Mat 397 Spring 2016 Quiz 1 Name: Caleb McWhorter Score: $\frac{}{10}$

Solutions

1. Let $\bar{u} = \langle 2,3,-1\rangle$ and $\bar{v} = \langle 4,1,3\rangle$

(a) $|\bar{u}| =$ ______

$|\vec{u}| = \sqrt{2^2+3^2+(-1)^2} = \sqrt{4+9+1} = \sqrt{14}$

(b) Compute the dot product $\bar{u} \bullet \bar{v} =$ ______

$\vec{u}\cdot\vec{v} = 2(4)+3(1)+(-1)3 = 8+3-3 = 8$

(c) Find the angle between Let $\bar{u}$ and $\bar{v}$. (Note: Since you are not using a calculator, you will not be able to get a numerical approximation!)

We know $\vec{u}\cdot\vec{v} = |\vec{u}||\vec{v}|\cos\theta$

From above, $|\vec{u}| = \sqrt{14}$, $\vec{u}\cdot\vec{v} = 8$

$|\vec{v}| = \sqrt{4^2+1^2+3^2} = \sqrt{16+1+9} = \sqrt{26}$

So,

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

$8 = \sqrt{14}\sqrt{26}\cos\theta$

$\cos\theta = \frac{8}{\sqrt{14}\sqrt{26}}$

$\theta = \cos^{-1}\left(\frac{8}{\sqrt{14}\sqrt{26}}\right)$

2. Let $\bar{a}$, $\bar{b}$ and $\bar{c}$ be vectors with $\bar{a}\bullet\bar{b} = 2$ and $\bar{a}\bullet\bar{c} = 7$.

(a) $\bar{a}\bullet(\bar{b}+3\bar{c}) =$

$$\begin{aligned}\vec{a}\cdot(\vec{b}+3\vec{c}) &= \vec{a}\cdot\vec{b} + \vec{a}\cdot 3\vec{c}\\ &= \vec{a}\cdot\vec{b} + 3(\vec{a}\cdot\vec{c})\\ &= 2 + 3(7)\\ &= 23\end{aligned}$$

(b) For what value of k is $k\bar{b}+\bar{c}$ perpendicular to $\bar{a}$?

Recall two vectors $\vec{u}, \vec{v}$ are perpendicular if and only if $\vec{u}\cdot\vec{v} = 0$

$$\begin{aligned}0 = \vec{a}\cdot(k\vec{b}+\vec{c}) &= \vec{a}\cdot k\vec{b} + \vec{a}\cdot\vec{c}\\ &= k(\vec{a}\cdot\vec{b}) + \vec{a}\cdot\vec{c}\\ &= 2k+7\end{aligned}$$

So $2k+7=0$

$2k = -7$

$k = -7/2$