

# SOLUTIONS

Math 2568 (§75) – Feb. 10, 2017

Full Name: \_\_\_\_\_

## Quiz 3

Answers without proper justification will receive NO credit.

**Problem 1.** (1 point) Given the points  $A = (-1, -3)$ ,  $B = (3, 2)$  and  $C = (0, 2)$  in  $\mathbb{R}^2$  find a point  $D = (d_1, d_2)$  satisfying  $\overrightarrow{AB} = \overrightarrow{CD}$ .

$$\overrightarrow{AB} = \begin{bmatrix} 3 \\ 2 \end{bmatrix} - \begin{bmatrix} -1 \\ -3 \end{bmatrix} = \begin{bmatrix} 4 \\ 5 \end{bmatrix}$$

$$\overrightarrow{CD} = \begin{bmatrix} d_1 \\ d_2 \end{bmatrix} - \begin{bmatrix} 0 \\ 2 \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 - 2 \end{bmatrix}$$

so  $d_1 = 4$   
 $d_2 - 2 = 5$

$$\boxed{D = (4, 7)}$$

**Problem 2.** (2 points) Calculate the cross product  $\mathbf{u} \times \mathbf{v}$  where  $\mathbf{u} = \begin{bmatrix} 1 \\ 1 \\ 3 \end{bmatrix}$  and  $\mathbf{v} = \begin{bmatrix} 2 \\ 2 \\ 6 \end{bmatrix}$ .

Use determinant formula:

$$\begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & 1 & 3 \\ 2 & 2 & 6 \end{vmatrix} = \mathbf{i} \underbrace{\begin{vmatrix} 1 & 3 \\ 2 & 6 \end{vmatrix}}_{6-6=0} - \mathbf{j} \underbrace{\begin{vmatrix} 1 & 3 \\ 2 & 6 \end{vmatrix}}_{6-6=0} + \mathbf{k} \underbrace{\begin{vmatrix} 1 & 1 \\ 2 & 2 \end{vmatrix}}_{=0} = \vec{0}$$

Alternatively:  $2\vec{u} = \vec{v}$  so  $\vec{u} \times \vec{v} = 2\vec{u} \times 2\vec{u} = 2(\vec{u} \times \vec{u}) = 2\vec{0} = \boxed{\vec{0}}$

**Problem 3.** (2 points) Find a vector  $\mathbf{u}$  that has opposite direction to  $\begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}$  and  $\|\mathbf{u}\| = 5$ .

Find unit vector in opposite direction to  $\begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}$ :

$$\vec{v} = \frac{-\begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}}{\sqrt{1^2 + 2^2 + 2^2}} = \frac{-\begin{bmatrix} -1 \\ 2 \\ 2 \end{bmatrix}}{3} = \begin{bmatrix} 1/3 \\ -2/3 \\ -2/3 \end{bmatrix}$$

$$\text{so } \vec{u} = \left[ \frac{5}{3}, \frac{-10}{3}, \frac{-10}{3} \right]^t = \begin{bmatrix} 5/3 \\ -10/3 \\ -10/3 \end{bmatrix}$$