Self-Study Summary Collection

Volume 1

Physics

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Contents

Chapter 1

Study Plan

There are several course topics summarized in this document. They are related in someways but can be regarded as isolated and there for have to correlation to between topics. Each of the courses is summarized in each own chapter and is mostly based on a course from MIT, Yale, or Stanford. MIT in particular has a great selection of open courses in various scientific topics. Each of the chapters starts with a general info of the course it is based on and various relevant links for the course material. The chapters are in chronological order the courses was taken and as no relation to topics [1].

Chapter 2

Fundamental Mathematics

2.1 Temenology

- Axiom: "TODO" [2].
- Definition: "TODO" [2].
- Lemma: "TODO" [2].
- Theorem: "TODO" [2].
- Proposition: "TODO" [2].
- Corollary: "TODO" [2].
- Law: "TODO" [2].

2.2 Geometry

2.2.1 Volumes

Volumes has a unite of cube, e.g., m^3 "meter cube", and a cube has a volume of lenght $\times$ depth $\times$ height = lenght^3 = depth^3 = height^3 = volume since all sides are equal in a kube. For cuboid, however, the sides are different. A cube can express the voulume of three dimentional shapes.

Pyramid

Given a pyramid of height h, length L, and width W, the pyramid's voulume can be expressed in terms of cuboids of height h/n where $n \to \infty$. The lenght of the cuboid layer is $m \times \frac{L}{n}$, where $m \in [1, \ldots, n]$. Likewise, the width is $m \times \frac{W}{n}$, which gives us the sum of all the layer cuboid making

up the pyramid is equal to:

$$\begin{aligned}
&\sum_{m=1}^{n} \frac{h}{n} \times m\frac{L}{n} \times m\frac{W}{n} \\
&= \frac{1}{n^3} hWL \sum_{m=1}^{n} m^2 \\
&= \frac{1}{n^3} hWL \frac{n(n+1)(2n+1)}{6} \\
&= \frac{1}{n^3} hWL \frac{2n^3 + n^2 + 2n^2 + n}{6} \\
&= hWL \left(\frac{2n^3}{6n^3} + \frac{3n^2}{6n^3} + \frac{n}{6n^3} \right) \\
&= hWL \left(\frac{1}{3} + \frac{1}{2n} + \frac{1}{6n^2} \right)
\end{aligned}$$

Since $n \to \infty$:

$$\lim_{n\to\infty} hWL \left(\frac{1}{3} + \frac{1}{2n} + \frac{1}{6n^2} \right) = \frac{1}{3} hWL$$

2.3 Irational numbers

2.3.1 Consant e

$$e = \lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n$$

$$e = 2 + \cfrac{1}{1 + \cfrac{1}{2 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{4 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{6 + \dots}}}}}}}}$$

2.3.2 Constant π

Chapter 3

Abstract Algebra

Chapter 4

Topology

Bibliography

[1] European Union, *Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (recast)*, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0035, Official Journal of the European Union, L 96, 29 March 2014, pp. 357-374, 2014.

[2] *Oxford English Dictionary*, 3rd ed. Oxford University Press, 2024, Accessed online at the Oxford English Dictionary. [Online]. Available: https://www.oed.com (visited on 10/27/2024).