

## 150. Extension of the Pythagorean theorem from $\mathbb{R}^2$ to $\mathbb{R}^3$ and $\mathbb{R}^1$

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### Abstract

Pythagorean theorem has been and remains a fundamental pillar in many spheres of mathematics, physics and engineering and many other fields such as carbon dating and oceanography. The present study will theoretically study the transition of the Pythagorean theorem from  $\mathbb{R}^2$  to  $\mathbb{R}^3$  (three dimensional space) and thereafter from  $\mathbb{R}^3$  to  $\mathbb{R}^1$  (one dimensional space). Initially We shall then expand from  $\mathbb{R}^2$  to  $\mathbb{R}^3$  where we shall show that for any Pythagorean triples  $a$ ,  $b$  and  $c$  then  $a^3 + b^3 + c^3 = d^3$ . We shall then highlight the interplay between volumes of three geometrical constructs. In other words volume  $a^3$  plus volume  $b^3$  plus volume  $c^3$  equals volume  $d^3$ . Finally, we shall transition from  $\mathbb{R}^3$  to  $\mathbb{R}^1$  where we shall show that  $\frac{a^2}{d} + \frac{b^2}{d} = \frac{c^2}{d}$ . Both of the above transitions are not taken care of by the classical Pythagorean theorem in  $\mathbb{R}^2$ . In so doing we will investigate valuable insights into the challenges and considerations posed by the 3 dimensional scope. Additionally, we shall engage the Pythagorean Theorem to a rigorous test involving integers and decimals. We shall then cast our eyes onto the various practical applications in the realm of mathematics, Physics, engineering and architecture unveiling the theorems potential to optimize design and construction processes. Finally, the study will make recommendation and prospects for further generalizations to higher dimensions and the various generalizations to higher dimensions. This investigation will contribute to the enrichment of spatial mathematics and the broad spectrum of practical implications in diverse disciplines.

**Keywords:** *Pythagorean theorem, Three dimensional space, One dimensional space*