11.4.2 Change of Basis

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11.4.2 Change of Basis

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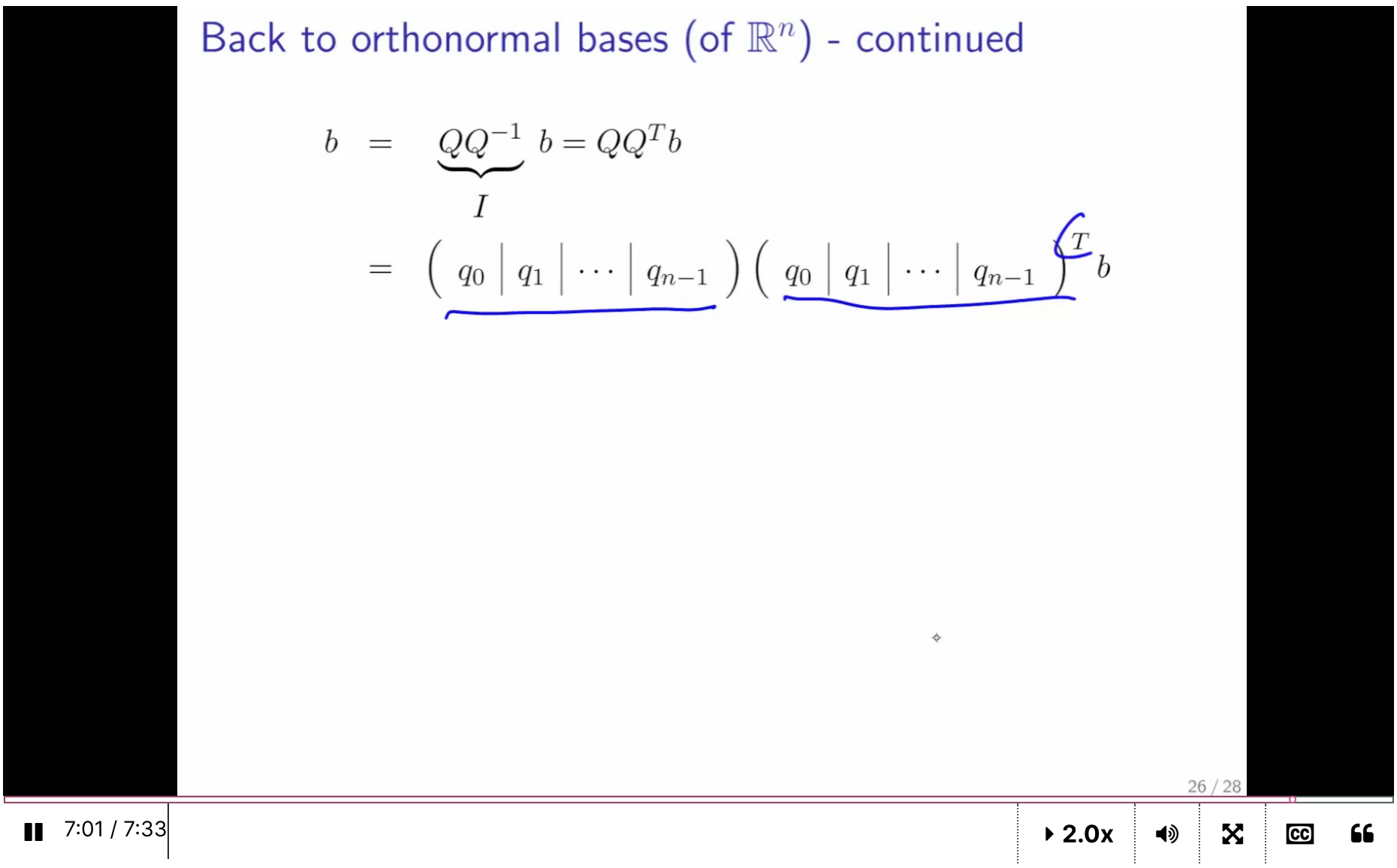

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Homework 11.4.1

1/1 point (graded)

The vectors

$$q_0 = \frac{\sqrt{2}}{2}\begin{pmatrix}1\\1\end{pmatrix} = \begin{pmatrix}\frac{\sqrt{2}}{2}\\ \frac{\sqrt{2}}{2}\end{pmatrix}, \quad q_1 = \frac{\sqrt{2}}{2}\begin{pmatrix}-1\\1\end{pmatrix} = \begin{pmatrix}-\frac{\sqrt{2}}{2}\\ \frac{\sqrt{2}}{2}\end{pmatrix}.$$

are mutually orthonormal.

TRUE ✔ Answer: TRUE

TRUE

Let $Q = \left(\begin{array}{c|c} q_0 & q_1 \end{array}\right)$. Then q_0 and q_1 are mutually orthonormal if and only if $Q^TQ = I$. Now,

$$Q^TQ = \begin{pmatrix}\frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2}\\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2}\end{pmatrix}^T \begin{pmatrix}\frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2}\\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2}\end{pmatrix} = \begin{pmatrix}\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2}\\ -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2}\end{pmatrix} \begin{pmatrix}\frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2}\\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2}\end{pmatrix} = \begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}.$$

Hence, the vectors are mutually orthonormal.

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Homework 11.4.2.2

4/4 points (graded)

If $Q \in \mathbb{R}^{n\times n}$ has mutually orthonormal columns then which of the following are true:

1. $Q^TQ = I$

TRUE ✔ Answer: TRUE

2. $QQ^T = I$

TRUE ✔ Answer: TRUE

3. $QQ^{-1} = I$

TRUE ✔ Answer: TRUE

4. $Q^{-1} = Q^T$

TRUE ✔ Answer: TRUE

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