3.3.1 Scaling a Matrix

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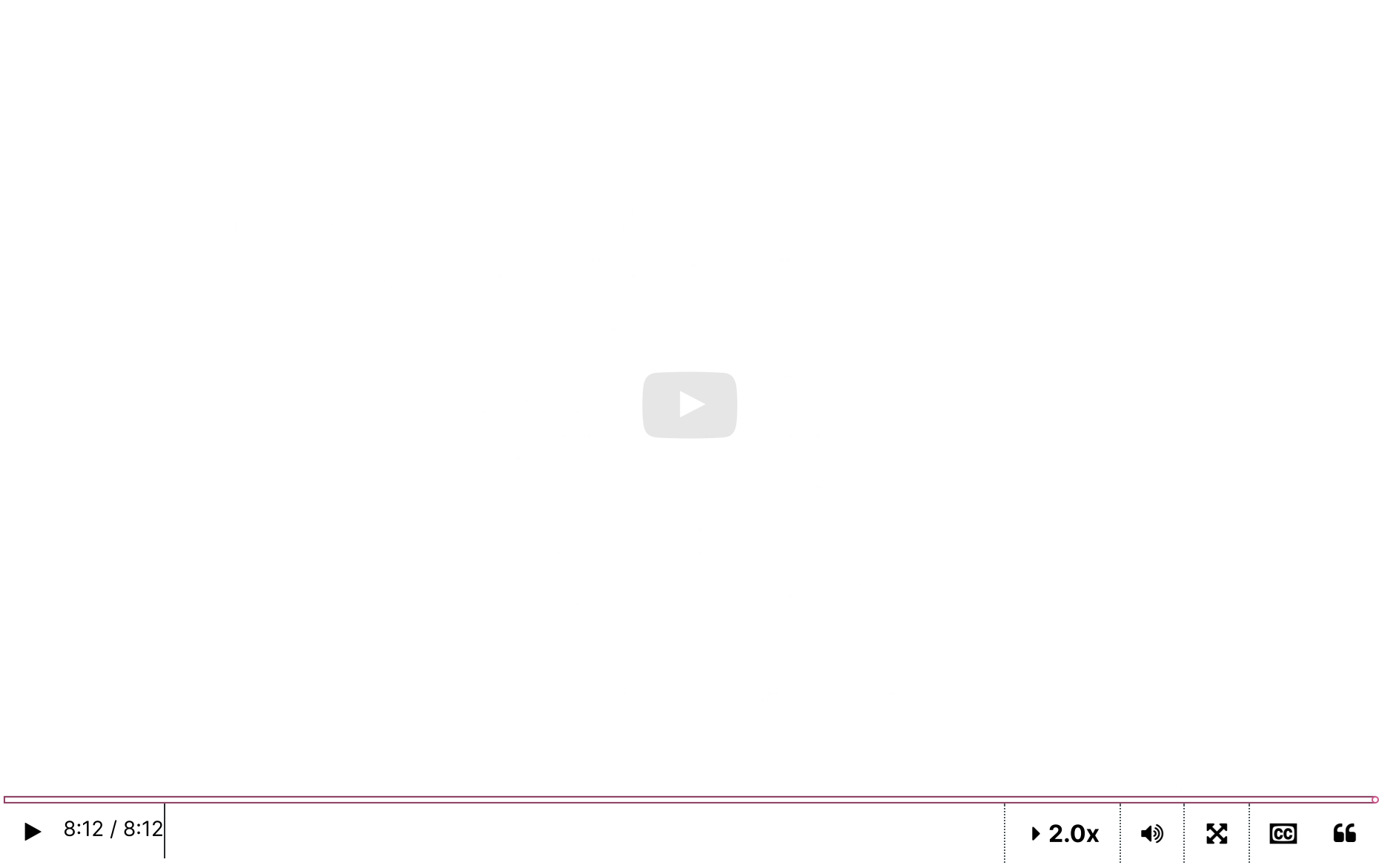
Week 3 due Oct 18, 2023 06:12 IST

3.3.1 Scaling a Matrix



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Reading Assignment

0 points possible (ungraded)

Read Unit 3.3.1 of the notes. [LINK]

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Calculator

HW 3.3.1.4 Alternative Proof ? 3

? HW 3.3.1.5 , what if scalar equals zero? 3

What is scalar = 0 ? In a such case, shouldn't all elements of the matrix A turn into zero making it a "zero-matrix" ? If thats the case "sometimes"...

Homework 3.3.1.1

1/1 point (graded)

Let $L_A : \mathbb{R}^n \rightarrow \mathbb{R}^m$ be a linear transformation and, for all $x \in \mathbb{R}^n$, define $L_B : \mathbb{R}^n \rightarrow \mathbb{R}^m$ by $L_B(x) = \beta L_A(x)$ where β is a scalar. Then $L_B(x)$ is a linear transformation.

Always ✔

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Homework 3.3.1.2

1/1 point (graded)

Algorithm: $[A] := \text{SCALE\_MATRIX\_ALTERNATIVE}(\beta, A)$

Partition $A \rightarrow \left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right)$

where A_T has 0 rows

while $m(A_T) < m(A)$ **do**

Repartition

$$\left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right) \rightarrow \left(\begin{array}{c} A_0 \\ \hline a_1^T \\ \hline A_2 \end{array}\right)$$

where a_1 has 1 row

Continue with

$$\left(\begin{array}{c} A_T \\ \hline A_B \end{array}\right) \leftarrow \left(\begin{array}{c} A_0 \\ \hline a_1^T \\ \hline A_2 \end{array}\right)$$

endwhile

Refering to the algorithm above,which of the following updates will scale A one row at a time?

- ◉ $a_1^T = \beta a_1^T$
- ○ $a_1^T = 0$
- ○ $a_1^T = a_1^T$
- ○ None of the Above

✔

Calculator

Explanation
$a_1^T = \beta a_1^T$ is the correct choice because β will scale the rows by value β.

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Answers are displayed within the problem

Homework 3.3.1.3

1/1 point (graded)
Implement function

- `Scale_matrix_unb( beta, A )`)

Some links that will come in handy:

- Spark (alternatively, open the file `LAFF2.0xM/Spark/index.html`)
- PictureFLAME (alternatively, open the file `LAFF-2.0xM/PictureFLAME/PictureFLAME.html`)

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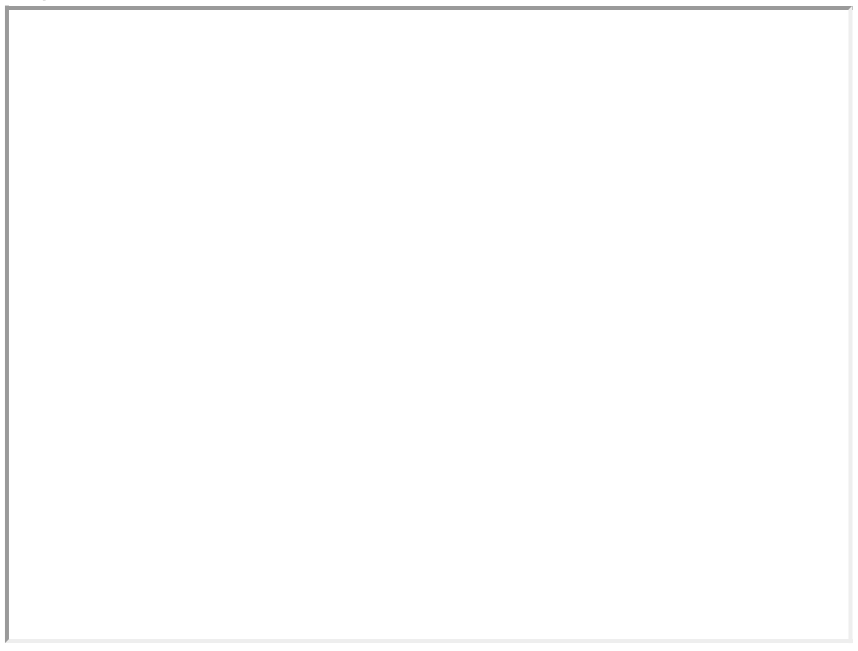
Correct (1/1 point)

Homework 3.3.1.4

1/1 point (graded)
Let $A \in \mathbb{R}^{n \times n}$ be a symmetric matrix and $\beta \in \mathbb{R}$ a scalar, βA is symmetric.

Always ✔ Answer: Always

Explanation



Transcripted in final section of this week
Scanned solution from video

Robert's explanation

Answer: Always

Let $C = \beta A$. We need to show that $\gamma_{i,j} = \gamma_{j,i}$. But $\gamma_{i,j} = \beta\alpha_{i,j} = \beta\alpha_{j,i} = \gamma_{j,i}$, since A is symmetric. Hence C is symmetric.

(The last beta in the explanation should be a gamma)

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Answers are displayed within the problem

Homework 3.3.1.5

1/1 point (graded)
Let $A \in \mathbb{R}^{n \times n}$ be a lower triangular matrix and $\beta \in \mathbb{R}$ a scalar. βA is a lower triangular matrix.

Always ✔ Answer: Always

Explanation

Transcripted in final section of this week
Scanned solution from video

Robert's explanation

Answer: Always
Assume A is a lower triangular matrix. Then $\alpha_{i,j} = 0$ if $i < j$.
Let $C = \beta A$. We need to show that $\gamma_{i,j} = 0$ if $i < j$. But if $i < j$, then $\gamma_{i,j} = \beta \alpha_{i,j} = \beta \times 0 = 0$ since A is lower triangular. Hence C is lower triangular.

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Answers are displayed within the problem

Homework 3.3.1.6

1/1 point (graded)
Let $A \in \mathbb{R}^{n \times n}$ be a diagonal matrix and $\beta \in \mathbb{R}$ a scalar. βA is a diagonal matrix.

Always ✔ Answer: Always

Explanation

Answer: Always
Assume A is a diagonal matrix. Then $\alpha_{i,j} = 0$ if $i \neq j$.
Let $C = \beta A$. We need to show that $\gamma_{i,j} = 0$ if $i \neq j$. But if $i \neq j$, then $\gamma_{i,j} = \beta \alpha_{i,j} = \beta \times 0 = 0$ since A is a diagonal matrix. Hence C is a diagonal matrix.

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Answers are displayed within the problem

Homework 3.3.1.7

1/1 point (graded)

Let $A \in \mathbb{R}^{m \times n}$ be a matrix and $\beta \in \mathbb{R}$ a scalar. $(\beta A)^T = \beta A^T$.

Always ✔

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