1. $\int x^3 \sin x \, dx$

Alt. Signs	u and derivatives	dv and antiderivatives
+	x^3	$\sin x$
−	$3x^2$	$-\cos x$
+	$6x$	$-\sin x$
−	6	$\cos x$
+	0	$\sin x$

$$\int x^3 \sin x \, dx = \boxed{-x^3 \cos x + 3x^2 \sin x + 6x \cos x - 6 \sin x + C}$$

2. $\int x^4 e^x \, dx$

Alt. Signs	u and deriv.	dv and antideriv.
+	x^4	e^x
−	$4x^3$	e^x
+	$12x^2$	e^x
−	$24x$	e^x
+	24	e^x
−	0	e^x

$$\int x^4 e^x \, dx = \boxed{x^4 e^x - 4x^3 e^x + 12x^2 e^x - 24x e^x + 24 e^x + C}$$

3. $\int x^2 (x-2)^{\frac{3}{2}} \, dx$

Alt. Signs	u and deriv	dv and antideriv
+	x^2	$(x-2)^{3/2}$
−	$2x$	$\frac{2}{5}(x-2)^{5/2}$
+	2	$\frac{4}{35}(x-2)^{7/2}$
	0	$\frac{8}{315}(x-2)^{9/2}$

$$\int x^2 (x-2)^{\frac{3}{2}} \, dx = \boxed{\frac{2}{5} x^2 (x-2)^{\frac{5}{2}} - \frac{8}{35} x (x-2)^{\frac{7}{2}} + \frac{16}{315} (x-2)^{\frac{9}{2}} + C}$$

4. $\int x^2 e^{x^3}\,dx$ $\quad u = x^3$

$du = 3x^2$

$\int \frac{1}{3} e^u\,du = \frac{1}{3}e^u + C = \boxed{\frac{1}{3}e^{x^3} + C}$

5. $\int x \sec^2 x\,dx$ $\quad u = x \quad dv = \sec^2 x\,dx$

$du = dx \quad v = \tan x$

$x\tan x - \int \tan x\,dx$

$\boxed{x\tan x + \ln|\cos x| + C}$

6. $\int e^{2x}\sin x\,dx$ $\quad u = e^{2x} \quad dv = \sin x\,dx$

$du = 2e^{2x}dx \quad v = -\cos x$

$\int e^{2x}\sin x\,dx = -e^{2x}\cos x + \int 2e^{2x}\cos x\,dx$ $\quad u = 2e^{2x} \quad dv = \cos x\,dx$

$du = 4e^{2x}dx \quad v = \sin x$

$\int e^{2x}\sin x\,dx = -e^{2x}\cos x + 2e^{2x}\sin x - \int 4e^{2x}\sin x\,dx$

$\int e^{2x}\sin x\,dx = -e^{2x}\cos x + 2e^{2x}\sin x - 4\int e^{2x}\sin x\,dx$

$5\int e^{2x}\sin x\,dx = -e^{2x}\cos x + 2e^{2x}\sin x$

$\int e^{2x}\sin x\,dx = \boxed{-\frac{1}{5}e^{2x}\cos x + \frac{2}{5}e^{2x}\sin x + C}$

7. $\int e^{-x}\cos 3x\,dx$

$u = \cos 3x$ $\quad dv = e^{-x}dx$

$du = -3\sin 3x\,dx$ $\quad v = -e^{-x}$

$$\int e^{-x}\cos 3x\,dx = -e^{-x}\cos 3x - \int 3e^{-x}\sin 3x\,dx$$

$u = 3\sin 3x$ $\quad dv = e^{-x}dx$

$du = 9\cos 3x\,dx$ $\quad v = -e^{-x}$

$$\int e^{-x}\cos 3x\,dx = -e^{-x}\cos 3x - \left[-3e^{-x}\sin 3x + \int 9e^{-x}\cos 3x\,dx\right]$$

$$\int e^{-x}\cos 3x\,dx = -e^{-x}\cos 3x + 3e^{-x}\sin 3x - 9\int e^{-x}\cos 3x\,dx$$

$$10\int e^{-x}\cos 3x\,dx = -e^{-x}\cos 3x + 3e^{-x}\sin 3x$$

$$\int e^{-x}\cos 3x\,dx = \boxed{-\frac{1}{10}e^{-x}\cos 3x + \frac{3}{10}e^{-x}\sin 3x + C}$$

8. $\int \frac{\cos(\ln x)}{x}\,dx$

$u = \ln x$

$du = \frac{1}{x}\,dx$

$$\int \cos u\,du$$

$$\sin u + C = \boxed{\sin(\ln x) + C}$$

9 & 10 – Answers in class

9. $\int \sin\sqrt{x}\, dx$ $\quad w^2 = x$

$2w\, dw = dx$

$\int 2w \sin w\, dw$ $\quad u = 2w$ $\quad dv = \sin w\, dw$

$du = 2\, dw$ $\quad v = -\cos w$

$-2w\cos w - \int -2\cos w\, dw$

$-2w\cos w + 2\sin w + C$

$\boxed{-2\sqrt{x}\cos\sqrt{x} + 2\sin\sqrt{x} + C}$

10. $\int 2x^3 \cos x^2\, dx$ $\quad w = x^2$

$dw = 2x\, dx$

$\int w\cos w\, dw$ $\quad u = w$ $\quad dv = \cos w\, dw$

$du = dw$ $\quad v = \sin w$

$w\sin w - \int \sin w\, dw$

$w\sin w + \cos w + C$

$\boxed{x^2 \sin x^2 + \cos x^2 + C}$