MATHEMATICS 2
First Practice

Exercise 1: Calculate the following indefinite integrals, by substitution:

$$\int 9\sqrt{3x+2}\,\mathrm{d}x = 2(3x+2)^{3/2} + c$$

$$\int 12x\sqrt{4x^2-1}\,\mathrm{d}x = (4x^2-1)^{3/2} + c$$

$$\int \cos x(\sin x - 1)^3\,\mathrm{d}x = \frac{(\sin x - 1)^4}{4} + c$$

$$\int (2e^x - 1/3)^2 e^x\,\mathrm{d}x = \frac{(2e^x - 1/3)^3}{6} + c$$

$$\int \frac{5}{x+1}\left(\log(x+1)\right)^{3/2}\mathrm{d}x = 2\left(\log|x+1|\right)^{5/2} + c$$

$$\int_{16}^{25} \frac{e^{\sqrt{x}-4}}{\sqrt{x}}\,\mathrm{d}x = 2e - 2$$

$$\int e^{2\cos x}\sin x\,\mathrm{d}x = -\frac{1}{2}e^{2\cos x} + c$$

$$\int x^2\sin(x^3)\,\mathrm{d}x = -\frac{1}{3}\cos x^3 + c$$

$$\int_1^e \frac{\cos(\log x)}{x}\,\mathrm{d}x = \sin(1)$$

$$\int_0^1 \frac{x}{3x^2+4}\,\mathrm{d}x = \frac{1}{6}\log\frac{7}{4}$$

$$\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cos x}{\sin x}\,\mathrm{d}x = \log 2$$

$$\int \frac{x}{1+x^4}\,\mathrm{d}x = \frac{1}{2}\arctan(x^2) + c$$

$$\int_1^3 \frac{1}{\sqrt{x}+x\sqrt{x}}\,\mathrm{d}x = \frac{\pi}{6}$$

Exercise 2: Calculate the following indefinite integrals, by parts:

$$\int x\, e^x \,\mathrm{d}x = e^x x - x + c$$

$$\int_0^\pi x\,\sin x\,\mathrm{d}x = -\pi$$

$$\int e^x\,\sin x\,\mathrm{d}x = \frac{1}{2}e^x(\sin x - \cos x) + c$$

$$\int_1^e \log x\,\mathrm{d}x = 1$$

$$\int 4x\log x\,\mathrm{d}x = 2x^2\log x - x^2 + c$$

$$\int x^2 e^x\,\mathrm{d}x = x^2e^x - 2xe^x + 2e^x + c$$

$$\int 9x^2\log x\,\mathrm{d}x = 3x^3\log x - x^3 + c$$

Exercise 3: Calculate the following integrals:

$$\int_0^4 e^{\sqrt{x}}\,\mathrm{d}x = 2(1+e^2)$$

$$\int_0^{2\pi} |\sin x|\,\mathrm{d}x = 4$$

$$\int_0^{\pi/3} \frac{\tan x}{1+\log\cos x}\,\mathrm{d}x = -\log(1-\log 2)$$

$$\int \frac{1}{\sqrt{x}+3}\,\mathrm{d}x = 2\sqrt{x} - 6\log(\sqrt{x}+3) + c$$

$$\int x^3\sqrt{1-x^2}\,\mathrm{d}x = -\frac{1}{15}(3x^{+}2)(1-x^2)^{\frac{3}{2}} + c$$

$$\int_0^2 \frac{x^3}{1+x^2}\,\mathrm{d}x = 2 - \frac{\log 5}{2} + c$$

Exercise 4: Calculate the following integrals by partial fraction:

$$\int \frac{x^3-2x^2-x+3}{x^2-3x+2}\,\mathrm{d}x = \frac{x^2}{2} + x - \log(1-x) + \log(2-x) + c$$

$$\int \frac{x+2}{x^2+2}\,\mathrm{d}x = \frac{1}{2}\log(x^2+2) + \sqrt{2}\arctan(\frac{x}{\sqrt{2}}) + c$$

$$\int \frac{3x+2}{x(x^2+1)}\,\mathrm{d}x = -\log(x^2+1) + 2\log x + 3\arctan(x) + c$$