CPSC 314
Computer Graphics

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Vector Spaces

Announcements

- iClicker registration now working on Connect (?)
- Assignment 1 will be released on or before Monday.
- Labs start next week. Next week focus on getting the starter code for Assignment 1 working in your computing environment.
- “Prerequisite letter”. Contact me if you received email about this.

Preparing for Assignment 1

- Read Appendix A of Textbook
- Lab machines are setup to run the assignment
- You can do the assignments in your personal computing environment. However..
  - Make sure your drivers support OpenGL 3.3 or later
  - Download and install freeGLUT and GLEW. Instructions available at many places on the web, including textbook site

    http://www.3dgraphicsfoundations.com/setup.html

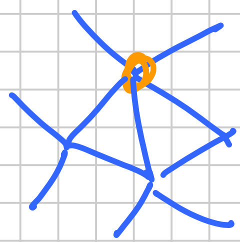
Vector spaces
(Textbook Chapter 2)

Switch to pen

Vector Spaces

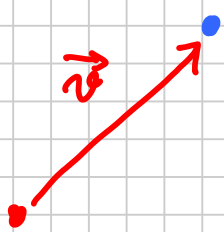
Note Title 1/9/2014

Geometry represented in OpenGL



Vertex → position, normals, . . .

Representing a point



"origin"

$\vec v$ is a "displacement" or "motion"

Most of the class will be dealing with displacement vectors.

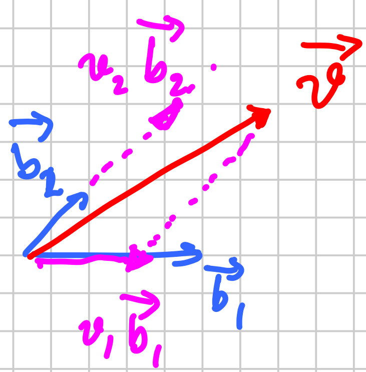
Other examples: normals, velocities..

§ Vector Space $V = \{\vec v_1, \vec a, \ldots\}$

$\vec a + \vec b \in V$ if $\vec a, \vec b \in V$

$\alpha \vec a \in V$

§ Basis $\vec b_1$ $\vec b_2$ $\vec b_3$



$\vec v = v_1 \vec b_1 + v_2 \vec b_2$

A basis is some linearly indep. set of vectors which is complete: all $\vec{v} \in V$ can be expressed as above.

The size of this basis set is called the "dimension" of the vector space.

The basis is NOT unique.

§ Orthonormal basis

suppose we have a dot product

Two vectors are orthogonal if $\vec{v}_1 \cdot \vec{v}_2 = 0$

A basis of orthogonal vectors, with $\vec{b}_i \cdot \vec{b}_i = 1$ is called Orthonormal.

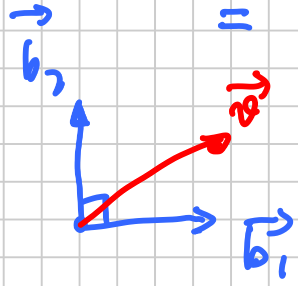
Dot of 2 vectors, in an orthonormal basis.

$$\vec{u} = u_1 \vec{b}_1 + u_2 \vec{b}_2$$

$$\vec{v} = v_1 \vec{b}_1 + v_2 \vec{b}_2$$

$$\vec{u} \cdot \vec{v} = u_1 v_1 \, \vec{b}_1 \cdot \vec{b}_1 + u_2 v_2 \, \vec{b}_2 \cdot \vec{b}_2$$

$$= u_1 v_1 + u_2 v_2$$



$v_1 = \vec{v} \cdot \vec{b}_1$

§ Important No(ta)tions

	Mine	Book	
Point	$\hat{p}$	✓	} these are "real" physical things
Vector	$\vec{v}$	✓	
Column matrix	$\bar{a}$	$\mathbf{a}$	$\begin{bmatrix} 2 \\ 3.5 \\ 6 \end{bmatrix}$
Row matrix	$\underline{a}$	$\mathbf{a}^t$	$[1 \quad 3 \quad 7.6]$

☆ Note change from book

§ Basis Matrix / Coordinate System

$$\vec{v} = \sum_{i=1}^{3} \vec{b}_i v_i$$

$$= [\vec{b}_1 \ \vec{b}_2 \ \vec{b}_3] \begin{bmatrix} v_1 \\ v_2 \\ v_3 \end{bmatrix}$$

$$= \underline{\vec{b}}\,\bar{v}$$

(in book $\vec{\mathbf{b}}^t \mathbf{v}$