Workshop Exercises: Techniques of Integration I

1. Integrate by the method of integration by parts.

a) $\int x e^x \, dx.$

b) $\int x \sin x \, dx.$

c) $\int x^2 \sin x \, dx.$

d) $\int x^3 \ln x \, dx.$

e) $\int_0^1 \tan^{-1} x \, dx.$

f) $\int e^{2x} \cos x \, dx.$

g) $\int x^5 \sqrt{x^3 + 4} \, dx.$

2. Integrate the following trigonometric integrals.

a) $\int \cos x \sin^2 x \, dx.$

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

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

d) $\int \sin^2 x \cos^2 x \, dx.$

e) $\int \tan^3 x \sec^2 x \, dx$ (or $\int \cot^3 x \csc^2 x \, dx$).

f) $\int \tan^3 x \sec^4 x \, dx$ (or $\int \cot^3 x \csc^4 x \, dx$).

g) $\int \cot^3 x \csc^3 x \, dx$ (or $\int \tan^3 x \sec^3 x \, dx$).

h) $\int \cot^2 x \csc x \, dx$ (or $\int \tan^2 x \sec x \, dx$).

3. Integrate by the method of trigonometric substitution.

a) $\int \frac{x^3}{\sqrt{9-x^2}} \, dx.$

b) $\int \frac{1}{(2-x^2)^{\frac{3}{2}}} \, dx.$

c) $\int \frac{\sqrt{4-x^2}}{x} \, dx.$

d) $\int_0^4 \frac{x^3}{(x^2+9)^{\frac{3}{2}}} \, dx.$

e) $\int \frac{1}{\sqrt{1+4x^2}} \, dx.$

f) $\int_2^3 \frac{1}{x^2 \sqrt{x^2-1}} \, dx.$

g) $\int \frac{1}{\sqrt{x^2+4x+3}} \, dx.$

h) $\int \sqrt{5 - 4x - x^2} \, dx.$