

Introduction to *Orthogonality*

What you need to know already:

- Basic properties of vectors and matrices.
- Geometric and algebraic meaning of orthogonality between vectors.

What you can learn here:

- Several important concepts and properties related to the concept of orthogonality between vectors.

What would mathematics be without the Pythagorean Theorem?

Simpler?

Not at all, on the contrary! I am sure you have noticed how often that theorem comes to our assistance in the solution of so many mathematical problems. And what is its key assumption? That we are dealing with a *right* triangle, that is, that we are in a situation in which two sides are *perpendicular* to each other.

Since we are in linear algebra, we prefer to use the word *orthogonal* for that relationship and in this chapter we shall start exploring the advantages of dealing

with orthogonal vectors. And keep in mind that those advantages will extend to more general, non-Euclidean vectors.

So, shall we encounter the Pythagorean theorem here too?

Yes, but we shall look more generally at the concept of orthogonality and in doing so we shall discover some other interesting facts and procedures that you may not have noticed before. Believe me: it is worth devoting a whole chapter to it!

OK, I will buy that, although I hope that the surprises will be pleasant...

By the way, do you know a proof of the Pythagorean theorem?

Summary

- This chapter will explore in detail the concept of orthogonality.

Common errors to avoid

- We are looking at orthogonality from a general, linear algebra perspective: while the Pythagorean theorem is relevant here, don't expect to see it at every corner!

What questions do you have for your instructor?