Cornell Notes	Topic/Objective: 12.3 Scalar Product (aka Dot Product)	Name:
AVID Decades of College Dreams		Class/Period: 3rd
		Date: 9/21/17

Essential Question: What is the scalar product? What are its properties and how is it used?

Questions:	Notes:
	WHY DO WE CARE?
	MATH ANSWER: Scalar PRODUCTS ALLOW US TO ALGEBRAICALLY WORK WITH THE GOMETRIC NOTIONS OF LENGTH, DISTANCE AND ANGLE IN HIGHER DIMENSIONS
	def Let $\mathbf{u} = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_n \end{bmatrix}$ and $\mathbf{v} = \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_n \end{bmatrix}$ Be vectors in $\mathbb{R}^n$

Questions:	Notes:
	THE SCALAR (DOT) PRODUCT OF u, v, denoted $\vec{u}\cdot\vec{v}$ IS A SINGLE NUMBER (SCALAR!) YOU GET WHEN YOU LINE UP THE COMPONENTS, MULTIPLY, AND SUM
	$\vec{u}\cdot\vec{v} = u_1 \times v_1 + u_2 \times v_2 + \cdots + u_n v_n$
	Ex) $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \cdot \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix} = (1\times4)+(2\times5)+(3\times6) = 4 + 10 + 18 = 32$
	PROPERTIES
	a) $\vec{u}\cdot\vec{v}=\vec{v}\cdot\vec{u}$ commutative
	b) $\vec{u}\cdot(\vec{v}+\vec{w})=\vec{u}\cdot\vec{v}+\vec{u}\cdot\vec{w}$ dist.
	c) $(c\vec{u})\cdot\vec{v}=c(\vec{u}\cdot\vec{v})$ associative
	FINDING AN ANGLE BETWEEN TWO VECTORS
	def) THE SCALAR PRODUCT $\underbrace{a\cdot b}_{\text{scalar, a number}} = \underbrace{\lvert a\rvert\ \lvert b\rvert}_{\text{magnitude}} \cos\theta$
	where θ IS THE ANGLE BTWN $a + b$.
	recall $\lvert a\rvert = \sqrt{a_1^2 + a_2^2 + \cdots a_n^2}$

Questions:	Notes: Ex) FIND THE ANGLE BETWEEN
	$a = 3i + 4j$ and $b = 5i + 2j$
	$a \cdot b = \lvert a \rvert \lvert b \rvert \cos\theta$
	$\theta = \cos^{-1}\left(\dfrac{a \cdot b}{\lvert a \rvert \lvert b \rvert}\right)$
	$a \cdot b = (3)(5) + (4)(2)$
	$= 15 + 8$
	$= 23$
	$\lvert a \rvert = \sqrt{3^2 + 4^2}$
	$= \sqrt{9 + 16}$
	$= 5$
	$\lvert b \rvert = \sqrt{29}$
	$\theta = \cos^{-1}\left(\dfrac{23}{5\sqrt{29}}\right) = 31.3^\circ$

Questions: | **Notes:** (more) SPECIAL PROPERTIES OF SCALAR PROD.

① VECTORS THAT ARE PERPENDICULAR, $a \cdot b = 0$

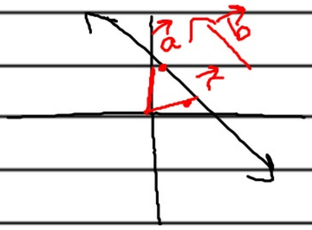
$$a \cdot b = |a||b| \cos 90^\circ$$
$$= |a||b|(0)$$
$$= 0$$

② VECTORS THAT ARE PARALLEL, $a \cdot b = |a||b|$

③ VECTORS THAT ARE COINCIDENT, $a \cdot b = |a|^2$

HW10 12L P428 2,3,5,6,9,13,14

Questions:



Notes:

12.4 VECTOR EQUATION OF A LINE

def) THE VECTOR EQUATION OF A LINE IS GIVEN BY $\vec{r} = \vec{a} + t\vec{b}$, where $\vec{r}$ IS A ~~GIVEN~~ GENERAL POSITION VECTOR OF A POINT ON THE LINE, $\vec{a}$ IS THE GIVEN POSITION VECTOR OF A PT ON LINE AND $\vec{b}$ IS THE DIRECTION VECTOR PARALLEL TO THE LINE. t IS CALLED A PARAMETER.

SO $\vec{r} = \begin{bmatrix} x \\ y \end{bmatrix}$, $\vec{a}$ IS A SPECIFIC POINT, t IS A SCALAR, $\vec{b}$ IS A VECTOR PARALLEL TO LINE

Ex) WRITE EQ. GOES THRU $(1, -1, 3)$ AND

a) IS PARALLEL TO $-i + 3j - K$

$a = i - j + 3K$, $b = -i + 3j - K$

$$\vec{r} = (i - j + 3K) + t(-i + 3j - K)$$

Questions:

HW 12J
p. 432
1, 2, 7, 8

multi-part - do 1/2

Notes:

b) FIND THE VECTOR EQ OF A LINE THRU POINTS $A(1, 0, -4)$ and $B(-2, 1, 1)$

*need direction vector:

$$\overrightarrow{OA} = \begin{pmatrix} 1 \\ 0 \\ -4 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} -2 \\ 1 \\ 1 \end{pmatrix}$$

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA} = \begin{pmatrix} -3 \\ 1 \\ +5 \end{pmatrix}$$

$$\vec{r} = \begin{pmatrix} 1 \\ 0 \\ -4 \end{pmatrix} + t \begin{pmatrix} -3 \\ 1 \\ 5 \end{pmatrix}$$

c) Find the angle between lines in a + b

the direction vectors are $\begin{pmatrix} -1 \\ 3 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} -3 \\ 1 \\ 5 \end{pmatrix}$

$$\theta = \cos^{-1}\left(\frac{\begin{pmatrix} -1 \\ 3 \\ 1 \end{pmatrix} \cdot \begin{pmatrix} -3 \\ 1 \\ 5 \end{pmatrix}}{\left|\begin{pmatrix} -1 \\ 3 \\ -1 \end{pmatrix}\right| \left|\begin{pmatrix} -3 \\ 1 \\ 5 \end{pmatrix}\right|} \right)$$

$$\theta = \cos^{-1}\left(\frac{1}{\sqrt{11} \cdot \sqrt{35}} \right) = 87.1^\circ$$