

Assignment 4

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Abstract—This document converts convolution in to matrix form

Download all python codes from

<https://github.com/Zeehan-IITH/IITH-EE5609/new/master/codes>

and latex-tikz codes from

<https://github.com/Zeehan-IITH/IITH-EE5609>

1 PROBLEM

$\triangle ABC$ and $\triangle DBC$ are two isosceles triangles on the same base BC . Prove that $\angle ABD = \angle ACD$.

2 CONSTRUCTION

In an Isosceles triangle the angles opposite to sides of equal length are equal. Therefore the angles $\angle ABC = \angle ACB$ and $\angle DBC = \angle DCB$. Since the two triangles are isosceles, $\|BD\| = \|CD\|$ and $\|AB\| = \|AC\|$.

3 EXPLANATION

The triangles $\triangle ABC$ and $\triangle DBC$ are isosceles triangles, so

$$AB^T CB = AC^T BC \quad (3.0.1)$$

$$DB^T CB = DC^T BC \quad (3.0.2)$$

$$\cos \angle ABD = \frac{AB^T DB}{\|DB\| \|AB\|} \quad (3.0.3)$$

$$\cos \angle ACD = \frac{AC^T DC}{\|AC\| \|DC\|} \quad (3.0.4)$$

From the equations, (3.0.3) and (3.0.4) we get

$$\begin{aligned} & \|AC\| \|DC\| (\cos \angle ABD - \cos \angle ACD) \\ &= AB^T DB - AC^T DC \end{aligned} \quad (3.0.5)$$

$$= (AC + CB)^T DB - AC^T (DB + BC) \quad (3.0.6)$$

$$= AC^T DB + CB^T DB - AC^T DB - AC^T BC \quad (3.0.7)$$

$$= CB^T DB - AC^T BC \quad (3.0.8)$$

$$= CB^T DB - CB^T AB \quad (3.0.9)$$

$$\begin{aligned} &= CB^T (DB - AB) \\ & \quad (3.0.10) \end{aligned}$$

$$\begin{aligned} &= CB^T DA = 0 \\ & \quad (3.0.11) \end{aligned}$$

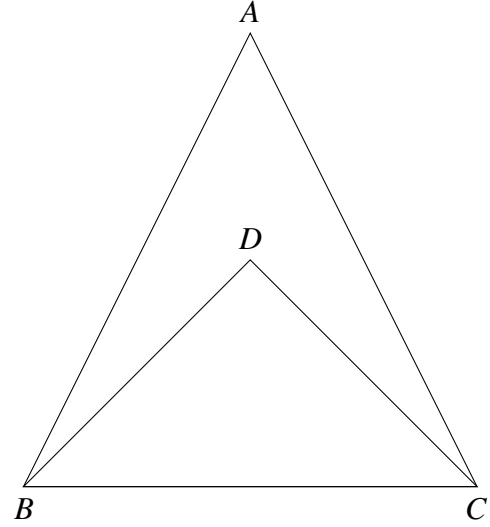


Fig. 1: Isosceles triangles with common base BC

Since A, D lie on the normal to CB . Therefore

$$\cos \angle ABD - \cos \angle ACD = 0 \quad (3.0.12)$$

$$\cos \angle ABD = \cos \angle ACD \quad (3.0.13)$$

$$\angle ABD = \angle ACD \quad (3.0.14)$$