

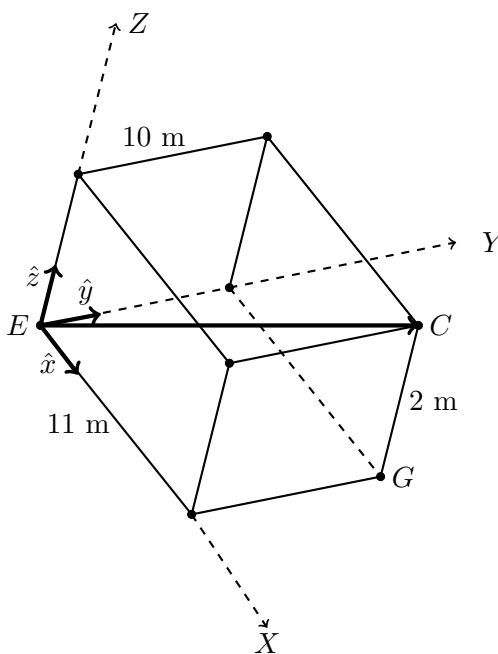
# Applied Mathematics APM01A1, 2017

March 13, 2017

## Tutorial 5

### Question 1

Study the following figure



- 1.a) Let  $\bar{a} = \overline{EC}$ . Write  $\bar{a}$  in component form. Then use the scalar product to calculate the angles  $\alpha, \beta$  and  $\gamma$  that  $\bar{a}$  make with in the  $X$ -,  $Y$ - and  $Z$ - directions.
- 1.b) Use the scalar product to calculate the component of  $\bar{a}$  in the  $\overline{EG}$  direction. For this question, write the unit vector in same direction  $\overline{EG}$  as  $\hat{e}$ .

### Question 2

Let  $\bar{a}$  and  $\bar{b}$  be vectors with magnitudes 24 and 20 respectively. Suppose  $\bar{c} = \bar{a} + \bar{b}$  and  $\bar{c}$  makes an angle  $\theta$  with  $\bar{b}$ , where  $\cos(\theta) = 1/10$ .

- 2.a) Solve for  $\bar{a}$  and use the scalar product to square both sides of this equation.
- 2.b) Solve for the magnitude of vector  $\bar{c}$ .

### Question 3

Suppose that  $ABCD$  is a parallelogram such that  $\bar{b} = \overline{AB} = 6\hat{x} + 2\hat{y} - 3\hat{z}$  and  $\bar{c} = \overline{AC} = 8\hat{x} + 6\hat{y} - 2\hat{z}$ . From the previous tutorial, you have already calculated  $\overline{BC}$ .

- 2.a) Use the scalar product to confirm that  $\angle ABC = \angle ADC$ .
- 2.b) Use the scalar product to confirm that  $\angle DAB = \angle DCB$ .

### Question 4

Find, in component form, the projections of  $\bar{a} = \hat{x} - 2\hat{y} + \hat{z}$  parallel and perpendicular to  $\bar{b} = 4\hat{x} - 4\hat{y} + 7\hat{z}$ .