

# Homework 1

## CM4650

### Spring 2009

Due: Wednesday January 21 2009, in class

Please write on one side of the page only! Please write legibly and large. Thank you.

1. What are the magnitudes of the two vectors given below? What are unit vectors in the directions of each of the two vectors?

$$\underline{a} = 4\hat{e}_x + 2\hat{e}_y - 0.8\hat{e}_z = \begin{pmatrix} 4 \\ 2 \\ -0.8 \end{pmatrix}_{xyz}$$

$$\underline{b} = 6\underline{a} - 5\hat{e}_y$$

2. Using Einstein notation, work out the following quantities:

- a.  $(\underline{v} \cdot \underline{u})$

- b.  $(\underline{v} \cdot \underline{C})$

- c.  $(\underline{C} \cdot \underline{v})$

- d.  $(\underline{D} \cdot \underline{F})$

3. Using Einstein notation, work out the components of the tensor  $\underline{\underline{A}}$  given below.

What is the 21-component of  $\underline{\underline{A}}$ ?

$$\underline{\underline{A}} = (\underline{v} \cdot \underline{u} \underline{b}) \underline{a}.$$

4. For the tensor  $\underline{\underline{A}}$  defined in problem 3, evaluate  $A_{21}$  for the vectors given below.

$$\underline{a} = \begin{pmatrix} 4 \\ 2 \\ -0.8 \end{pmatrix}_{xyz}$$

$$\underline{b} = \hat{e}_x + 2\hat{e}_y + 2\hat{e}_z$$

$$\underline{u} = \begin{pmatrix} 0 \\ 2 \\ -1 \end{pmatrix}_{xyz}$$

$$\underline{v} = \hat{e}_x - 1\hat{e}_y + \hat{e}_z$$

5. Text Problem 2.11 (change basis for tensor)
6. Text Problem 2.47 (mass flow through surface)