Question: Using the properties of an inner product, prove that

Using the properties of an inner product, prove that the Pythagorean Theorem holds for any "induced norm". Specifically, show that if $\|\boldsymbol{x}\| = \sqrt{\langle \boldsymbol{x}, \boldsymbol{x} \rangle}$, then for any $\boldsymbol{x}, \boldsymbol{y}$ satisfying $\langle \boldsymbol{x}, \boldsymbol{y} \rangle = 0$, $\|\boldsymbol{x}+\boldsymbol{y}\|^2 = \|\boldsymbol{x}\|^2 + \|\boldsymbol{y}\|^2$.

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Expert Answer

Anonymous Chegg expert
answered this

Sol:- $\langle x, y \rangle = 0$ and $\|x\| = \sqrt{\langle x, x \rangle}$ → Given

Consider, $\|x+y\|^2 = \langle x+y, x+y \rangle$

$= \langle x, x \rangle + \langle x, y \rangle + \langle y, x \rangle + \langle y, y \rangle$

$= \|x\|^2 + 0 + 0 + \|y\|^2$

$= \|x\|^2 + \|y\|^2$ H.P

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Using the properties of an inner product, prove that the Cauchy-Schwarz inequality holds for any "induced norm". = ≮ק y. (a) Specifically, show that if || 2 || = V (æ,x), then for any x, y we have |(x, y)| 5 || 20 |||| y ||. (Hint: Consider writing x as a linear combination of y and the vector z = x - (x,y) ||y||2 What is (z, y)? What can we infer from the previous problem?] (b...

See answer