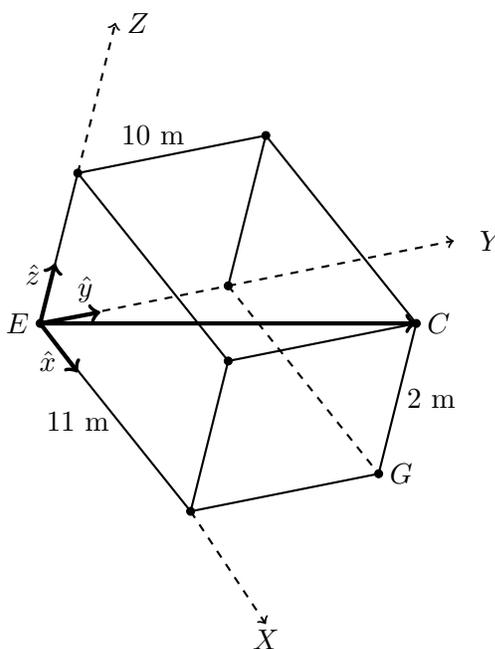# Applied Mathematics APM01A1, 2017

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Tutorial 4

Question 1

Study the following figure

1.a) Let $\bar{a} = \overline{EC}$. Calculate the components of vector $\bar{a}$.

1.b) Calculate the projection of $\bar{a}$ in the $X-, Y-$ and $Z-$ directions.

1.c) The vector $\bar{a}$ in component form.

1.d) The magnitude of $\bar{a}$.

1.e) The projection 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

Suppose that $ABCD$ is a parallelogram such that $\bar{b} = \overline{AB} = 6\hat{x} + 2\hat{y} - 3\hat{z}$ and $\bar{c} = \overline{AC} = 8\hat{x} + 6\hat{y} - 2\hat{z}$. In this question, write all vectors in component form.

2.a) Use the fact that $ABCD$ is a parallelogram, and find $\overline{DC}$.

2.b) Calculate $\overline{BC}$.

2.c) Calculate $\overline{DB}$.

2.d) Label the bisection point on the diagonals by P and calculate $\overline{BC}$ using $\overline{BP}$ and $\overline{PC}$ directly.

Question 3

Consider two points P_1 and P_2 with coordinates $P_1 = (2, 4, 2)$ and $P_2 = (-3, 1, -4)$.

3.a) Calculate the magnitudes of $\bar{r}_1$ and $\bar{r}_2$, the position vectors associated with P_1 and P_2 respectively.

3.b) Write the unit vector for $\bar{r}_1$ in component form and in terms of the direction cosines, $\cos(\alpha), \cos(\beta)$ and $\cos(\gamma)$. Note, you should calculate values for α, β and γ.

3.c) Calculate $|\bar{r}_2 - \bar{r}_1|$.

Question 4

4.a) Is the vector $\bar{e} = \hat{x} + \hat{y}$ a unit vector? Explain your answer.

4.b) Consider the point P with coordinates $(3, 3, 3)$. Write down the position vector $\bar{r}$ associated to P and calculate its magnitude.

4.c) Calculate the component of $\bar{r}$ in the direction of vector $\bar{e}$.

4.d) Calculate the projection of $\bar{r}$ in the direction of $\bar{e}$ in component form.