Quiz 1

Hunter Shiells. 500946154. Section 5

Let $\vec{a}=(6,8)$ and $\vec{b}=(1,x)$, find $x \in \mathbb{R}$ such that

i. $\vec{a} \perp \vec{b}$

ii. $\vec{a} \parallel \vec{b}$

iii. the angle between $\vec{a}$ and $\vec{b}$ is $\pi/4$

i. $x=$ $\quad \vec{a}=(6,8) \quad \vec{b}=(1,x)$

$A \cdot B = (6)(1)+8x=0 \quad x=-3/4 \quad a \perp b$

$\therefore A \cdot B = 0 \quad x=3/4 \quad a \perp b$

ii. $\frac{6}{1}=\frac{8}{x}$ then $6x=4$ when $x=\frac{4}{3}$ $\vec{a} \parallel \vec{b}$

$\frac{1}{3}$

iii. $a \cdot b = 6+8x \quad \|\vec{a}\| = \sqrt{6^2+8^2} = 10 \quad \|\vec{b}\| = \sqrt{1+x^2}$

$$\cos\theta = \frac{6+8x}{10\sqrt{1+x^2}} / 2 = \frac{3+4x}{5\sqrt{1+x^2}}$$

if $\theta = \pi/4$ then

$$\frac{3+4x}{5\sqrt{1+x^2}} = \cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$$

$$= 2(3+4x) = \sqrt{2}(5\sqrt{1+x^2})$$

square both sides

$$4(3+4x)^2 = 2(25)(1+x^2)$$

$$2(4+24x+16x^2) = 25+25x^2 = 7x^2+48x-7=0$$

$x=1/7$ and $x=-7$ x cannot be -7 cause $3+4x \geq 0$. $\therefore$ $x=1/7$, the angle between $\vec{a}$ and $\vec{b}$ is $\pi/4$