**Lecture 5 Practice Exercises**

Evaluate the following integrals using the method of partial fractions and any additional methods or substitutions that you might need

$$\int \frac{1}{(x^3+5x^2+12x+8)}dx$$
$$\int \frac{1+x}{x(x^4+2x^2+1}dx$$

**Hint:** In the first example the denominator vanishes at $x = -1$.

Find the proper form for the partial fractions expansion of the following rational functions. You do not need to actually calculate the coefficients.

$$\frac{2x^5+1}{(x-1)^3(x^4+2x^2+1)}$$
$$\frac{2}{(x+1)^3(x^4+2x^2+1)^2}$$
$$\frac{5x-7}{x^4+6x^2+5}$$

Compute the limit:

$$\lim_{x\to 0} x \ln^n |x|$$

where $n$ is an integer. If you cannot do the general case try $n = 1, 2$.

For what values of $\alpha$ does the integral

$$\int_0^1 x^{-\alpha}dx$$

converge?

For what values of $\beta$ does the integral

$$\int_0^{\frac{1}{2}} \frac{1}{x \ln^\beta |x|}dx$$

converge?