③ Per parts.

(a) $\int x^3 e^x\,dx = \left\{\begin{array}{l} u=x^3 \to du=3x^2dx \\ dv=e^x dx \to v=e^x \end{array}\right\} = x^3e^x - 3\int x^2e^x dx = \left\{\begin{array}{l} u=x^2 \to du=2xdx \\ dv=e^xdx \to v=e^x \end{array}\right\} =$

$= x^3e^x - 3\left[x^2e^x - 2\int xe^xdx\right] = \left\{\begin{array}{l} u=x \to du=dx \\ dv=e^xdx \to v=e^x \end{array}\right\} = x^3e^x - 3x^2e^x +$

$+6\left[xe^x - \int e^x dx\right] = x^3e^x - 3x^2e^x + 6xe^x - 6e^x + C$

(b) $\int x\ln x\,dx = \left\{\begin{array}{l} u=\ln x \to du=dx/x \\ dv=xdx \to v=x^2/2 \end{array}\right\} = \frac{x^2}{2}\ln x - \int \frac{x^2}{2}\frac{dx}{x} = \frac{x^2}{2}\ln x - \frac{1}{2}\int x dx =$

$= \frac{x^2}{2}\ln x - \frac{x^2}{4} + C.$

(c) $\int x\sqrt{x-5}\,dx = \left\{\begin{array}{l} u=x \to du=dx \\ dv=\sqrt{x-5}\,dx \to V=\frac{(x-5)^{3/2}}{3/2} \end{array}\right\} = \frac{2}{3}x(x-5)^{3/2} - \frac{2}{3}\int (x-5)^{3/2}dx =$

$= \frac{2}{3}x(x-5)^{3/2} - \frac{2}{3}\frac{(x-5)^{5/2}}{5/2} + C = \frac{2}{3}x(x-5)^{3/2} - \frac{4}{15}(x-5)^{5/2}.$

(d) $\int x^2\cos x\,dx = \left\{\begin{array}{l} u=x^2 \to du=2xdx \\ dv=\cos x\,dx \to V=\sin x \end{array}\right\} = x^2\sin x - 2\int x\sin x\,dx =$

$= \left\{\begin{array}{l} u=x \to du=dx \\ dV=\sin x\,dx \to V=-\cos x\,\cancel{dx} \end{array}\right\} = x^2\sin x - 2\left[-x\cos x + \int \cos x\,dx\right] =$

$= x^2\sin x + 2x\cos x - 2\sin x + C$

(e) $\int \arctan x\,dx = \left\{\begin{array}{l} u=\arctan x \to du=\frac{dx}{1+x^2}dx \\ dv=dx \to v=x \end{array}\right\} = x\arctan x - \int \frac{x}{1+x^2}dx =$

$= x\arctan x - \frac{1}{2}\ln(1+x^2)$

(f) $\int e^{2x}\sin x\,dx = I = \left\{\begin{array}{l} u=e^{2x} \to du=2e^{2x}dx \\ dv=\sin x\,dx \to v=-\cos x \end{array}\right\} = -e^{2x}\cos x + 2\int e^{2x}\cos x\,dx =$

$= \left\{\begin{array}{l} u=e^{2x} \to du=2e^{2x}dx \\ dv=\cos x\,dx \to V=\sin x \end{array}\right\} = -e^{2x}\cos x + 2\left[e^{2x}\sin x - 2\int e^{2x}\sin x\,dx\right]$

Així: $I = -e^{2x}\cos x + 2e^{2x}\sin x - 4I \to I = -\frac{1}{5}e^{2x}\cos x + \frac{2}{5}e^{2x}\sin x + C$

(g) $\int x\sin^2 x\,dx = \int x\left(\frac{1-\cos 2x}{2}\right)dx = \frac{x^2}{4} - \frac{1}{2}\int x\cos 2x = \left\{\begin{array}{l} u=x \to du=dx \\ dv=\cos 2x\,dx \to v=\frac{\sin 2x}{2} \end{array}\right\}$

$= \frac{x^2}{4} - \frac{1}{2}\left[\frac{x\sin 2x}{2} - \frac{1}{2}\int \sin 2x\,dx\right] = \frac{x^2}{4} - \frac{x\sin 2x}{4} - \frac{\cos 2x}{8} + C$