$ satisfy $0 < L < \infty$?

11. Section 8.8:

    For what values of $p > 0$ does $\int_0^1 \cot^p x \, dx$ converge?

12. Chapter 8, Additional and Advanced Exercises:

    Problem 8.

    Hint: Use $\frac{\infty}{\infty}$ version of L'Hôpital's Rule.