

# Exercise 9E

1)  $\int (2x+5)^2 dx$   $\begin{cases} u = 2x+5 \\ du = 2dx \\ \frac{1}{2}du = dx \end{cases}$

$$\int u^2 \cdot \frac{1}{2} du$$

$$\frac{1}{2} \int u^2 du = \frac{1}{2} \cdot \left(\frac{1}{3}u^3\right) + C = \frac{1}{6}u^3 + C$$

$$\frac{1}{6}(2x+5)^3 + C$$

2)  $\int (-3x+5)^3 dx$   $\begin{cases} u = -3x+5 \\ du = -3dx \\ -\frac{1}{3}du = dx \end{cases}$

$$\int u^3 \cdot -\frac{1}{3} du$$

$$-\frac{1}{3} \int u^3 du = -\frac{1}{3} \cdot \left(\frac{1}{4}u^4\right) + C = -\frac{1}{12}(-3x+5)^4 + C$$

3)  $\int e^{\frac{1}{2}x-3} dx$   $\begin{cases} u = \frac{1}{2}x-3 \\ du = \frac{1}{2}dx \\ 2du = dx \end{cases}$

$$\int e^u \cdot 2 du$$

$$2 \int e^u du = 2e^u + C = 2e^{\frac{1}{2}x-3} + C$$

4)  $\int \frac{1}{5x+4} dx$   $\begin{cases} u = 5x+4 \\ du = 5dx \\ \frac{1}{5}du = dx \end{cases}$

$$\int \frac{1}{u} \cdot \frac{1}{5} du$$

$$\frac{1}{5} \int \frac{1}{u} du = \frac{1}{5} \cdot \ln|u| + C = \frac{1}{5} \ln|5x+4| + C$$

5)  $\int \frac{3}{7-2x} dx$   $\begin{cases} u = 7-2x \\ du = -2dx \\ -\frac{1}{2}du = dx \end{cases}$

$$3 \int \frac{1}{7-2x} dx$$

$$3 \int \frac{1}{u} \cdot -\frac{1}{2} du = -\frac{3}{2} \int \frac{1}{u} du = -\frac{3}{2} \ln|u| + C$$

$$-\frac{3}{2} \ln|7-2x| + C$$

$$6) \quad 4 \int e^{2x+1} dx \quad u=2x+1$$

$$4 \int e^u \cdot \frac{1}{2} du \quad du=2dx$$

$$2 \int e^u du = 2e^u + C = 2e^{2x+1} + C$$

$$7) \quad 6 \int (4x-3)^7 dx \quad u=4x-3$$

$$6 \int u^7 \cdot \frac{1}{4} du \quad du=4dx$$

$$\frac{3}{2} \int u^7 du = \frac{3}{2} \cdot \frac{1}{8} u^8 + C = \boxed{\frac{3}{16} (4x-3)^8 + C}$$

$$8) \quad \int (7x+2)^{1/2} dx \quad u=7x+2$$

$$\int u^{1/2} \cdot \frac{1}{7} du \quad du=7dx$$

$$\frac{1}{7} \int u^{1/2} du = \frac{1}{7} \cdot \frac{2}{3} u^{3/2} + C = \boxed{\frac{2}{21} (7x+2)^{3/2} + C}$$

$$9) \quad \int \left( e^{4x} + \frac{4}{3x-5} \right) dx =$$

$$\int e^{4x} dx \quad u=4x \quad du=4dx \quad \frac{1}{4} du = dx$$

$$+ \int \frac{4}{3x-5} dx \quad u=3x-5 \quad du=3dx \quad \frac{1}{3} du = dx$$

$$\int e^u \cdot \frac{1}{4} du$$

$$\frac{1}{4} \int e^u du$$

$$\frac{1}{4} e^u + C = \frac{1}{4} e^{4x} + C$$

$$4 \int \frac{1}{u} \cdot \frac{1}{3} du$$

$$\frac{4}{3} \int \frac{1}{u} du$$

$$\frac{4}{3} \ln|u| + C$$

$$\frac{1}{4} e^{4x} + C + \frac{4}{3} \ln|3x-5| + C$$

$$10) \int \frac{2}{3(4x-5)^3} dx \Rightarrow \frac{2}{3} \int \frac{1}{(4x-5)^3} dx$$

$$u = 4x - 5$$

$$du = 4 dx$$

$$\frac{1}{4} du = dx$$

$$\frac{2}{3} \int \frac{1}{u^3} \cdot \frac{1}{4} du$$

$$\frac{1}{6} \int \frac{1}{u^3} du = \frac{1}{6} \int u^{-3} du = \frac{1}{6} (-\frac{1}{2} u^{-2}) + C$$

$$-\frac{1}{12} \cdot \frac{1}{(4x-5)^2} + C$$

$$-\frac{1}{12(4x-5)^2} + C$$

11) a)  $f(x) = (4x+5)^3$   
 $f'(x) = 3(4x+5)^2 \cdot 4 = 12(4x+5)^2$

b)  $\int f(x) = \int (4x+5)^3$   
 $\int u^3 \cdot \frac{1}{4} du$

$$u = 4x + 5$$

$$du = 4 dx$$

$$\frac{1}{4} du = dx$$

$$\frac{1}{4} \int u^3 du = \frac{1}{4} \cdot \frac{1}{4} u^4 + C = \frac{1}{16} (4x+5)^4 + C$$

12)  $\int v(A) = \int$   
 $\int e^{-3t} \cdot 6t = \int 6t e^{-3t}$

$$u = -3t$$

$$du = -3 dt$$

$$-\frac{1}{3} du = dt$$

$$\int u \cdot -\frac{1}{3} du$$

$$-\frac{1}{3} \int u du$$

$$-\frac{1}{3} \cdot \frac{1}{2} u^2 + C$$

$$-\frac{1}{6} u^2 + C$$

$$-\frac{1}{6} (-3t)^2 + C$$

$$-\frac{1}{6} \cdot 9t^2 + C$$

$$-\frac{3}{2} t^2 + C$$

$$6 \cdot \frac{1}{2} t^2 + C$$

$$3t^2 + C$$

$$-\frac{1}{3} e^{-3t} + 3t^2 + C$$

$$C = \frac{13}{3}$$

$$\textcircled{12} \int (v(t)) = s$$

$$\int e^{-3t} + 6t$$

$$\int e^{-3t} dt + \int 6t dt$$

$$\downarrow \begin{aligned} u &= -3t \\ du &= -3dt \\ -\frac{1}{3}du &= dt \end{aligned}$$

$$6 \cdot \frac{1}{2} t^2 + C$$

$$3t^2 + C$$

$$\int e^u (-\frac{1}{3} du)$$

$$-\frac{1}{3} \int e^u du$$

$$-\frac{1}{3} e^u + C = -\frac{1}{3} e^{-3t} + C$$

$$-\frac{1}{3} e^{-3t} + 3t^2 + C$$

$$\cancel{s(t)} = s(0) = 4$$

$$4 = -\frac{1}{3} e^{-3(0)} + 3(0)^2 + C$$

$$4 = -\frac{1}{3}(1) + 0 + C$$

$$12/3 = -1/3 + C$$

$$C = 13/3$$

$$s(t) = -\frac{1}{3} e^{-3t} + 3t^2 + 13/3$$