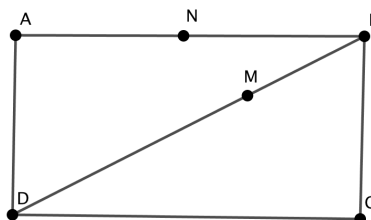




Vector basics

Name.....

- (1) For rectangle ABCD, N is the midpoint of AB and DM:MB = 3:2.
 $\overrightarrow{AB} = \mathbf{a}$. $\overrightarrow{DA} = \mathbf{b}$.



- (a) Find $\overrightarrow{MD}$

$$\overrightarrow{BD} = -\mathbf{a} - \mathbf{b}$$

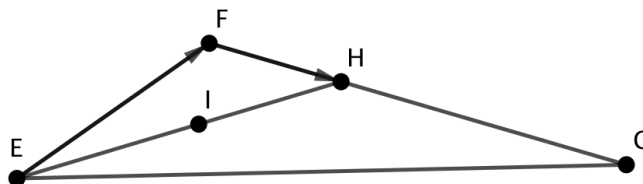
$$\overrightarrow{MD} = \frac{3}{5}(-\mathbf{a} - \mathbf{b})$$

- (b) Find $\overrightarrow{MN}$

$$\overrightarrow{MN} = \frac{3}{5}(-\mathbf{a} - \mathbf{b}) + \mathbf{b} + 0.5\mathbf{a}$$

$$\overrightarrow{MN} = -0.1\mathbf{a} + 0.4\mathbf{b}$$

- (2) For triangle EFG, $\overrightarrow{EF} = \mathbf{a}$, $\overrightarrow{FH} = \mathbf{b}$. I is the midpoint of EH and FH:HG = 1:4.



- (a) Find $\overrightarrow{EI}$

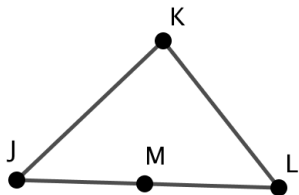
$$\overrightarrow{EI} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$$

- (b) Find $\overrightarrow{IG}$

$$\overrightarrow{IG} = \frac{1}{2}(\mathbf{a} + \mathbf{b}) + 4\mathbf{b} = 0.5\mathbf{a} + 4.5\mathbf{b}$$



- (3) In the triangle JKL, the position vector of J is **a**, the position vector of K is **b** and the position vector of L is **c**. M is the midpoint of JL. Find $\overrightarrow{KM}$.



$$\overrightarrow{LJ} = -c + a$$

$$\overrightarrow{LM} = \frac{1}{2}(-c + a)$$

$$\overrightarrow{KM} = -b + c + \frac{1}{2}(-c + a) = 0.5a - b + 0.5c$$

- (4) A line passes through the point (3,2) and is parallel to the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$. Find the equation of the line in the form $y = mx + c$.

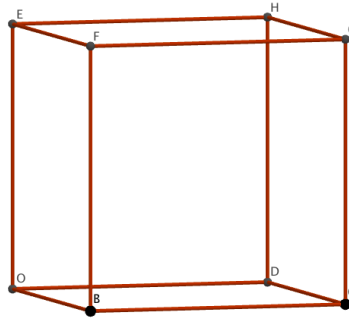
$$m = \frac{1}{2}$$

$$y - 2 = \frac{1}{2}(x - 3)$$

$$y = 0.5x + 0.5$$



- (5) A cuboid OBCDEFGH is shown below, where O is the origin. $\overrightarrow{OB} = 3i$, $\overrightarrow{OD} = 5j$, $\overrightarrow{OE} = 4k$. Find $\overrightarrow{EC}$.



$$\overrightarrow{EC} = \overrightarrow{EO} + \overrightarrow{OB} + \overrightarrow{BC}$$

$$\overrightarrow{EC} = -4k + 3i + 5j$$

$$\overrightarrow{EC} = \begin{pmatrix} 3 \\ 5 \\ -4 \end{pmatrix}$$

- (6) Points A and B have coordinates $(6, -2, 0)$ and $(-2, 4, -5)$ respectively. Find the vector $\overrightarrow{AB}$.

$$\overrightarrow{AB} = \begin{pmatrix} -2 \\ 4 \\ -5 \end{pmatrix} - \begin{pmatrix} 6 \\ -2 \\ 0 \end{pmatrix} = \begin{pmatrix} -8 \\ 6 \\ -5 \end{pmatrix}$$

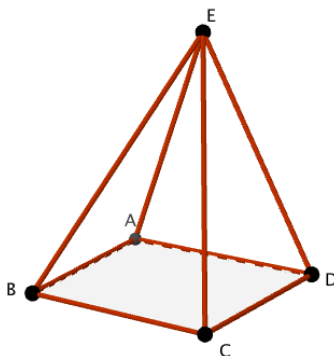
- (b) N is on the line AB such that $AN:NB = 1:3$. Find the coordinate N.

$$\begin{pmatrix} 6 \\ -2 \\ 0 \end{pmatrix} + \frac{1}{4} \begin{pmatrix} -8 \\ 6 \\ -5 \end{pmatrix} = \begin{pmatrix} 4 \\ -0.5 \\ -1.25 \end{pmatrix}$$

$$(4, -0.5, -1.25)$$



- (7) Rectangular based pyramid ABCDE has coordinate A(0,1,1), C(2,4,1) and E(1.5, 3,6). Find $\overrightarrow{AE}$.



$$\overrightarrow{AE} = \overrightarrow{AC} + \overrightarrow{CE}$$

$$\overrightarrow{AC} = \begin{pmatrix} 2 \\ 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$$

$$\overrightarrow{CE} = \begin{pmatrix} 1.5 \\ 3 \\ 6 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \\ 1 \end{pmatrix} = \begin{pmatrix} -0.5 \\ -1 \\ 5 \end{pmatrix}$$

$$\overrightarrow{AE} = \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix} + \begin{pmatrix} -0.5 \\ -1 \\ 5 \end{pmatrix} = \begin{pmatrix} 1.5 \\ 2 \\ 5 \end{pmatrix}$$