Math 121 Assignment 3

Due Friday January 29

■ Practice problems (do NOT turn in):

- Try out as many problems from Sections 6.1-6.4 as you can, with special attention to the ones marked as challenging problems. As a test of your understanding of the material, work out the problems given in the chapter review. You may skip the ones that require computer aid.

■ Problems to turn in:

1. Evaluate the following integrals:

$$(a) \int \frac{\ln(\ln x)}{x}\,dx \qquad (b) \int (\arcsin(x))^2\,dx \qquad (c) \int xe^x \cos x\,dx$$

$$(d) \int \frac{x^3+1}{12+7x+x^2}\,dx \qquad (e) \int \frac{dt}{(t-1)(t^2-1)^2} \qquad (f) \int \frac{dx}{e^{2x}-4e^x+4}$$

$$(g) \int \frac{dx}{x^2(x^2-1)^{\frac{3}{2}}} \qquad (h) \int \frac{dx}{x^2(x^2+1)^{\frac{3}{2}}} \qquad (i) \int \frac{d\theta}{1+\cos\theta+\sin\theta}.$$

2. Use the method of undetermined coefficients to evaluate the integral $\int x^2(\ln x)^4\,dx$.
3. Write down the form that the partial fraction expansion of

$$\frac{x^5+x^3+1}{(x-1)(x^2-1)(x^3-1)}$$

will take. Do not evaluate the constants.

4. Consider the integral $I = \int e^{-x^2}\,dx$. It is known (and you can use this fact without proof) that if it were possible to evaluate the integral I using elementary functions, it would take the form

$$I = P(x)e^{-x^2} + C$$

where P is a polynomial. Show that such a polynomial P does not exist. This is called a proof by contradiction, and it shows that an elementary function (such as e^{-x^2}) may very well possess non-elementary anti-derivatives.

5. Obtain reduction formulae for

$$I_n = \int_0^{\frac{\pi}{2}} x^n \sin x\,dx \qquad \text{and} \qquad J_n = \int \sin^n x\,dx$$

and use them to evaluate I_6 and J_7.