Calculus II (Maths 201–NYB)

1. $\displaystyle\int \frac{dx}{\sqrt[3]{5-2x}}$
2. $\displaystyle\int x^3\,\mathrm{e}^{3x^4}\,dx$
3. $\displaystyle\int x^3\,\mathrm{e}^{3x}\,dx$
4. $\displaystyle\int \arctan x\,dx$
5. $\displaystyle\int \tan(x+3)\,dx$
6. $\displaystyle\int \frac{\sqrt{1+\sqrt{x}}}{\sqrt{x}}\,dx$
7. $\displaystyle\int \frac{x^2+2}{x\sqrt{x^2-1}}\,dx$
8. $\displaystyle\int \frac{dx}{x\sqrt{\ln x}}$
9. $\displaystyle\int 3x\cos(4x)\,dx$
10. $\displaystyle\int \frac{(x+1)\,dx}{\sqrt{x^2+2x+3}}$
11. $\displaystyle\int \mathrm{e}^{3x}\sin(2x)\,dx$
12. $\displaystyle\int \frac{1}{x^2}\sqrt{1+\frac{1}{x}}\,dx$
13. $\displaystyle\int \frac{x+\arcsin(x)}{\sqrt{1-x^2}}\,dx$
14. $\displaystyle\int \frac{\sin x+\cos x+1}{\sin x}\,dx$
15. $\displaystyle\int (\ln(x))^2\,dx$

Quiz 1P - Answers Maths NYB

① $= -\frac{1}{2}\int u^{-1/3}du = -\frac{3}{4}(5-2x)^{2/3} + C$ $\begin{cases} u = 5-2x & du = -2dx \end{cases}$

② $= \frac{1}{12}\int e^u du = \frac{1}{12}e^{3x^4} + C$ $\begin{cases} u = 3x^4 & du = 12x^3dx \end{cases}$

③ $= \frac{x^3}{3}e^{3x} - \frac{x^2}{3}e^{3x} + \frac{2}{9}xe^{3x} - \frac{2}{27}e^{3x} + C$

$\begin{cases} x^3 & e^{3x} \\ 3x^2 & \frac{1}{3}e^{3x} \\ 6x & \frac{1}{9}e^{3x} \\ 6 & \frac{1}{27}e^{3x} \\ 0 & \frac{1}{81}e^{3x} \end{cases}$

④ $= x\arctan x - \frac{1}{2}\ln(1+x^2) + C$ $\begin{cases} u = \arctan x & dv = dx \\ du = \frac{dx}{1+x^2} & v = x \end{cases}$ $\leftarrow \begin{matrix} t = 1+x^2 \\ dt = 2x\,dx \end{matrix}$

⑤ $= \ln|\sec(x+3)| + C$ $\begin{cases} u = x+3 & du = dx \end{cases}$

⑥ $= 2\int u^{1/2}du = \frac{4}{3}(1+\sqrt{x})^{3/2} + C$ $\begin{cases} u = 1+\sqrt{x} \\ du = \frac{1}{2\sqrt{x}}dx \end{cases}$

⑦ $= \int \frac{x\,dx}{\sqrt{x^2-1}} + 2\int \frac{dx}{x\sqrt{x^2-1}} = \frac{1}{2}\int u^{-1/2}du + 2\operatorname{arcsec}(x) + C = \sqrt{x^2-1} + 2\operatorname{arcsec}x + C$ $\begin{cases} u = x^2-1 \\ du = 2x\,dx \end{cases}$

⑧ $= \int u^{-1/2}du = 2\sqrt{\ln x} + C$ $\begin{cases} u = \ln x \\ du = \frac{1}{x}dx \end{cases}$

⑨ $= \frac{3}{4}x\sin 4x + \frac{3}{16}\cos 4x + C$

$\begin{cases} u = 3x & dv = \cos 4x\,dx \\ 3 & \frac{1}{4}\sin 4x \\ 0 & -\frac{1}{16}\cos 4x \end{cases}$

⑩ $= \frac{1}{2}\int u^{-1/2}du = \sqrt{x^2+2x+3} + C$ $\begin{cases} u = x^2+2x+3 \\ du = 2(x+1)\,dx \end{cases}$

⑪ $= -\frac{1}{2}e^{3x}\cos 2x + \frac{3}{4}e^{3x}\sin 2x - \frac{9}{4}\int e^{3x}\sin 2x\,dx$

$\begin{cases} u = e^{3x} & dv = \sin 2x\,dx \\ du = 3e^{3x}dx & v = -\frac{1}{2}\cos 2x \\ u = 3e^{3x} & dv = -\frac{1}{2}\cos 2x \\ du = 9e^{3x} & v = -\frac{1}{4}\sin 2x \end{cases}$

So ⑪ $= \frac{4}{13}\left[-\frac{1}{2}e^{3x}\cos 2x + \frac{3}{4}e^{3x}\sin 2x\right] + C$

⑫ $= -\int u^{1/2}du = -\frac{2}{3}(1+\frac{1}{x})^{3/2} + C$ $\begin{cases} u = 1+\frac{1}{x} \\ du = -\frac{1}{x^2}dx \end{cases}$

⑬ $= \int \frac{x}{\sqrt{1-x^2}}dx + \int \frac{\arcsin x}{\sqrt{1-x^2}}dx = \int -\frac{1}{2}u^{-1/2}du + \int t\,dt$

$\begin{cases} u = 1-x^2 & t = \arcsin x \\ du = -2x\,dx & dt = \frac{1}{\sqrt{1-x^2}}dx \end{cases}$

$= -\sqrt{1-x^2} + \frac{1}{2}(\arcsin x)^2 + C$

⑭ $= \int(1 + \cot x + \csc x)\,dx = x - \ln|\csc x| - \ln|\csc x + \cot x| + C$

⑮ $= x(\ln x)^2 - 2x\ln x + 2x + C$

$\begin{cases} u = (\ln x)^2 & dv = dx \\ du = 2\ln x\frac{1}{x}dx & v = x \end{cases}$

$\begin{cases} u = 2\ln x & dv = \frac{x}{x}dx = dx \\ du = \frac{2}{x}dx & v = x \end{cases}$

$\begin{cases} u = 2 & dv = \frac{x}{x}dx = dx \\ du = 0 & v = x \end{cases}$