Lecture 3

Thursday, May 2, 2024 10:53 PM

Continue dot product:

$v = (a, b, c)$

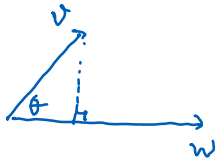
$w = (d, e, f)$

$v \cdot w = ad + be + cf$

Geometrically, $v \cdot w$ is the projection of v onto w if $|w| = 1$.

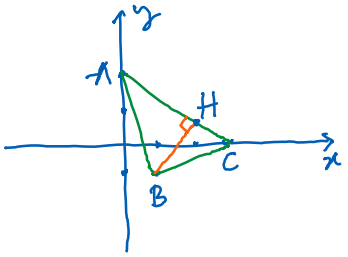
If $|w|$ is not necessarily equal to 1 then the projection of v onto w is $v \cdot e_w$, where e_w is the unit vector in the direction of w.

$$e_w = \frac{w}{|w|}$$



$$\cos\theta = \frac{v \cdot e_w}{|v|} = \frac{v \cdot \left(\frac{w}{|w|}\right)}{|v|} = \frac{v \cdot w}{|v||w|}$$

Ex



Find the coordinates of H.

Observe that $|\vec{AH}|$ is the projection of $\vec{AB}$ onto $\vec{AC}$.

Cross product

$v = (a, b)$

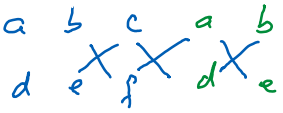
$w = (c, d)$

$$v \times w = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

Cross product is more interesting for 3D vectors:

$v = (a, b, c)$

$w = (d, e, f)$



$$v \times w = (bf - ce,\ cd - af,\ ae - bd)$$

Ex: $v = (1, 2, 3)$

$w = (2, -1, 0)$

$v \times w = ?$

$w \times v = ?$