

Calculus II

Homework

Integration by parts

1. Evaluate the indefinite integral. Illustrate the steps of your solutions.

(a) $\int x \sin x dx.$

(f) $\int x^2 e^{-2x} dx.$

(b) $\int x e^{-x} dx.$

(g) $\int x \sin(2x) dx.$

(c) $\int x^2 e^x dx.$

(h) $\int x \cos(3x) dx.$

(d) $\int x \sin(-2x) dx.$

(i) $\int x^2 e^{2x} dx.$

(e) $\int x^2 \cos(3x) dx.$

(j) $\int x^3 e^x dx.$

2. Evaluate the indefinite integral. Illustrate the steps of your solutions.

(a) $\int x^2 \cos(2x) dx.$

(m) $\int (\arcsin x)^2 dx.$ (Hint: Try substituting $x = \sin y.$)

(b) $\int x^2 e^{ax} dx$, where a is a constant.

(n) $\int \arctan\left(\frac{1}{x}\right) dx.$

(c) $\int x^2 e^{-ax} dx$, where a is a constant.

(o) $\int \sin x e^x dx$

(d) $\int x^2 \frac{(e^{ax} + e^{-ax})^2}{4} dx$, where a is a constant.

(p) $\int \cos x e^x dx$

(e) $\int \frac{1}{\cos^2 x} dx.$ (Hint: This problem does not require integration by parts. What is the derivative of $\tan x$?)

(q) $\int \sin(\ln(x)) dx.$

(f) $\int (\tan^2 x) dx.$ (Hint: This problem does not require integration by parts. We can use $\tan^2 x = \frac{1}{\cos^2 x} - 1$ and the previous problem.)

(r) $\int \cos(\ln(x)) dx.$

(g) $\int x \tan^2 x dx.$ (Hint: $\tan^2 x dx = d(F(x))$, where $F(x)$ is the answer from the preceding problem).

(s) $\int \ln x dx$

(h) $\int e^{-\sqrt{x}} dx.$

(t) $\int x \ln x dx.$

(i) $\int \cos^2 x dx.$

(u) $\int \frac{\ln x}{\sqrt{x}} dx.$

(j) $\int \frac{x}{1+x^2} dx$ (Hint: use substitution rule, don't use integration by parts)

(v) $\int (\ln x)^2 dx.$

(k) $\int (\arctan x) dx.$

(w) $\int (\ln x)^3 dx.$

(x) $\int x^2 \cos^2 x dx.$ (This problem is related to Problem 2.d as $\cos x = \frac{e^{ix} + e^{-ix}}{2}.$)

3. Compute $\int x^n e^x dx$, where n is a non-negative integer.