Mathematical Physics — PHZ 3113

Vectors 2 (Classwork January 9, 2013)

Group #

Participating students (print):

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1. Write down the **commutative** law of vector addition

$$\vec{a} + \vec{b} \; = \tag{1}$$

2. Write down the **associative** law of vector addition

$$\left(\vec{a} + \vec{b}\right) + \vec{c} \; = \tag{2}$$

3. How is the positively chosen angle θ between two nD vectors $\vec{a}$, $\vec{b}$ defined?

$$\cos(\theta) \; = \tag{3}$$

4. Write down the velocity for a nD position vector

$$\vec{r} = \begin{pmatrix} x_1(t) \\ . \\ . \\ . \\ x_n(t) \end{pmatrix}, \quad \vec{v} = \tag{4}$$

5. Draw (millimeter paper provided) $\vec{r}(t) = \vec{r}_0 + \vec{v}\,t$ with (in arbitrary units)

$$\vec{r}_0 = \begin{pmatrix} 2 \\ 4 \end{pmatrix}, \quad \vec{v}_0 = \begin{pmatrix} 4 \\ 2 \end{pmatrix}, \quad 0 \leq t \leq 2\,. \tag{5}$$

6. Calculate the work (in SI units $[J]$) for

$$\vec{F} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} [N], \quad \triangle\vec{r} = \begin{pmatrix} 1 \\ 3 \end{pmatrix} [m]\,. \tag{6}$$

$$W = \tag{7}$$

7. Describe the the surface swept out by $\vec{r}$ for

$$(\vec{r} - \vec{a}) \cdot \vec{a} = 0\,, \tag{8}$$

$$(\vec{r} - \vec{a}) \cdot \vec{r} = 0\,, \tag{9}$$

where $\vec{a}$ is a constant non-zero nD vector (compare exercise 1.2.2 of the book).

The trick is to write $\vec{r}$ as

$$\vec{r} = \tag{10}$$

Continue freely with the calculations for (8) and (9).