# Exercise 9f

① $\int (2x^2+5)^2(4x)\,dx$ $\quad u = 2x^2+5$, $du = 4x\,dx$

$\int u^2\,du$

$\frac{1}{3}u^3 + C = \boxed{1/3(2x^2+5)^3 + C}$

② $\int \frac{3x^2+2}{x^3+2x}\,dx = \int (3x^2+2)\cdot\frac{1}{x^3+2x}\,dx$ $\quad u = x^3+2x$, $du = (3x^2+2)dx$

$\int \frac{1}{u}\,du = \ln|u| + C = \boxed{\ln|x^3+2x| + C}$

③ $\int (6x+5)(3x^2+5x)^{1/2}\,dx$ $\quad u = 3x^2+5x$, $du = (6x+5)dx$

$\int u^{1/2}\,du$

$2/3\,u^{3/2} + C = \boxed{2/3(3x^2+5x)^{3/2} + C}$

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

$\int e^u\,du$

$e^u + C = \boxed{e^{x^4} + C}$

(5) $\int 2x+3 \cdot (x^2+3x+1)^{-2}\,dx$ $\quad u = x^2+3x+1$, $du = (2x+3)dx$

$\int u^{-2}\,du$

$-1u^{-1}+C = \frac{-1}{u}+C = \boxed{\frac{-1}{x^2+3x+1}+C}$

(6) $\int e^{x^{1/2}} \cdot \frac{1}{2} \cdot x^{-1/2}\,dx$ $\quad u = x^{1/2}$, $du = 1/2\,x^{-1/2}dx$

$\int e^u\,du$

$e^u+C = \boxed{e^{x^{1/2}}+C}$ or $\boxed{e^{\sqrt{x}}+C}$

(7) $\int x^2(2x^3+5)^4\,dx$ $\quad u = 2x^3+5$, $du = 6x^2\,dx$, $1/6\,du = x^2dx$

$\int u^4 \cdot 1/6\,du$

$1/6 \int u^4\,du = 1/6 \cdot (1/5\,u^5)+C = \boxed{\frac{1}{30}(2x^3+5)^5+C}$

(8) $\int (2x+1)(x^2+x)^{-1/4}\,dx$ $\quad u = x^2+x$, $du = (2x+1)dx$

$\int u^{-1/4}\,du$

$4/3 \cdot u^{3/4}+C = \boxed{4/3\,(x^2+x)^{3/4}+C}$

(9) $\int (8x^3-4x)(x^4-x^2)^3\,dx$

$u = x^4-x^2$

$du = (4x^3-2x)\,dx$

$2\,du = (8x^3-4x)\,dx$

$\int u^3 \cdot 2\,du$

$2\int u^3\,du$

$2\cdot(1/4\,u^4)+C = \boxed{1/2(x^4-x^2)^4+C}$

(10) $\int 4-3x^2 \cdot \frac{1}{x^3-4x}\,dx$

$u = x^3-4x$

$du = (3x^2-4)\,dx$

$-du = (-3x^2+4)\,dx$

$-du = (4-3x^2)\,dx$

$\int \frac{1}{u}(-du)$

$-\int \frac{1}{u}\,du = -\ln|u|+C = \boxed{-\ln(x^3-4x)+C}$

(11) $\int \frac{8x}{4x^2+1}\,dx = \int 8x \cdot \frac{1}{4x^2+1}\,dx$

$u = 4x^2+1$

$du = 8x\,dx$

$\int \frac{1}{u}\,du = \ln|u|+C = \ln|4x^2+1|+C$

$f(0) = 4$

$4 = \ln|4(0)^2+1|+C$

$4 = \ln 1 + C$

$4 = 0 + C \quad C = 4$

$\boxed{\ln|4x^2+1|+4}$

(12) $\int 3x^2 e^{x^3} dx$ $\quad u = x^3$

$du = 3x^2 dx$

$\int e^u du$

$e^u + C = e^{x^3} + C = f(x)$

pt $(1, 5e)$

$5e = e^{(1)^3} + C$

$5e = e^1 + C$

$5e = e + C$

$C = 4e$

$f(x) = e^{x^3} + 4e$