# Example #2 p. 5 Ch. 9

Find the angle between the vectors
$2\boldsymbol{i} + \boldsymbol{j}$ and $-3\boldsymbol{i} + \boldsymbol{j}$

# Understand Component form of unit vectors

- Remember that you “pluck off” *i* & *j* and use them as components a & b

so, 2***i*** + ***j*** = <2, 1>

so, -3***i*** + ***j*** = <-3, 1>

# Find the magnitude of u = <2, 1>, |u|

- Magnitude of u is $c = \sqrt{a^2 + b^2}$

*So,* $c = \sqrt{4 + 1} = \sqrt{5}$

$|u| = \sqrt{5}$

# Find the magnitude of v = <-3, 1>, |v|

- Magnitude of v is $c = \sqrt{a^2 + b^2}$

*So,* $c = \sqrt{9 + 1} = \sqrt{10}$

$|v| = \sqrt{10}$

# Find the dot product of u & v

- Multiply the vertical components of u & v

$$u_a \bullet v_a = 2 \bullet -3 = -6$$

- Multiply the horizontal components of u & v

$$u_b \bullet v_b = 1 \bullet 1 = 1$$

- The dot product is a scalar. Sum vertical & horizonatl component products

$$u \text{ dot } v = -6 + 1 = -5$$

# Use the dot product formula to solve for θ

- Using the fact that the dot product of u & v is equal to |u||v| cos θ, θ can be found as

$$\theta = \cos^{-1} \frac{u \text{ dot } v}{|u||v|}$$

So, $\theta = \cos^{-1} \dfrac{-5}{\sqrt{5} \bullet \sqrt{10}} = \cos^{-1} \dfrac{-5}{5\sqrt{2}} = \cos^{-1} \dfrac{-1}{\sqrt{2}}$

thus, we know this is 45° in Quadrant II since inverse cosine is defined on [0, π), therefore the angle between them is 180° – 45° = 135°

# Thus, θ is

$$\theta = 135°$$