

Math 12002  
Basic Integration Formulas

Integrals of Specific Functions:

1.  $\int u^n du = \frac{1}{n+1}u^{n+1} + C$ , if  $n \neq -1$  is a number

$$\int x^3 dx = \frac{1}{4}x^4 + C$$

$$\int \frac{1}{x^3} dx = \int x^{-3} dx = -\frac{1}{2}x^{-2} + C$$

$$\int 3 dx = 3x + C$$

2.  $\int u^{-1} du = \int \frac{1}{u} du = \ln |u| + C$

3.  $\int \sin u du = -\cos u + C$

$$\int \sin(3x) dx = -\frac{1}{3} \cos(3x) + C$$

4.  $\int \cos u du = \sin u + C$

$$\int \cos(3x) dx = \frac{1}{3} \sin(3x) + C$$

5.  $\int e^u du = e^u + C$

$$\int e^{3x} dx = \frac{1}{3}e^{3x} + C$$

6.  $\int b^u du = \frac{1}{\ln b}b^u + C$ , if  $b > 0$  is a number

$$\int 3^x dx = \frac{1}{\ln 3}3^x + C$$

7.  $\int \frac{1}{1+u^2} du = \arctan u + C$

8.  $\int \frac{1}{\sqrt{1-u^2}} du = \arcsin u + C$

9.  $\int \frac{1}{u\sqrt{u^2-1}} du = \operatorname{arcsec} u + C$

General Rules:

1.  $\int (f(x) + g(x)) dx = \int f(x) dx + \int g(x) dx$

$$\int x^3 + \frac{1}{x^3} + 3 dx = \int x^3 dx + \int \frac{1}{x^3} dx + \int 3 dx = \frac{1}{4}x^4 - \frac{1}{2}x^{-2} + 3x + C$$

2.  $\int cf(x) dx = c \int f(x) dx$ , if  $c$  is a number

$$\int \frac{1}{3x} dx = \int \frac{1}{3} \cdot \frac{1}{x} dx = \frac{1}{3} \int \frac{1}{x} dx = \frac{1}{3} \ln |x| + C$$

$$\int \frac{3}{1+x^2} dx = 3 \int \frac{1}{1+x^2} dx = 3 \arctan x + C$$

$$\int 2 \sin x + 3 \cos x dx = -2 \cos x + 3 \sin x + C$$

3.  $\int f(g(x)) \cdot g'(x) dx = F(g(x)) + C$ , if  $F'(x) = f(x)$

$$\int 2x \cos(x^2) dx = \sin(x^2) + C$$

4.  $\int f(x)g(x) dx$  **IS NOT**  $\int f(x) dx \cdot \int g(x) dx$  !!!

$$\int x^3(x^2 + 3) dx = \int x^5 + 3x^3 dx = \frac{1}{6}x^6 + \frac{3}{4}x^4 + C, \text{ whereas}$$

$$\int x^3 dx \cdot \int (x^2 + 3) dx = \left(\frac{1}{4}x^4 + C_1\right) \cdot \left(\frac{1}{3}x^3 + 3x + C_2\right)$$

5.  $\int \frac{f(x)}{g(x)} dx$  **IS NOT**  $\frac{\int f(x) dx}{\int g(x) dx}$  !!!

$$\int \frac{3}{1+x^2} dx = 3 \arctan x + C, \text{ whereas}$$

$$\frac{\int 3 dx}{\int 1+x^2 dx} = \frac{3x + C_1}{x + \frac{1}{3}x^3 + C_2}$$