

MATHEMATICS FOR SCIENCE STUDENTS

An open-source book

Written, illustrated and typeset (mostly) by

PELEG BAR SAPIR

with contributions from others

$$\begin{aligned}a^b &= e^{b \log(a)} & (a+b)^n &= \sum_{k=0}^n \binom{n}{k} a^{n-k} b^k \\ \binom{n}{k} &= \frac{n!}{k!(n-k)!} & T(\alpha \vec{u} + \beta \vec{v}) &= \alpha T(\vec{u}) + \beta T(\vec{v}) \\ R(\theta) &= \begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix} & A &= Q \Lambda Q^{-1} \\ e^{\pi i} + 1 &= 0 & \frac{df}{dx} &= \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \\ \langle \hat{e}_i, \hat{e}_j \rangle &= \delta_{ij} & \Gamma(z) &= \int_0^\infty t^{z-1} e^{-t} dt \\ \int_a^b f(x) dx &= F(b) - F(a) & \vec{v} &= \sum_{i=1}^n \alpha_i \hat{e}_i \\ \cos(x) &= \sum_{n=0}^\infty \frac{(-1)^n}{(2n)!} x^{2n}\end{aligned}$$



PUBLISHED IN THE WILD

! To be written/to do: Rights, lefts, etc. will be written here in the future **!**

HERE BE TABLE

CHAPTER

0



INTRODUCTION

In this chapter we introduce key concepts that will be used in later chapters. For this reason, unlike other chapters it contains many statements, sometimes given without thorough explanations or reasoning. While all of these statements are grounded in deep ideas and can be formulated in a rigorous manner, it is advised to first get an intuitive understanding of the ideas before diving into their more formal construction.

Note 0.1 In case you are already familiar with the topics

It is recommended for readers who are familiar with the topics to at least gloss over this chapter and make sure they know and understand all the concepts presented here.



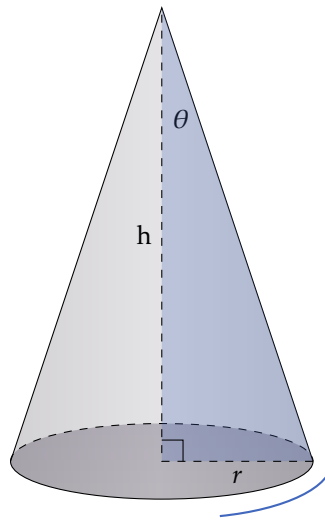


Figure 0.1 Rotating a right triangle by 360° around its height h , yielding a right circular cone with radius r and angle θ .

0.1 CONIC SECTIONS

An important family of shapes in mathematics are the **conic sections**, which arise as the intersection of a plane and an infinite “right circular” cone (let’s call it *RC cone* for simplicity). An RC cone is a 3D shape which is created when a right triangle is rotating by 360° around the triangle’s height (see [Figure 0.1](#)).