

C3 Integration Practice

All that can come up in Core 3 in integration is the following:

$$\int x^n dx = \frac{x^{n+1}}{n+1} + c, \quad \int e^x dx = e^x + c, \quad \int \frac{1}{x} dx = \ln x + c.$$

But with reverse chain rule we also have:

$$\int f'(x)[f(x)]^n dx = \frac{[f(x)]^{n+1}}{n+1} + c, \quad \int f'(x)e^{f(x)} dx = e^{f(x)} + c, \quad \int \frac{f'(x)}{f(x)} dx = \ln f(x) + c.$$

Evaluate the following integrals:

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| 1. $\int (x-1)^3 dx.$ | $\frac{(x-1)^4}{4} + c$ | 16. $\int \frac{\pi}{\sqrt{\pi-x}} dx.$ | $-2\pi\sqrt{\pi-x} + c$ |
| 2. $\int 2e^{5x} dx.$ | $\frac{2e^{5x}}{5} + c$ | 17. $\int xe^{2x^2} dx.$ | $\frac{e^{2x^2}}{4} + c$ |
| 3. $\int \frac{1}{2x} dx.$ | $\frac{\ln x}{2} + c$ | 18. $\int \frac{a}{b-kx} dx.$ | $-\frac{a \ln(b-kx)}{k} + c$ |
| 4. $\int (3x+2)^4 dx.$ | $\frac{(3x+2)^5}{15} + c$ | 19. $\int x\sqrt{x^2+a} dx.$ | $\frac{(x^2+a)^{\frac{3}{2}}}{3} + c$ |
| 5. $\int -e^{3x-2} dx.$ | $-\frac{e^{3x-2}}{3} + c$ | 20. $\int 7x^2e^{x^3+1} dx.$ | $\frac{7e^{x^3+1}}{3} + c$ |
| 6. $\int \frac{4}{x-1} dx.$ | $4\ln(x-1) + c$ | 21. $\int \frac{x}{x^2+a^2} dx.$ | $\frac{\ln(x^2+a^2)}{2} + c$ |
| 7. $\int (5-2x)^{10} dx.$ | $-\frac{(5-2x)^{11}}{22} + c$ | 22. $\int \frac{x^2}{\sqrt[3]{x^3+1}} dx.$ | $\frac{(x^3+1)^{\frac{2}{3}}}{3} + c$ |
| 8. $\int \frac{6}{e^{kx}} dx.$ | $-\frac{6}{ke^{kx}} + c$ | 23. $\int \frac{\pi e^{x^2+3}}{x^{-1}e^3} dx.$ | $\frac{\pi e^{x^2}}{2} + c$ |
| 9. $\int \frac{-3}{2x+1} dx.$ | $-\frac{3\ln(2x+1)}{2} + c$ | 24. $\int \frac{e^x}{\pi + e^x} dx.$ | $\ln(\pi + e^x) + c$ |
| 10. $\int \frac{7}{(5-x)^4} dx.$ | $\frac{7}{3(5-x)^3} + c$ | 25. $\int \frac{1}{\sqrt[n]{nx+a}} dx.$ | $\frac{(nx+a)^{1-\frac{1}{n}}}{n-1} + c$ |
| 11. $\int \frac{k}{e^{x-1}} dx.$ | $-ke^{1-x} + c$ | 26. $\int e^{\ln x^2} + x dx.$ | $\frac{x^3}{3} + \frac{x^2}{2} + c$ |
| 12. $\int \frac{7}{1-x} dx.$ | $-7\ln(1-x) + c$ | 27. $\int \frac{6x^2+4x}{x^3+x^2} dx.$ | $2\ln(x^3+x^2) + c$ |
| 13. $\int \sqrt{\frac{x}{2}} - 3 dx.$ | $\frac{4(\frac{x}{2}-3)^{\frac{3}{2}}}{3} + c$ | 28. $\int \frac{ax^n}{(x^{n+1}+1)^2} dx.$ | $-\frac{a}{(n+1)(x^{n+1}+1)} + c$ |
| 14. $\int \frac{e^{2x}}{e^{1+x}} dx.$ | $e^{x-1} + c$ | 29. $\int ae^x e^{e^x} dx.$ | $ae^{e^x} + c$ |
| 15. $\int \frac{5}{4x-1} - \frac{6}{7-2x} dx.$ | $\frac{5\ln(4x-1)}{4} + 3\ln(7-2x) + c$ | 30. $\int \frac{e^{2x}}{e^{2x}-1} dx.$ | $\frac{\ln(e^{2x}-1)}{2} + c$ |
| | | 31. $\int \frac{e^x}{\sqrt[n]{e^x+3}} dx.$ | $\frac{n(e^x+3)^{1-\frac{1}{n}}}{n-1} + c$ |

$$32. \int \frac{e^{\sqrt{x}}}{b\sqrt{x}} dx.$$

$$\boxed{\frac{2e^{\sqrt{x}}}{b} + c}$$

$$35. \int \frac{ae^{\frac{1}{x+1}}}{(x+1)^2} dx.$$

$$\boxed{-ae^{\frac{1}{x+1}} + c}$$

$$33. \int \frac{ax^3}{x^4+1} dx.$$

$$\boxed{\frac{a \ln(x^2+1)}{4} + c}$$

$$36. \int \frac{e^x}{e^{x+1} + k} dx.$$

$$\boxed{\frac{\ln(e^{-x+1}+k)}{e} + c}$$

$$34. \int \frac{\sqrt{a \ln x + 1}}{bx} dx.$$

$$\boxed{\frac{2(a \ln x + 1)^{\frac{3}{2}}}{3ab} + c}$$