Math 1432 – Review for Test 3 (Chapter 8)

1. Integrate:
   a. $\int \frac{3x^2+3x+3}{x^2+1}dx$
   b. $\int \frac{x^2}{(x+1)(x-1)^2}dx$
   c. $\int \frac{x^2+5x+2}{(x+1)(x^2+1)}dx$
   d. $\int \frac{2x^2}{\sqrt{9-x^2}}dx$
   e. $\int \frac{2}{x\sqrt{9+x^2}}dx$
   f. $\int \frac{5}{36+(x-1)^2}dx$
   g. $\int \frac{1}{\sqrt{4+x^2}}dx$
   h. $\int \frac{5x+14}{(x+1)(x^2-4)}dx$
   i. $\int_0^{\frac{\sqrt{3}}{2}} \frac{1}{\sqrt{1-x^2}}dx$
   j. $\int \frac{1}{\sqrt{9-4x^2}}dx$
   k. $\int x\ln(2x)dx$
   l. $\int 2x\sin(3x)dx$
   m. $\int \frac{5}{36+(x-1)^2}dx$
   n. $\int x^2e^x dx$

o. $\int 2x\sec\left(4x^2\right)dx$

p. $\int\left[2x+\ln(x)\right]dx$

q. $\int\left[\arctan x\right]dx$

2. Integrate

a. $\int \tan^4(x)dx$

b. $\int \sin^3 x\cos x\ dx$

c. $\int \cos^3 x\sin^2 x\ dx$

d. $\int \tan^2 x\ dx$

e. $\int \sec^4(x)\tan^2 xdx$

f. $\int \sec^5(x)\tan x\ dx$

g. $\int \sec^4(x)dx$

h. $\int \cot^3 xdx$

3. Integrate using trigonometric substitution:

a. $\int \frac{1}{x^2\sqrt{4+x^2}}dx$

b. $\int \sqrt{25-x^2}dx$

c. Integrating using trigonometric substitution $x=5\sin\theta$, the result is

$2\theta+\ln\left(\left|\sec\theta+\tan\theta\right|\right)+\cos\theta+C$. Express the answer in terms of "x".

4. Give the form of the partial fraction decomposition (A,B,C..):

a. $\dfrac{x+1}{x^2-4}$

b. $\dfrac{2x+1}{(x-4)(x+2)}$

c. $\dfrac{5x+1}{(x-4)^2(x+2)}$

d. $\dfrac{5x+1}{(x-1)^2(x^2+6)}$

e. $\dfrac{1}{(x^2-1)(x^2+2)}$

5. Approximate $\int_1^5 \dfrac{1}{x+2}dx$ using (i) Trapezoidal rule with n=4, (ii) Simpson's rule with n=4.

6. Find an upperbound for the error if $\int_1^5 \left(\sin\left(\dfrac{x}{2}\right)\right)dx$ is approximated using (i) Trapezoidal rule with n=4, (ii) Simpson's rule with n=4.

7. Determine the values of n which guarantee a theoretical error less than $\varepsilon = 0.01$ if the integral is estimated by trapezoidal rule

a. $\int_1^3 \left(\dfrac{1}{4}x^2 + 3x - 2\right)dx$

b. $\int_1^3 (\cos 5x)dx$

Note: Must know how to answer "factual" questions about approximations; for example, for a given function, can you order R_n, L_n, T_n, S_n without computing them? How do they compare?