MATH 1300(A02) QUIZ 4 March 18, 2016 B05

NAME SOLUTIONS ID Number _____

INSTRUCTIONS: Answer the following questions in the spaces provided below.

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[12] TOTAL

[4] **1.**

(a) State the formula for the cosine of the angle between two vectors $\mathbf{u}$ and $\mathbf{v}$.

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

(b) State the *triangle inequality* for vector norms.

$$\|\underline{u}+\underline{v}\| \le \|\underline{u}\| + \|\underline{v}\|$$

[4] **2.** Let $\mathbf{a} = \langle 1, -1, -1, 1\rangle$ and $\mathbf{u} = \langle 2, -1, 4, -3\rangle$.
Find the vector component of $\mathbf{u}$ along $\mathbf{a}$.

$$\text{proj}_{\underline{a}}(\underline{u}) = \frac{\underline{u}\cdot\underline{a}}{\|\underline{a}\|^2}\,\underline{a}$$

$$= \frac{\langle 1\ -1\ -1\ 1\rangle\langle 2\ -1\ 4\ -3\rangle}{(1^2+1^2+1^2+1^2)}\langle 1,-1,-1,1\rangle$$

$$= \frac{1}{4}(2+1-4-3)\langle 1,-1,-1,1\rangle$$

$$= \langle -1, 1, 1, -1\rangle.$$

[4] **3.** Let $\mathbf{a} = \langle 3, -2\rangle$ and $\mathbf{u} = \langle 1, 2\rangle$.
Find an equation of the straight line through $\mathbf{a}$ in the direction of $\mathbf{u}$, and find an equation of the straight line through $\mathbf{a}$ and perpendicular to $\mathbf{u}$.

- An equation of the line through $\underline{a}$ in the direction of $\underline{u}$ is $\underline{x} = \underline{a} + t\,\underline{u}$.
  or $\langle x, y\rangle = \langle 3+t, -2+2t\rangle$
- An equation of the line through $\underline{a}$ perpendicular to $\underline{u}$ is $(\underline{x}-\underline{a})\cdot\underline{u} = 0$
  or $\langle x-3, y+2\rangle\cdot\langle 1, 2\rangle = 0$
  $(x-3)+2(y+2) = 0$
  $x+2y = -1.$