

Pencil and Paper homework Number 4

This homework has some integral problems. The first page is Integration by Parts problems and the second page is Trig Problems by Parts. It is important that you do these by hand and not with your calculator. To get credit you must show all the work by hand.

Part I Integration by Parts

1) Do the following routine by parts integrals

a) $\int x e^x dx$

b) $\int_0^1 x e^x dx$

c) $\int x \sin 2x dx$

d) $\int_0^{\pi/4} x \sin 2x dx$

e) $\int (x + 3) \sin 2x dx$

f) $\int_1^2 x^2 e^{-x} dx$ Do it twice!

g) $\int \ln x dx$ Let $u = \ln x$, $dv = dx$

h) $\int x \ln x dx$ Use previous problem

i) $\int \arctan x dx$ (Same as $\int \tan^{-1} x dx$)

2) These are a little harder

a) $\int \frac{\ln x}{x^2} dx$

b) $\int_1^e \frac{\ln x}{x^2} dx$

c) $\int (\ln x)^3 dx$

d) $\int_2^3 (\ln x)^3 dx$

3) Derive the reduction formula

$$\int x^n e^{ax} dx = \frac{1}{a} x^n e^{ax} - \frac{n}{a} \int x^{n-1} e^{ax} dx$$

and use it to find $\int_0^1 x^2 e^{3x} dx$.

If you care to try your hand at a real challenge, find $\int \sec^3 x dx$ by doing two integration by parts's, getting the integral back with a minus sign in front, and using this to get the integral. (This is optional; there is no credit because they do it in the book. Try to do it by yourself).

Part II Trig Problems

1) Do the following routine sine cosine integrals

a) $\int \sin^3 x \, dx$

b) $\int_0^{\pi/2} \sin^3 x \, dx$

c) $\int \sin^3 x \cos^4 x \, dx$

d) $\int_0^{\pi/2} \sin^3 x \cos^4 x \, dx$

e) $\int \sin 3x \cos^4 3x \, dx$

f) $\int_0^{\pi/6} \sin 3x \cos^4 3x \, dx$

2) Do the following problems with double angle formulas.

a) $\int \sin^2 3x \, dx$

b) $\int_0^{\pi/6} \sin^2 3x \, dx$

c) $\int \cos^2 2x \, dx$

d) $\int_0^{\pi/4} \cos^2 2x \, dx$

e) $\int \sin^2 3x \cos^2 3x \, dx$

f) $\int_0^{\pi/4} \sin^2 3x \cos^2 3x \, dx$

3) Do the following problems with reduction formulas

a) $\int \sin^6 3x \, dx$

b) $\int_0^{\pi/6} \sin^6 3x \, dx$

c) $\int \sin^6 3x \cos^4 3x \, dx$

4) Do the following routine secant tangent integrals

a) $\int \sec^3 x \tan^3 x \, dx$

b) $\int_0^{\pi/6} \sec^3 x \tan^3 x \, dx$

c) $\int \sec^4 x \tan x \, dx$

d) $\int \sec^4 3x \tan 3x \, dx$

5) Do the following secant tangent integrals using a reduction formula

a) $\int \sec x \tan^4 x \, dx$

b) $\int \sec^3 x \tan^4 x \, dx$