(a) $2x\sin(x^2+1)$ (b) $\frac{5}{\sqrt{x}}\sin(\sqrt{x})$ (c) $\frac{2}{x^2}\cos\left(2+\frac{1}{x}\right)$

(d) $\sin x\sqrt{\cos x}$ (e) $\frac{\sin 3x}{\cos 3x}$ (f) $\frac{4\sec^2 3x}{1+\tan 3x}$

(g) $\frac{4\sec^2 3x}{(1+\tan 3x)^2}$ (h) $\frac{2}{x}\cos(\ln x)$ (i) $\sin x\cos x\sqrt{1+\cos 2x}$

(j) $e^x\cos(e^x)$ (k) $3x^2e^{-x^3+2}$ (l) $\cot\frac{1}{2}x\ln\left(\sin\frac{1}{2}x\right)$

(m) $\sin x\sec^2 x$ (n) $\frac{1}{e^{-x}+2}\ln(1+2e^x)$ (o) $(x^2-3)\sec^2\left(\frac{1}{3}x^3-3x\right)$

Integrate the following expressions with respect to $x$:

(a) $x\sin x$ (b) $x\cos\frac{x}{2}$ (c) $2x\sin\frac{x}{2}$ (d) $xe^{-x}$

(e) $5xe^{-4x}$ (f) $\ln x$ (g) $x\ln x$ (h) $-x\cos(-5x)$

(i) $4x\sin\left(-\frac{x}{3}\right)$ (j) $\frac{x}{\cos^2 x}$ (k) $\sqrt{x}\ln x$

Find the following integrals (not all are best evaluated using the parts formula):

(a) $\int x^2e^x dx$ (b) $\int 3x^2\cos(2x)dx$ (c) $\int x^3\ln(2x)dx$

(d) $\int e^x\sin(2x)dx$ (e) $\int x^2\cos(3x)dx$ (f) $\int e^{-2x}\cos(2x)dx$

(g) $\int 4x^3\sin\frac{x}{2}dx$ (h) $\int\frac{1}{x}\ln x dx$ (i) $\int(\ln(3x))^2dx$

(j) $\int\cos x\sin(2x)dx$ (k) $\int e^{ax}\cos\frac{x}{a}dx$ (l) $\int x^2\sqrt{x+2}dx$

(m) $\int x^3\ln(ax)dx$ (n) $\int\frac{x^2}{\sqrt{4-x^2}}dx$ (o) $\int\frac{3x^2dx}{\sqrt{x^2-9}}$

(p) $\int\frac{x}{x^2+4}dx$ (q) $\int\frac{x^2}{x^2+4}dx$

**1.** (a) $\frac{2}{3}(5x^2+2)^{3/2}+c$ (b) $-\frac{1}{3(x^3+4)}+c$ (c) $\frac{3}{8}(1-2x^2)^4+c$ (d) $\frac{1}{5}(9+2x^{3/2})^5+c$

(e) $\frac{9}{4}(x^2+4)^{4/3}+c$ (f) $\frac{-1}{2(x^2+3x+1)^2}+c$ (g) $4\sqrt{x^2+2}+c$ (h) $\frac{1}{12(1-x^4)^3}+c$

(i) $\frac{2}{3}(1+e^{3x})^{3/2}+c$ (j) $\frac{-1}{2(x^2+2x-1)}+c$ (k) $\frac{2}{3}\sqrt{x^3+3x+1}+c$ (l) $\frac{1}{12}(3+4x^2)^{3/2}+c$

(m) $2\sqrt{e^x+2}+c$ (n) $-\frac{1}{4}(1-e^{-2x})^{-2}+c$ (o) $\frac{2}{3}(x^3+1)^5+c$ (p) $\frac{1}{24}(x^4+8x-3)^6+c$

(q) $\frac{1}{5}(x^4+5)^{5/2}+c$ (r) $-\sqrt{1-\sin 2x}+c$ (s) $\frac{2}{9}(4+3\sin x)^{3/2}+c$ (t) $-\frac{1}{12(1+3\tan 4x)}+c$

(u) $\frac{3}{2}(x+\cos x)^{2/3}+c$ (v) $-\frac{1}{2}\cos^4\frac{x}{2}+c$ (w) $2\sqrt{1+x\sin x}+c$ (x) $\frac{4}{3}(x^{1/2}+1)^{3/2}+c$

**1.** (a) $\sin x-x\cos x+c$ (b) $4\cos\frac{x}{2}+2x\sin\frac{x}{2}+c$ (c) $2\left(4\sin\frac{x}{2}-2x\cos\frac{x}{2}\right)+c$

(d) $-e^{-x}(x+1)+c$ (e) $-5e^{-4x}\left(\frac{x}{4}+\frac{1}{16}\right)+c$ (f) $x\ln x-x+c$ (g) $\frac{x^2}{2}\ln x-\frac{x^2}{4}+c$

(h) $-\frac{1}{25}(\cos 5x+5x\sin 5x)+c$ (i) $12\left(x\cos\frac{x}{3}-3\sin\frac{x}{3}\right)+c$ (j) $\ln\cos x+x\tan x+c$

(k) $\frac{2}{3}x\sqrt{x}\ln x-\frac{4}{9}x\sqrt{x}+c$ **2.** (a) $\frac{2}{15}(3x-2)(x+1)^{3/2}+c$ (b) $\frac{2}{15}(3x+4)(x-2)^{3/2}+c$

(c) $\frac{2}{15}(3x+1)(x+2)^{3/2}+c$ **3.** (a) $x\mathrm{Cos}^{-1}x-\sqrt{1-x^2}+c$ (b) $x\mathrm{Tan}^{-1}x-\frac{1}{2}\ln(x^2+1)+c$

(c) $x\mathrm{Sin}^{-1}x+\sqrt{1-x^2}+c$

**1.** (a) $e^x(x^2-2x+2)+c$ (b) $3\left(\frac{x}{2}\cos 2x+\frac{2x^2-1}{4}\sin 2x\right)+c$ (c) $\frac{x^4}{4}\log 2x-\frac{x^4}{16}+c$

(d) $-\frac{e^x}{5}(2\cos 2x-\sin 2x)+c$ (e) $\frac{2x}{9}\cos 3x+\frac{9x^2-2}{27}\sin 3x+c$ (f) $-\frac{e^{-2x}}{4}(\cos 2x-\sin 2x)+c$

(g) $-8\left(x^3\cos\frac{x}{2}-6x^2\sin\frac{x}{2}-24x\cos\frac{x}{2}+48\sin\frac{x}{2}\right)+c$ (h) $\frac{1}{2}(\ln x)^2+c$

(i) $2x-2x\ln(3x)+x(\ln(3x))^2+c$ (j) $-\frac{\cos x}{2}-\frac{\cos 3x}{6}+c$

(k) $\frac{1}{1+a^4}\left(a^3e^{ax}\cos\left(\frac{x}{a}\right)+ae^{ax}\sin\left(\frac{x}{a}\right)\right)+c$ (l) $\left(\frac{2x^3}{7}+\frac{4x^2}{35}-\frac{32x}{105}+\frac{128}{105}\right)\sqrt{x+2}+c$

(m) $\frac{x^4}{4}\ln ax-\frac{x^4}{16}+c$ (n) $2\sin^{-1}\left(\frac{x}{2}\right)-\frac{x}{2}\sqrt{4-x^2}+c$ (o) $\frac{3}{2}(x\sqrt{x^2-9}+9\ln(x+\sqrt{x^2-9}))+c$

(p) $\frac{1}{2}\ln(x^2+4)+c$ (q) $x-2\mathrm{Tan}^{-1}\left(\frac{x}{2}\right)+c$ **2.** (a) $\frac{\pi^2}{16}-\frac{1}{4}$ (b) $\frac{\pi}{8}$ (c) $\frac{1}{2}(e^{2\pi}-e^{\pi/2})$