

General Integration

i.e. Anti-Derivatives

Chap 6 Sec 1 – 2

$f(x)$	$f'(x)$
u^n	$nu^{n-1}u'$
au	au'
a	0
e^u	$e^u u'$
a^u	$\ln(a) \cdot a^u u'$
$\ln(u)$	$\frac{1}{u} \cdot u'$
$\log_a(u)$	$\frac{1}{\ln(a)u} \cdot u'$
$a \cdot u(x) \pm b \cdot v(x)$	$a \cdot u'(x) \pm b \cdot v'(x)$
$a \cdot u(x)$	$a \cdot u'(x)$
$u(x) \cdot v(x)$	$u \cdot v' + v \cdot u'$
$\frac{u}{v}$	$\frac{v \cdot u' - u \cdot v'}{v^2}$

$f(x)$	$F(x) = \int f(x) dx$
$u^n \cdot u'$	$\frac{u^{n+1}}{n+1} + C, n \neq -1$
$\frac{1}{u} \cdot u'$	$\ln(u) + C$
a	$ax + C$
$e^u \cdot u'$	$e^u + C$
$a^u \cdot u'$	$\frac{a^u}{\ln(a)} + C$

$$A_0 e^{rt}$$

$$A_0 \left(1 + \frac{r}{n}\right)^{nt}$$

Calculate the following integrals.

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

2. $\int 11(x - 7)^9 dx$

3. $\int 5x^4(x^5 + 3)^8 dx$

4. $\int 7(1.03^x) dx$

5. $\int \frac{2x}{x^2 + 1} dx$

6. $\int \frac{x}{x^2 + 1} dx$

7. $\int 5x^2(2x^3 - 7)^7 dx$

8. $\int \frac{e^x}{1 + e^x} dx$

9. $\int 7x^4(2x^5 - 9)^3 dx$

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

11. $\int x^2 e^{(x^3)} dx$

12. $\int \frac{1}{x} (\ln(x))^5 dx$

13. $\int 19x(5x^2 + 1)^9 dx$

14. $\int 9 \cdot e^{-0.01x} dx$

15. $\int (\ln(x))^7 \frac{9}{x} dx$

16. $\int \frac{2x}{(x^2 + 1)^5} dx$

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The following integrals are beyond us and, in some cases, impossible to define using any familiar mathematical functions.

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

18. $\int xe^x dx$

19. $\int x(x^3 + 1)^5 dx$

20. $\int x^3(x^3 + 1)^5 dx$

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

22. $\int \frac{1}{1+x^2} dx$

23. $\int \sqrt{3^2 - x^2} dx$

24. $\int \sqrt{3^2 - 2^2 x^2} dx$

Test questions on this topic are formatted with two or three parts, as follows.

In #25 – 28 circle one integral not to be evaluated (for one point) and evaluate the other two.

25. a. $\int \frac{x^3 - 3x^2 + x + \sqrt{x}}{x^3} dx$

b. $\int 11(x - 7)^9 dx$

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

26. a. $\int 5x^4(x^5 + 3)^8 dx$

b. $\int \frac{1}{1+x^2} dx$

c. $\int 5x^2(2x^3 - 7)^7 dx$

27. a. $\int \sqrt{3^2 - x^2} dx$

b. $\int \frac{2x}{(x^2 + 1)^5} dx$

c. $\int 19x(5x^2 + 1)^9 dx$

28. a. $\int \sqrt{3^2 - 2^2 x^2} dx$

b. $\int 9 \cdot e^{-0.01x} dx$

c. $\int xe^{(x^2)} dx$

Answers:

1. $x - 3\ln(x) + \frac{x^{-1}}{-1} + \frac{x^{-3/2}}{-3/2} + c$

2. $\frac{11}{10}(x - 7)^{10} + c$

3. $\frac{(x^5 + 3)^9}{9} + c$

4. $\frac{7(1.03^x)}{\ln(1.03)} + c$

5. $\ln|x^2 + 1| + C$

6. $\frac{1}{2}\ln(x^2 + 1) + C$

7. $\frac{5}{6} \frac{(2x^3 - 7)^8}{8} + C$

8. $\ln(1 + e^x) + C$

9. $\frac{7}{10} \frac{(2x^5 - 9)^4}{4} + c$

10. $\frac{1}{2}e^{(x^2)} + c$

11. $\frac{1}{3}e^{(x^3)} + c$

12. $\frac{(\ln(x))^6}{6} + c$

13. $\frac{19}{5 \cdot 2} \cdot \frac{(5x^2 + 1)^{10}}{10} + C$

14. $\frac{9}{-0.01} e^{-0.01x} + C$

15. $\frac{9}{8} (\ln(x))^8 + C$

16. $\frac{(x^2 + 1)^{-4}}{-4} + C$

17 – 24 are impossible or beyond the scope of this course

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25.

$$\text{a. } \int \frac{x^3 - 3x^2 + x + \sqrt{x}}{x^3} dx \quad \text{b. } \int 11(x-7)^9 dx \quad \text{c. } \int e^{(-x^2)} dx$$

$$x - 3\ln(x) + \frac{x^{-1}}{-1} + \frac{x^{-3/2}}{-3/2} + c \quad \frac{11}{10}(x-7)^{10} + c$$

26.

$$\text{a. } \int 5x^4(x^5 + 3)^8 dx \quad \text{b. } \int \frac{1}{1+x^2} dx \quad \text{c. } \int 5x^2(2x^3 - 7)^7 dx$$

$$\frac{(x^5 + 3)^9}{9} + c \quad \frac{5(2x^3 - 7)^8}{6 \cdot 8} + C$$

27.

$$\text{a. } \int \sqrt{3^2 - x^2} dx \quad \text{b. } \int \frac{2x}{(x^2 + 1)^5} dx \quad \text{c. } \int 19x(5x^2 + 1)^9 dx$$

$$\frac{(x^2 + 1)^{-4}}{-4} + C \quad \frac{19}{5 \cdot 2} \cdot \frac{(5x^2 + 1)^{10}}{10} + C$$

28.

$$\text{a. } \int \sqrt{3^2 - 2^2 x^2} dx \quad \text{b. } \int 9 \cdot e^{-0.01x} dx \quad \text{c. } \int x e^{(x^2)} dx$$

$$\frac{9}{-0.01} e^{-0.01x} + C \quad \frac{1}{2} e^{(x^2)} + c$$