10.3.1 Orthogonal Vectors

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Week 10 due Dec 16, 2023 07:42 IST Completed

10.3.1 Orthogonal Vectors

Video

Start of transcript. Skip to the end.

Dr. Robert van de Geijn: Next we're going to revisit orthogonal vectors.

Now we talked a little bit about orthogonal vectors in week one

when we talked about the dot product.

And we linked the dot product of two vectors

being equal to 0, two vectors being orthogonal or perpendicular.

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Reading Assignment

0 points possible (ungraded)

Read Unit 10.3.1 of the notes. [LINK]

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Question on lecture note 10.3.1 5

Greetings, I was curious why under the section 10.3.1 - orthogonal vectors in the page 364 of our lecture note (pdf), you restrict the x, y to non-...

Calculator

Homework 10.3.1.1

Homework 10.3.1.1

4/4 points (graded)

For each of the following, indicate whether the vectors are orthogonal:

- $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

  TRUE ✔ Answer: TRUE

- $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$

  TRUE ✔ Answer: TRUE

- The unit basis vectors e_i and e_j.

  Sometimes ✔ Answer: Sometimes

- $\begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}$ and $\begin{pmatrix} -\sin\theta \\ \cos\theta \end{pmatrix}$

  Always ✔ Answer: Always

$\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$	True because $\begin{pmatrix} 1 \\ -1 \end{pmatrix}^T \begin{pmatrix} 1 \\ 1 \end{pmatrix} = 0$
$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$	True because $\begin{pmatrix} 1 \\ 0 \end{pmatrix}^T \begin{pmatrix} 0 \\ 1 \end{pmatrix} = 0$
The unit basis vectors e_i and e_j.	Sometimes because $e_i^T e_j = 0$ if $i \neq j$ but $e_i^T e_j = 1$ if $i = j$.
$\begin{pmatrix} c \\ s \end{pmatrix}$ and $\begin{pmatrix} -s \\ c \end{pmatrix}$	Always because $\begin{pmatrix} c \\ s \end{pmatrix}^T \begin{pmatrix} -s \\ c \end{pmatrix} = 0$

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Answers are displayed within the problem

Homework 10.3.1.2

1/1 point (graded)

Let $A \in \mathbb{R}^{m \times n}$. Let a_i^T be a row of A and $x \in \mathcal{N}(A)$. Then a_i is orthogonal to x.

Always ✔ Answer: Always

Answer: Always Since $x \in \mathcal{N}(A)$, $Ax = 0$. But then, partitioning A by rows,

$$0 = \begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix} = Ax = \begin{pmatrix} a_0^T \\ a_1^T \\ \vdots \\ a_{m-1}^T \end{pmatrix} x = \begin{pmatrix} a_0^T x \\ a_1^T x \\ \vdots \\ a_{m-1}^T x \end{pmatrix}.$$

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Calculator

Calculator