Mathematical Physics — PHZ 3113

Vectors 1 (Classwork January 7, 2013)

Group #

Participating students (print):

In the following $i = 1, \ldots, n$, $j = 1, \ldots, n$.

1. Let $\hat{x}_i$ and $\hat{x}_j$ be Cartesian unit vectors. It holds the relation

$$\hat{x}_i \cdot \hat{x}_j \; = \tag{1}$$

   Name the r.h.s. quantity:

2. Write down n-dimensional (nD henceforth) column vectors.

$$\vec{a} \; = \qquad\qquad \vec{b} \; = \tag{2}$$

3. Write down the scalar product.

$$\vec{a}\cdot\vec{b} \;=\; \sum_{i=} \tag{3}$$

4. Write down the scalar products

$$\vec{a}\cdot\vec{a} \;=\; \qquad\qquad \vec{b}\cdot\vec{b} \;=\; \tag{4}$$

5. Give the definition of the magnitude of $\vec{a}$.

$$|\vec{a}| \;=\; \tag{5}$$

6. Express the unit vectors $\hat{a}$ and $\hat{b}$ through previously defined quantities.

$$\hat{a} \;=\; \qquad\qquad \hat{b} \;=\; \tag{6}$$

7. Use $\vec{b}$ to find a unit vector that is perpendicular to $\hat{a}$.

$$\vec{a}_{\perp} = \tag{7}$$

Which condition has $\vec{b}$ to fulfill, so that this is possible?

Show $\vec{a}_{\perp} \cdot \vec{a} = 0$.

8. Expand the vectors $\vec{a}$ and $\vec{b}$ in terms of the unit vectors $\hat{x}_i$.

$$\vec{a} = \sum_{i=1}^{n} \qquad \vec{b} = \sum_{j=1}^{n} \tag{8}$$

9. Calculate the scalar products for the r.h. sides of the previous equation and show that the results agrees with Eq. (3).

$$\vec{a} \cdot \vec{b} \; =$$