I- Answer with ***justification*** by ***True*** or ***False***.

1. If $\overrightarrow{AC} = \overrightarrow{BD}$ then, $\overrightarrow{AB} = \overrightarrow{CD}$.
2. If $AC = BD$ then, $\overrightarrow{AC} = \overrightarrow{BD}$.
3. If $ABCD$ is a rectangle such that $AB = 6cm$ & $AD = 4cm$ then, $\left\|\overrightarrow{CB} + \overrightarrow{CD}\right\| = 2\sqrt{13}cm$.
4. If $\vec{AB} = k\vec{CD}$ $where\, k \in Z^{*-}, then$:
   a. Vectors $\vec{AB}$ and $\vec{CD}$ are of the same sense.
   b. Vectors $\vec{AB}$ and $\vec{CD}$ have same direction.
   c. $\|\vec{AB}\| = k\|\vec{CD}\|$.
5. If A, B & C are any three non-collinear point, so that $\vec{n} = 3\overrightarrow{AB} - 2\overrightarrow{AC}$ and $\vec{s} = 3\overrightarrow{AB} + 2\overrightarrow{BC}$ then the coordinates of $\vec{n}$ & $\vec{s}$ in the system $\left(A; \overrightarrow{AB}, \overrightarrow{AC}\right)$ are $\vec{s}(2,1)$ & $\vec{n}(-3,2)$
6. If ABC is a right isosceles triangle at A, so that $AB = 6cm$, and the point J is defined by $\overrightarrow{JB} = \frac{3}{2}\overrightarrow{AC}$, then the coordinates of J in the system $\left(O; \frac{1}{3}\overrightarrow{AB}, \frac{1}{3}\overrightarrow{AC}\right)$ are $J(3,5)$
7. In the system $(O, \vec{i}, \vec{j})$:
   a. The two vectors: $\vec{u} = \vec{i} + \vec{j}, \vec{v} = \vec{i} - \vec{j}$ represent basis.
   b. If the vectors $\vec{a}(3, 2m-1)$ & $\vec{s} = \vec{i} - 2m\vec{j}$ are collinear, then $m = 2$

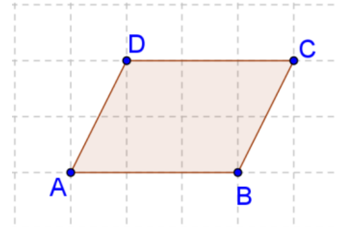
II- Consider in a given plane the two distinct points A & B and a point G defined by the vector relation: $\vec{GB} - 2\vec{AG} = \vec{0}$.

a. Construct the point G.

b. If N is any point of the given plane, then express: $2\overrightarrow{NA} + \overrightarrow{NB}$ as a function of $\overrightarrow{NG}$.

c. Determine the locus of the set of points N in the plane such that: $\left\|2\vec{NA} + \vec{NB}\right\| = 3\left\|\vec{NA}\right\|$

III- The adjacent figure represents a parallelogram *ABCD*.



a. Construct the points *E* & *F* such that $\overrightarrow{AB}=3\overrightarrow{BE}$ & $\overrightarrow{DF}=3\overrightarrow{AD}$.

b. 1) Calculate *a* & *b* so that, $\overrightarrow{CF}=a\overrightarrow{AB}+b\overrightarrow{AD}$.

2) Calculate *m* & *n* so that, $\overrightarrow{EC}=m\overrightarrow{AB}+n\overrightarrow{AD}$.

3) Deduce that the points *E*, *C* & *F* are collinear.

c. Consider the reference frame defined by $(A,\vec{i},\vec{j})$, where $\vec{i}=\overrightarrow{AB}$ & $\vec{j}=\overrightarrow{AD}$.

i. Find coordinates of all points in the given plane.

ii. Deduce using coordinates that the points *E*, *C* & *F* are collinear

IV- Let ABC be any triangle and $x\in Z^*$ so that $\overrightarrow{AE}=\frac{1}{3}\overrightarrow{AB}+x\cdot\overrightarrow{AC}$ and $\overrightarrow{AM}=x\cdot\overrightarrow{AB}+\frac{1}{3}\overrightarrow{AC}$.

a. Find $\overrightarrow{EF}$ in terms of $\overrightarrow{BC}$ & x.

b. For what values of x, the vectors $\overrightarrow{EF}$ and $\overrightarrow{BC}$ have the same sense?

c. Calculate the numerical value of x, such that $BCFE$ is a parallelogram.

V- Consider the point G, the centroid of triangle ABC, and the point M to be any point in the plane of the given triangle.

a. Show that: $\overrightarrow{MA}+\overrightarrow{MB}+\overrightarrow{MC}=3\overrightarrow{MG}$..

b. Consider the vector: $\overrightarrow{U}=3\overrightarrow{MA}+2\overrightarrow{MB}-5\overrightarrow{MC}$.

i. Express vector $\vec{U}$ independent of M.

ii. Find the set of points M for $\left\|\overrightarrow{MA}+\overrightarrow{MB}+\overrightarrow{MC}\right\|=6\,units$.

c. Let D be a point defined by $\overrightarrow{AD}=-2\overrightarrow{AB}+3\overrightarrow{AC}$.

i. Show that $\overrightarrow{BD}=k\cdot\overrightarrow{BC}$, where k is a real number to be determined.

ii. Deduce that the points $B, D \,\&\, C$ are collinear.

VI- Let ABC be any triangle and D be a point defined by: $\overrightarrow{AD}=3\overrightarrow{AB}-2\overrightarrow{AC}$.

a. Prove that the points $B, C \,\&\, D$ are collinear, then place D.

b. Take E & F to be any two points defined by: $\overrightarrow{AE}=\overrightarrow{AC}+2\overrightarrow{AB}$ *and* $\overrightarrow{AF}=5\overrightarrow{AB}-8\overrightarrow{AC}$.

Express the vectors $\overrightarrow{DE}$ then $\overrightarrow{DF}$ in terms of $\overrightarrow{AB}$ & $\overrightarrow{AC}$.

c. Verify that $\overrightarrow{DF}+2\overrightarrow{DE}=\vec{0}$.

VII- Consider the plane of reference $(O,\vec{i},\vec{j})$ the vectors $\vec{V}=-2\vec{i}+3\vec{j}$ and the points $A(1;-2), B(3;-4), C(-1;2)$ and the point M such that $\overrightarrow{OM}=x\vec{i}+y\vec{j}$.

1) Calculate the coordinates of vector $\vec{U}=2\overrightarrow{OB}-3\overrightarrow{OC}+3\overrightarrow{BA}$.
2) Find a relation between x & y so that the point A, B & M are collinear.
3) Determine the real values of x & y where, $\overrightarrow{AM}=-2\vec{V}$.
4) Find the coordinates of the points A, B & M in the system $(C,\vec{i},\vec{j})$.

VIII- Consider the plane of reference $(o,\vec{i},\vec{j})$ the points A,B,C,D & M such that: $\overrightarrow{OA}=-\vec{i}-\vec{j}, \overrightarrow{OB}=4\vec{i}, \overrightarrow{OC}=4(\vec{i}+\vec{j}), \overrightarrow{OD}=-\vec{i}+2\vec{j}$ & $\overrightarrow{OM}=x\vec{i}+y\vec{j}$.

a. Show that $ABCD$ is a parallelogram.

b. Calculate the coordinates of the point E so that, $\overrightarrow{AE}=2\overrightarrow{AB}$.

c. Find the coordinates of the point F so that $BCFD$ is a parallelogram.

d. Show that the points are collinear.

e. In the new reference $(A,\vec{i}+\vec{j},-\vec{i}+2\vec{j})$ the coordinates of the point M becomes $M(X;Y)$.

1) Find a relation between coordinates of M in the two reference frames.
2) Deduce the coordinates of the points A,B,C & D in the new system.

Mastering problems		
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