MATH 203 QUIZ 3 - Version A

June 9, 2014

Name: ANSWERS

Instructions: (1) No calculators! (2) Use your own scrap paper. Write your answers in the space provided.

1. (1/2 point each) (a) State the required form for the equation of a line:

(i) Vector form: $\vec{r} = \vec{r}_0 + t\vec{v}$ or $\langle x, y, z \rangle = \langle x_0, y_0, z_0 \rangle + t\langle a, b, c \rangle$

(ii) Parametric form: $x = x_0 + at,\ y = y_0 + bt,\ z = z_0 + ct$

(iii) Symmetric form: $\frac{x - x_0}{a} = \frac{y - y_0}{b} = \frac{z - z_0}{c}$

(b) Give the meanings of the symbols used above: $\vec{r} = \langle x, y, z \rangle$ - arbitrary pt., $\vec{r}_0 = \langle x_0, y_0, z_0 \rangle$ - point on line, $\vec{v} = \langle a, b, c \rangle$ - direction vector. t = parameter

2. (1/2 point each) Let $\vec{a} = \langle a_1, a_2 \rangle$ and $\vec{b} = \langle b_1, b_2 \rangle$. What are the formulas for:

(a) $\vec{a} \cdot \vec{b} =$ $a_1 b_1 + a_2 b_2$

(b) $|\vec{a}| =$ $\sqrt{a_1^2 + a_2^2}$

(c) $2\vec{a} =$ $\langle 2a_1, 2a_2 \rangle$

(d) $2\vec{a} - 3\vec{b} =$ $\langle 2a_1 - 3b_1, 2a_2 - 3b_2 \rangle$

3. (1 point each) (a) Compute $\langle 1, 3, -1 \rangle \times \langle 2, 0, 5 \rangle =$ $\langle 15, -7, -6 \rangle$

(b) What's the super special property of your answer to (a), in regards to the vectors involved?
It is orthogonal to both $\langle 1, 3, -1 \rangle$ and $\langle 2, 0, 5 \rangle$

4. (1 point each) Complete the statements: (a) $\vec{a} \cdot \vec{b} = 0$ iff $\vec{a}$ and $\vec{b}$ are orthogonal / perpendicular

(b) $\vec{a} \times \vec{b} = \vec{0}$ iff $\vec{a}$ and $\vec{b}$ are parallel

5. (1 point each) If θ is the angle between $\vec{a}$ and $\vec{b}$, then in terms of θ:

(a) $\vec{a} \cdot \vec{b} =$ $|\vec{a}||\vec{b}| \cos\theta$

(b) $|\vec{a} \times \vec{b}| =$ $|\vec{a}||\vec{b}| \sin\theta$

Bonus 1: (1 point) State the formula for the equation of a plane, and give the meanings of the symbols $a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$; (x_0, y_0, z_0) - point in plane, $\vec{n} = \langle a, b, c \rangle$ - normal vector

Bonus 2: (2 points) A big boat is being pulled by two smaller boats. One of the smaller boats is pulling at an angle $\frac{\pi}{6}$ to the horizontal at 4 m/s, the other is pulling at $-\frac{\pi}{4}$ to the horizontal at 1 m/s. In what direction will the big boat move? (Assume you have a bird's eye view of the situation and the tip of the big boat is your "origin") $\langle 2\sqrt{3} + \sqrt{2}/2,\ 2 - \sqrt{2}/2 \rangle$