

# The Vulnavian Degree Network Level 3

## Fourier Analysis - Study Guide

### Fourier Series: Introductory Course

Task 0302 (16 pages)

1. **Introducing the Fourier Series  $f(x)$**  (Pg.1)
2. **Dirichlet's Conditions on  $f(x)$**  (Pg.1)
3. **Fourier Coefficients** (Pg.1)
4. **Odd and Even Functions** (Pg.2)
5. **FOURIER SERIES:**  
Example 1:  $f(x) = x^2$  (Pg.3)  
**MATHCAD: Demonstration.** (Pg.5)  
Application of the Fourier Series (Pg.7)

$$\text{Example 1a: } \sum_{r=1}^{\infty} \frac{1}{r^2} = \frac{\pi^2}{6}$$

- Example 2:  $f(x) = x$  (Pg.8)  
Example 3: **The Step Function** (Pg.10)  
Example 4:  $f(x) = \exp(-x)$  (Pg.11)  
Example 5: **The Saw-tooth Function.** (Pg.14)

### Task 0302x: Fourier Series (9 pages)

Derivation of the Fourier Coefficients

### Task 0303: Fourier Series: (12 pages) Change of Interval

1. **Expansion over the Half-Interval  $0 \leq x \leq \pi$**  (Pg.1)  
(a) **Cosine Series**  
(b) **Sine Series**
2. **Half-Interval Examples:**  
Example 1: Fourier sine series for  $f(x) = x^4$  (Pg.2)  
Example 2: Fourier sine series for  $f(x) = x^6$  (Pg.5)
3. **Change of Interval:** (Pg.6)  
Adapted Fourier Coefficients.  
Example 1:  $f(x) = x$  (Pg.7)  
Example 2: **Saw-tooth Function** (Pg.9)

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### Fourier Series: Complex Exponential Form

Task 0304 (6 pages)

1. **Complex Fourier Coefficients** (Pg.1)
2. **Complex Fourier Series** (Pg.3)  
Example 1:  $f(x) = x$
3. **Parseval's Theorem** (Pg.5)  
Example (Pg.6)

### Differentiating & Integrating Fourier Series

Task 0305 (5 pages)

1. **Integration of a Fourier Series** (Pg.1)  
Example
2. **Differentiation of a Fourier Series** (Pg.2)
3. **Examination Question** (Pg.5)

### Fourier Series

Task 0305x (7 pages)

1. Model Answers to the Examination Question

**END OF THE STUDY GUIDE FOR FOURIER ANALYSIS**