Appendix A: Some Useful Integrals

1. $\int u\,dv = u\int dv - \int v\,du = uv - \int v\,du$, useful for integration by parts

2. $\int x^n dx = \dfrac{x^{n+1}}{n+1}$, except when $n = -1$

3. $\int \dfrac{f'(x)\,dx}{f(x)} = \log f(x), \left(df(x) = f'(x)\,dx\right)$

4. $\int \dfrac{dx}{x} = \log x$

5. $\int \dfrac{f'(x)\,dx}{2\sqrt{f(x)}} = \sqrt{f(x)}$

6. $\int e^x dx = e^x$

7. $\int e^{ax} dx = \dfrac{e^{ax}}{a}$

8. $\int \log x\,dx = x\log x - x$

9. $\Gamma(n) = \int\limits_0^\infty x^{n-1} e^x dx$, Gamma function

10. $B(m,n) = \int\limits_0^1 x^{m-1}(1-x)^{n-1}\,dx$, Beta function

11. $\displaystyle\int \sin x\,dx = -\cos x$

12. $\displaystyle\int \cos x\,dx = \sin x$

13. $\displaystyle\int_{0}^{\infty} \sqrt{x}\,e^{-x}\,dx = \frac{1}{2}\sqrt{\pi}\left[\Gamma\!\left(\frac{1}{2}\right) = \sqrt{\pi}\right]$

14. $\displaystyle\int_{0}^{\infty} e^{-ax^2}\,dx = \frac{1}{2}\sqrt{\frac{\pi}{a}}$, Gaussian integral