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1.4.3 Dot or Inner Product (DOT)

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Week 1 due Oct 5, 2023 03:12 IST Completed

1.4.3 Dot or Inner Product (DOT)

Summary

▶ The dot product (or inner product) of vectors $x, y \in \mathbb{R}^n$ is defined as

$$\chi_0\psi_0 + \chi_1\psi_1 + \cdots + \chi_{n-1}\psi_{n-1} = \sum_{i=0}^{n-1} \chi_i\psi_i.$$

▶ We will write this operation as x^Ty for reasons that will become clear later in the course.

And then multiplying the row vector times a column vector means multiplying the first components together, and adding that to the second components multiplied together, and so forth.

And that gives you done the same result as before.

So in summary, the dot product of two vectors is defined by multiplying the **corresponding components together, and adding the results of that.**

We can write that shorthand with the summation sign.

And in this course, almost always we will denote the dot product by x transpose y .

⏮ 4:40 / 4:54

▶ 2.0x

🔊

🔍

📄

🗣

Video
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Reading Assignment

0 points possible (ungraded)
Read Unit 1.4.3 of the notes. [\[LINK\]](#)

☒ Done

✓

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✓ Correct

Discussion

Topic: Week 1 / 1.4.3

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💬

[Cost of Dot product with vectors of size n \(flops and memops \).](#)

Hi everyone,I would like to made some statements and discuss about floating points and memory complexity of Dot Product. - - Flops should b...

4

?

[How to verify vector operations in the simplest way?](#)

Calculator

https://learning.edx.org/course/course-v1:UTAustinX+UT.5.05x+1T2022/block-v1:UTAustinX+UT.5.05x+1T2022+type@sequential+block@de9876de14394df395423b596b7884d4/block-v1:UTAustinX+UT.5.05x+1T20...

2/9

	for example, homework 1.4.3.10 and 1.4.3.12, how to verify using graphic or other method? because I can only rely on intuition now.	
? 1.4.3.12	This seems to be a property of vectors. I can work it out but substitution but does a proof exist?	2
💬 Question about 1.4.3.11	Where did vector Z come from in the explanation? It isn't brought up in the question itself, which only says vector x or y has to be equal to 0. Of...	4
💬 Purpose of transpose notation	Why do we do that way? Sometimes I realize it is compact to print on paper a transpose, but other than that?	6
💬 Homework proof	Hello, I saw an earlier post which mentioned that there are homework transcript proofs available somewhere--is this true, or did I misunderstand...	2
💬 Proof of the homework 1.4.3.4	The transcript of the proof for Homework 1.4.3.4 is wrong. It's not for this video.	5
? Solution for 1.4.3.7	Hi, Does anybody have the solution/calculation for 1.4.3.7? I got "11". Cheers, Erdal	2

Homework 1.4.3.1

1/1 point (graded)

$$\begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix}^T \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} =$$

☐ 1

☐ 2

☐ -2

☐ 6

☒ Can't be done



Submit

i Answers are displayed within the problem

Homework 1.4.3.2

1/1 point (graded)

$$\begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix}^T \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix} =$$

2

Answer: 2

Submit

Calculator

 Answers are displayed within the problem

Homework 1.4.3.3

1/1 point (graded)

$$\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}^T \begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix} =$$

 Answer: 2

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Homework 1.4.3.4

1/1 point (graded)

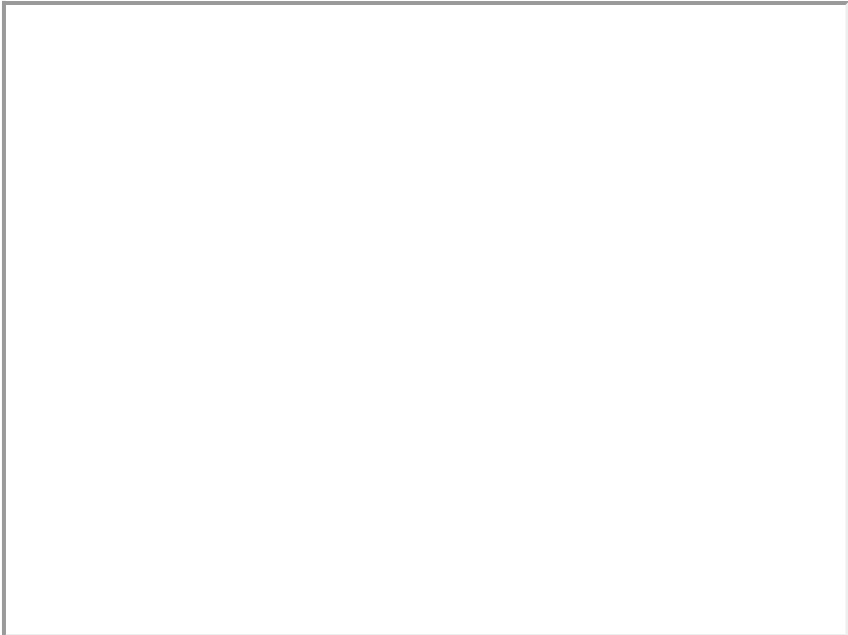
For $x, y \in \mathbb{R}^n$, $x^T y = y^T x$.

Always

▼

 Answer: Always

Explanation
video



[Transcribed in final section of this week](#)
[Image Proof](#)


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Homework 1.4.3.5

1/1 point (graded)

$$\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}^T \left(\begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} \right) =$$

 Calculator

12

✔ Answer: 12

Submit

ⓘ Answers are displayed within the problem

Homework 1.4.3.6

1/1 point (graded)

$$\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}^T \begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}^T \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} =$$

12

✔ Answer: 12

Submit

ⓘ Answers are displayed within the problem

Homework 1.4.3.7

1/1 point (graded)

$$\left(\begin{pmatrix} 2 \\ 5 \\ -6 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix} \right)^T \begin{pmatrix} 1 \\ 0 \\ 0 \\ 2 \end{pmatrix} =$$

13

✔ Answer: 13

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Homework 1.4.3.8

1/1 point (graded)

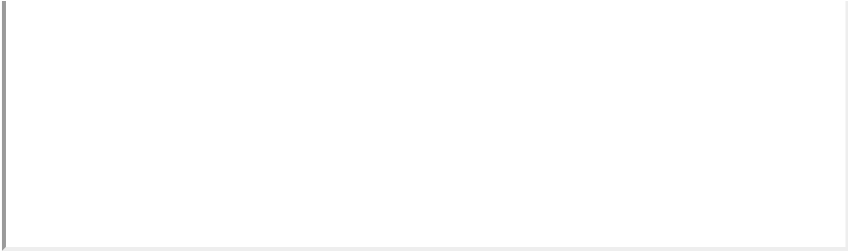
For $x, y, z \in \mathbb{R}^n$, $x^T (y + z) = x^T y + x^T z$.

Always

✔ Answer: Always

Explanation
video





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Homework 1.4.3.9

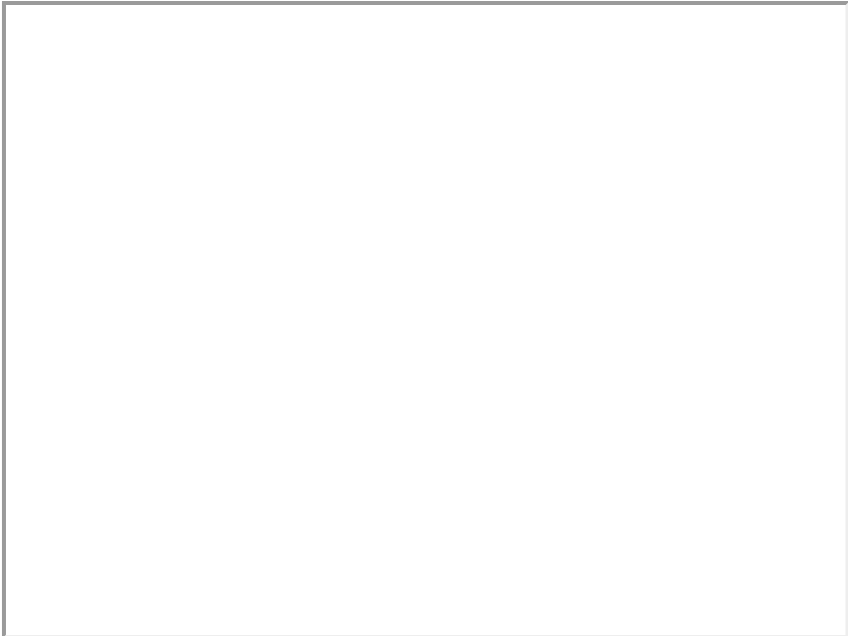
1/1 point (graded)

For $x, y, z \in \mathbb{R}^n$, $(x + y)^T z = x^T z + y^T z$.

Always

Answer: Always

Explanation
video



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Homework 1.4.3.10

1/1 point (graded)

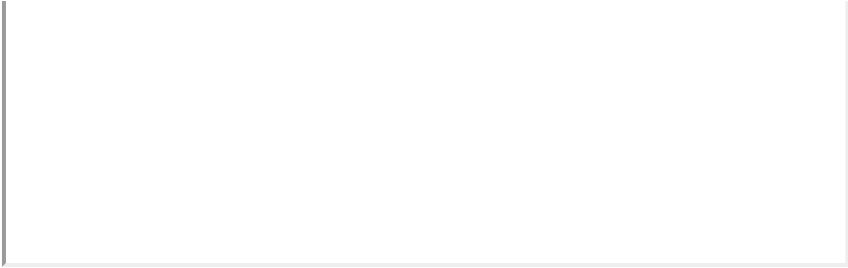
For $x, y, z \in \mathbb{R}^n$, $(x + y)^T (x + y) = x^T x + 2x^T y + y^T y$.

Always

Answer: Always

Explanation
video





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Homework 1.4.3.11

1/1 point (graded)
For $\boldsymbol{x}, \boldsymbol{y} \in \mathbb{R}^n$, when $\boldsymbol{x}^T \boldsymbol{y} = 0$, $\boldsymbol{x} = \mathbf{0}$ or $\boldsymbol{y} = \mathbf{0}$.

Sometimes **✓** Answer: Sometimes

Explanation
video



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Homework 1.4.3.12


1/1 point (graded)
For $\boldsymbol{x} \in \mathbb{R}^n$, $\boldsymbol{e}_i^T \boldsymbol{x} = \boldsymbol{x}^T \boldsymbol{e}_i = \chi_i$,

where χ_i equals the i th component of \boldsymbol{x} .

Always **✓** Answer: Always

Explanation
video



 Calculator



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