PART 1 Common integrals

	Indefinite integral*	Constraint	Definite integral
Algebraic functions			
A.1	$\int x^n \mathrm{d}x = \frac{1}{n+1}x^{n+1} + c$	$n \neq -1$	$\int_a^b x^n \,\mathrm{d}x = \frac{1}{n+1}(b^{n+1} - a^{n+1})$
A.2	$\int \frac{1}{x}\mathrm{d}x = \ln x + c$		$\int_a^b \frac{1}{x}\mathrm{d}x = \ln\frac{b}{a}$
A.3	$\int \frac{1}{(A-x)(B-x)}\mathrm{d}x = \frac{1}{B-A}\ln\frac{B-x}{A-x} + c$	$A \neq B$	$\int_a^b \frac{1}{(A-x)(B-x)}\mathrm{d}x = \frac{1}{B-A}\ln\frac{(B-b)(A-a)}{(A-b)(B-a)}$
Exponential functions			
E.1	$\int \mathrm{e}^{-kx}\mathrm{d}x = -\frac{1}{k}\mathrm{e}^{-kx} + c$		$\int_a^b \mathrm{e}^{-kx}\,\mathrm{d}x = \frac{1}{k}(\mathrm{e}^{-ka} - \mathrm{e}^{-kb})$
E.2	$\int x\mathrm{e}^{-kx}\mathrm{d}x = -\frac{1}{k^2}\mathrm{e}^{-kx} - \frac{x}{k}\mathrm{e}^{-kx} + c$		$\int_a^b x\mathrm{e}^{-kx}\,\mathrm{d}x = -\frac{1}{k^2}(\mathrm{e}^{-kb} - \mathrm{e}^{-ka}) - \frac{1}{k}(b\mathrm{e}^{-kb} - a\mathrm{e}^{-ka})$
E.3		$n \geq 0$, $k > 0$	$\int_0^\infty x^n\mathrm{e}^{-kx}\,\mathrm{d}x = \frac{n!}{k^{n+1}}$ $\quad n! = n(n-1)\ldots1;\ 0! = 1$
E.4			$\int_0^\infty \frac{x^4\mathrm{e}^x}{(\mathrm{e}^x-1)^2}\mathrm{d}x = \frac{4\pi^4}{15}$
Gaussian functions			
G.1			$\int_0^\infty \mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{1}{2}\left(\frac{\pi}{k}\right)^{1/2}$
G.2	$\int x\mathrm{e}^{-kx^2}\,\mathrm{d}x = -\frac{1}{2k}\mathrm{e}^{-kx^2} + c$		$\int_0^\infty x\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{1}{2k}$
G.3			$\int_0^\infty x^2\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{1}{4}\left(\frac{\pi}{k^3}\right)^{1/2}$
G.4	$\int x^3\mathrm{e}^{-kx^2}\,\mathrm{d}x = -\frac{1}{2k^2}\mathrm{e}^{-kx^2} - \frac{x^2}{2k}\mathrm{e}^{-kx^2} + c$	$k > 0$	$\int_0^\infty x^3\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{1}{2k^2}$
G.5		$k > 0$	$\int_0^\infty x^4\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{3}{8k^2}\left(\frac{\pi}{k}\right)^{1/2}$
G.6			$\mathrm{erf}\,z = \frac{2}{\pi^{1/2}}\int_0^z \mathrm{e}^{-x^2}\,\mathrm{d}x \quad \mathrm{erfc}\,z = 1 - \mathrm{erf}\,z$
G.7		$m \geq 0$, $k > 0$	$\int_0^\infty x^{2m+1}\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{m!}{2k^{m+1}}$
G.8		$m \geq 1$, $k > 0$	$\int_0^\infty x^{2m}\mathrm{e}^{-kx^2}\,\mathrm{d}x = \frac{(2m-1)!!}{2^{m+1}k^m}\left(\frac{\pi}{k}\right)^{1/2}$
			$n!! = n \times (n-2) \times (n-4) \ldots 1$ or 2
Trigonometric functions			
T.1	$\int \sin kx\,\mathrm{d}x = -\frac{1}{k}\cos kx + c$		$\int_0^a \sin kx\,\mathrm{d}x = \frac{1}{k}(1 - \cos ka)$
T.2	$\int \sin^2 kx\,\mathrm{d}x = \frac{1}{2}x - \frac{1}{4k}\sin 2kx + c$		$\int_0^a \sin^2 kx\,\mathrm{d}x = \frac{1}{2}a - \frac{1}{4k}\sin 2ka$
T.3	$\int \sin^3 kx\,\mathrm{d}x = -\frac{1}{3k}(\sin^2 kx + 2)\cos kx + c$		$\int_0^a \sin^3 kx\,\mathrm{d}x = \frac{1}{3k}\{2 - (\sin^2 ka + 2)\cos ka\}$
T.4	$\int \sin^4 kx\,\mathrm{d}x = \frac{3x}{8} - \frac{3}{8k}\sin kx\cos kx - \frac{1}{4k}\sin^3 kx\cos kx + c$		$\int_0^a \sin^4 kx\,\mathrm{d}x = \frac{3a}{8} - \frac{3}{8k}\sin ka\cos ka - \frac{1}{4k}\sin^3 ka\cos ka$
T.5	$\int \sin Ax\sin Bx\,\mathrm{d}x = \frac{\sin(A-B)x}{2(A-B)} - \frac{\sin(A+B)x}{2(A+B)} + c$	$A^2 \neq B^2$	$\int_0^a \sin Ax\sin Bx\,\mathrm{d}x = \frac{\sin(A-B)a}{2(A-B)} - \frac{\sin(A+B)a}{2(A+B)}$
T.6	$\int \cos Ax\cos Bx\,\mathrm{d}x = \frac{\sin(A-B)x}{2(A-B)} + \frac{\sin(A+B)x}{2(A+B)} + c$	$A^2 \neq B^2$	$\int_0^a \cos Ax\cos Bx\,\mathrm{d}x = \frac{\sin(A-B)a}{2(A-B)} + \frac{\sin(A+B)a}{2(A+B)}$

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T.7	$\int \sin kx \cos kx \,\mathrm{d}x = \frac{1}{2k}\sin^2 kx + c$		$\int_0^a \sin kx \cos kx \,\mathrm{d}x = \frac{1}{2k}\sin^2 ka$
T.8	$\int \sin Ax \cos Bx \,\mathrm{d}x = \frac{\cos(B-A)x}{2(B-A)} - \frac{\cos(A+B)x}{2(A+B)} + c$	$A^2 \neq B^2$	$\int_0^a \sin Ax \cos Bx \,\mathrm{d}x = \frac{\cos(B-A)a-1}{2(B-A)} - \frac{\cos(A+B)a-1}{2(A+B)}$
T.9	$\int x \sin Ax \sin Bx \,\mathrm{d}x = -\frac{\mathrm{d}}{\mathrm{d}B}\underbrace{\int \sin Ax \cos Bx \,\mathrm{d}x}_{\text{T.7}}$	$A^2 \neq B^2$	
T.10	$\int \cos^2 kx \sin kx \,\mathrm{d}x = -\frac{1}{3k}\cos^3 kx + c$		$\int_0^a \cos^2 kx \sin kx \,\mathrm{d}x = \frac{1}{3k}\{1-\cos^3 ka\}$
T.11	$\int x \sin^2 kx \,\mathrm{d}x = \frac{x^2}{4} - \frac{1}{4k}x\sin 2kx - \frac{1}{8k^2}\cos 2kx + c$		$\int_0^a x \sin^2 kx \,\mathrm{d}x = \frac{a^2}{4} - \frac{1}{4k}a\sin 2ka - \frac{1}{8k^2}(\cos 2ka - 1)$
T.12	$\int x^2 \sin^2 kx \,\mathrm{d}x = \frac{x^3}{6} - \left(\frac{x^2}{4k} - \frac{1}{8k^3}\right)\sin 2kx - \frac{x}{4k^2}\cos 2kx + c$		$\int_0^a x^2 \sin^2 kx \,\mathrm{d}x = \frac{a^3}{6} - \left(\frac{a^2}{4k} - \frac{1}{8k^3}\right)\sin 2ka - \frac{a}{4k^2}\cos 2ka$
T.13	$\int x \cos kx \,\mathrm{d}x = \frac{1}{k^2}\cos kx + \frac{x}{k}\sin kx + c$		$\int_0^a x \cos kx \,\mathrm{d}x = \frac{1}{k^2}(\cos ka - 1) + \frac{a}{k}\sin ka$
T.14	$\int \cos^2 kx \,\mathrm{d}x = \frac{x}{2} + \frac{1}{4k}\sin 2kx + c$		$\int_0^a \cos^2 kx \,\mathrm{d}x = \frac{a}{2} + \frac{1}{4k}\sin 2ka$

*In each case, c is a constant. Note that not all indefinite integrals have a simple closed form.