

CM 2607 Advanced Mathematics for Data Science

Tutorial No 05

Q1) Integrate with respect to x

i) $\frac{2x-5}{x^2-2x+1}$

ii) $\frac{3x-2}{x^2+x-12}$

iii) $\frac{x-5}{x^2+4x+8}$

iv) $\frac{2x+3}{x^2-2x+5}$

v) $\frac{3x-1}{x^2-6x+18}$

Q2) Integrate with respect to x .

i) $x^2 \cdot e^x$

ii) $\tan^{-1} x$

iii) $x^2 \ln x$

iv) $3x^2 \sin x$

v) $x^3 \cos x$

vi) $(x^3 + 3x) \sin\left(\frac{3\pi x}{2}\right)$

vii) $(-x^2 + 1) \cos \pi x$

viii) $\frac{3}{5}x^2 \cdot \sin nx$; where $n \in \mathbb{N}$

Q3) Integrate each function given with respect to x using the given substitution.

i) $\int_0^{\pi/3} \sec \theta \, d\theta ; u = \tan \frac{\theta}{2}$

ii) $\int \frac{1}{e^x-1} dx ; u = e^x$

iii) $\int \sec 2x \cos x \cdot dx ; u = \sin x$

iv) $\int \frac{\tan x}{2-\cos x} dx ; u = \cos x$

v) $\int_4^8 (x-2)\sqrt{x-4} \, dx ; u = x-4$

Q4) Show that the following integrals are equal to zero where $n, m \in \mathbb{N}$.

i) $\int_0^{2\pi} \sin nx \, dx$

ii) $\int_0^{2\pi} \cos nx \, dx$

iii) $\int_0^{2\pi} \sin nx \sin mx \, dx$

iv) $\int_0^{2\pi} \cos nx \cos mx \, dx$

v) $\int_0^{2\pi} \sin nx \cos nx \, dx$

Q5) Show that the following integrals are equal to π , where $n \in \mathbb{N}$.

i) $\int_0^{2\pi} \sin^2 nx \, dx$

ii) $\int_0^{2\pi} \cos^2 nx \, dx$

Q6) Evaluate the following integrals.

i) $\int_0^1 \int_0^2 (x^2 + y^2) \, dy \, dx$

ii) $\int_0^2 \int_0^{x^2} e^{(y/x)} \, dy \, dx$

iii) $\int_0^1 \int_0^2 (x^2 + 3xy^2) \, dy \, dx$