

The following are a list of integration formulas that you need to know. Even when you go through the different methods, you reduce the integrals to one of these basic integrals.

$$\int x^n dx = \frac{x^{n+1}}{n+1} + c \quad n \neq -1$$

$$\int \sec^2 x dx = \tan x + c$$

$$\int \frac{dx}{x} = \ln |x| + c$$

$$\int \csc^2 x dx = -\cot x + c$$

$$\int e^x dx = e^x + c$$

$$\int \sec x \tan x dx = \sec x + c$$

$$\int \sin x dx = -\cos x + c$$

$$\int \csc x \cot x dx = -\csc x + c$$

$$\int \cos x dx = \sin x + c$$

Hint I: If you think you have an antiderivative, just differentiate and see if you end up with the integrand!

Method 1. *Straight forward integration.* The integral can be reduced to one of the first set of integrals.

Example A. $\int (x^2 + 1)(x - 3) dx = \int (x^3 - 3x^2 + x - 3) dx = \frac{x^4}{4} - x^3 + \frac{x^2}{2} - 3x + c$

Example B. $\int \frac{1 - \sin^2 x}{1 + \sin x} dx = \int \frac{(1 - \sin x)(1 + \sin x)}{1 + \sin x} dx = \int (1 - \sin x) dx = x + \cos x + c$

Problems:

1. $\int e^x (1 - e^{-x} \sec^2 x) dx$

2. $\int \frac{x^3 - 2x + 4}{x} dx$

3. $\int \cos x \tan x dx$

4. Evaluate

a) $\int \left(\sqrt[3]{x^2} - \frac{1}{\sqrt{x}} + \frac{1}{x} - e^x + \cot x \csc x \right) dx$

b) $\int (x^2 + 1)(x - 1) dx$

c) $\int \tan^2 x dx$

d) $\int \frac{e^{2x} + x^3 e^x}{e^x} dx$

e) $\int (\sin x - \cos x) dx$

5. Evaluate

a) $\int_{\pi/4}^{\pi/3} (\csc^2 x + \sin x) dx$

b) $\int_1^2 \frac{x^{3/2} + x^{1/2} - 1}{x} dx$

6. Evaluate

a) $\int \left(\frac{1}{\sqrt{x}} - e^x + \cos x \right) dx$

b) $\int \frac{e^{2x} + x^2 e^x}{e^x} dx$

c) $\int \frac{2x^3 - x + 3\sqrt{x}}{x} dx$

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

e) $\int (x - 2)(x^2 + 1) dx$

f) $\int \left(\tan x \frac{\sin^2 x + \cos^2 x}{\cos x} \right) dx$

7. Evaluate

a) $\int_{\pi/4}^{\pi/3} (\cos x + \sin x) dx$

b) $\int_{-1}^3 x^2(x - 1) dx$

8. a) $\int_{-1}^2 f(x) dx$ where $f(x) = \begin{cases} 1 & x \leq 0 \\ x + 1 & x > 0 \end{cases}$.

b) $\int_{-2}^3 |x| dx$ Hint: Use the definition of $|x|$ before you integrate.