9.5 The Dot Product

The Dot Product

If $u = a_1\,\mathbf{i} + b_1\,\mathbf{j}$ and $v = a_2\,\mathbf{i} + b_2\,\mathbf{j}$ then the dot product $u \cdot v = a_1 \cdot a_2 + b_1 \cdot b_2$.

EXAMPLE: Given u = –3**i** + 4**j** and v = 6**i** + 5**j**, find the following:

a.) $u \cdot v$

b.) $v \cdot u$

c.) $u \cdot u$

d.) $v \cdot v$

e.) $\|u\|$

f.) $\|v\|$

Angle between two vectors

Given two vectors u and v, the angle between the two vectors is given as:

$$\cos\theta = \frac{u \cdot v}{\|u\| \cdot \|v\|}$$

EXAMPLE: u = –3**i** + 4**j** and v = 6**i** + 5**j**, find the angle between *u* and *v* and round your answer to two decimal places.

If the angle between the vectors is 0 or 180 degrees, then the vectors are **parallel**.

If the angle between the vectors is 90 degrees then the vectors are **orthogonal**.

EXAMPLE: Given u = –3**i** + 2**j** and v = 4**i** + 6**j**, find the following:

a.) $u \cdot v$

b.) $\|u\|$

c.) $\|v\|$

d.) The angle between u and v.

EXAMPLE: Are the vectors u = 2**i** + 5**j** and v = 3**i** – 7**j** orthogonal, parallel, or neither?