

# Mathematics: Odds and Sods

prepared by  
Wm. J. Garland, Professor, Department of Engineering Physics,  
McMaster University, Hamilton, Ontario, Canada

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## Summary:

*Here is a collection of various miscellaneous bits of mathematics that you need to know for nuclear engineering but may have forgotten.*

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# 1 Introduction

## 1.1 Overview

Excuse the mess, this paper is under construction.

## 1.2 Learning Outcomes

The goal of this chapter is for the student to understand:

- The basic mathematical tools needed for nuclear engineering.

# 2 Linear Algebra

## 2.1 Determinants

$$\left. \begin{array}{l} ax + by = 0 \\ cx + dy = 0 \end{array} \right\} \Rightarrow \underline{\underline{Ax}} = 0 \quad (3.1)$$

therefore 
$$y = -\frac{cx}{d} \quad (3.2)$$

$$\therefore ax - b\frac{cx}{d} = 0 \quad (3.3)$$

$$\therefore dax - bcx = 0 \quad (3.4)$$

$$\therefore (da - bc)x = 0 \quad (3.5)$$

$$\therefore da - dc = 0 \text{ if there is to be a solution where } x \neq 0. \quad (3.6)$$

We can generalize this:

$$\text{determinant of } A = \det(\underline{\underline{A}}) = |\underline{\underline{A}}| = 0 \text{ for } x \neq 0 \quad (3.7)$$

= ad - bc in the above particular case.

### 3 Solutions to Partial Differential Equations

#### 3.1 Bessel Functions

$J$  = Bessel function of the first kind (3.8)

$Y$  = Neuman =  $N_\nu(x)$

= Bessel function of the second kind (3.9)

$$= \frac{\cos(\nu\pi)J_\nu(x) - J_{-\nu}(x)}{\sin(\nu\pi)}$$

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**Author and affiliation:** Wm. J. Garland, Professor, Department of Engineering Physics,  
McMaster University, Hamilton, Ontario, Canada

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Contact person: Wm. J. Garland

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