1- Answer by True or False, and correct false statements:

a. A straight line admits one director vector only.

b. There is only one vector parallel to $\vec{V}(2,1)$.

c. If $\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{AC}$ then it is necessary that the points A, B & C are collinear.

d. If $ABCD$ is a parallelogram, then $\overrightarrow{AB}=\overrightarrow{CD}$

e. If I is the midpoint of $[AB]$ and M is any point in the plane, then $\overrightarrow{MA}+\overrightarrow{MB}=2\overrightarrow{MI}$

2- For each statement, indicate with ***justification*** the ***only*** correct answer. (*3-pts*)

No.	Statements	Proposed answers a	b	c
1.	The vector $\vec{u}(3,4)$ is parallel to the straight line (d) of equation,	$3x+4y-1=0$	$4x+3y-1=0$	$4x-3y-1=0$
2.	The vector $\vec{u}(2,3)$ is collinear with	$\vec{v}(-4,-6)$	$\vec{v}(-4,6)$	$\vec{v}(4,-6)$
3.	A zero vector is a vector with zero magnitude and	No direction No sense	Infinite directions No sense	No direction Infinite senses
4.	If $\vec{w}=\vec{u}+\vec{v}$, then $\left\lVert\vec{w}\right\rVert=$	$\left\lVert\vec{u}\right\rVert+\left\lVert\vec{v}\right\rVert$	$\left\lVert\vec{u}+\vec{v}\right\rVert$	$\sqrt{\vec{u}+\vec{v}}$

3- Given that triangle QMN is isosceles of principal vertex Q.

a. Construct the point I such that: $\overrightarrow{QI}=\overrightarrow{QM}+\overrightarrow{QN}$.

b. Prove that point I is the image of the point N, by a translation vector to be determined.

c. Determine the nature of quadrilateral $QMIN$. Justify.

d. Let J and K be the respective symmetries of I with respect to M and N.
Show that Q is the midpoint of $[JK]$.(Use vectors)

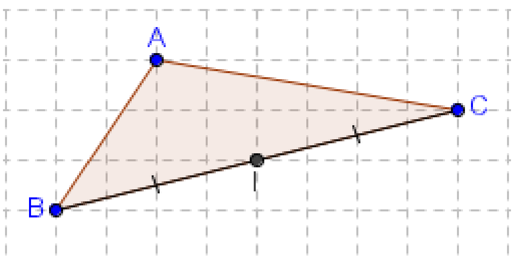
4- Use the adjacent figure to complete and ***justify*** the following equalities:

1. $\overrightarrow{AB}+\overrightarrow{BI}+\overrightarrow{IC}=....$

2. $\overrightarrow{AB}+\overrightarrow{AC}=....$

3. $\overrightarrow{IB}+....=\vec{0}$

4. $\overrightarrow{AB}+\overrightarrow{IC}=\overrightarrow{A...}$



5- Consider the points $A(-1;3), B(2;1), C(1;-1)$, and the vector $\vec{v}(a-1;b+2)$. Calculate the numerical value of:

a. a & b, if $\vec{v}=2\overrightarrow{AB}-\overrightarrow{BC}$.

b. b so that $\vec{v}$ is parallel to the ordinate axis.

6- In the plane of orthonormal system of axes $x'Ox$ *and* $y'Oy$, plot the points: $A(-2;4), B(-5;-2) \& C(0;3)$.

- ***a.*** Determine both ***graphically*** and ***analytically*** the coordinates of $\vec{AB}$.
- ***b.*** Let *E* be the translate of *C* by the translation of $\vec{AB}$.
  - ***i.*** Plot then find the coordinates of the point *E*.
  - ***ii.*** Calculate coordinates of vectors: $\vec{AE} \& \vec{AC}$, then deduce that: $\vec{AE} = \vec{AB} + \vec{AC}$.
- ***c.*** What is the nature of quadrilateral $ABEC$? Justify your answer.

7- In the plane of orthonormal system of axes $x'Ox$ *and* $y'Oy$, place the points: $A(1;-1), B(3;1) \& C(-1;3)$.

- ***a.*** Determine the nature of triangle ABC.
- ***b.*** Construct the point D so that: $\vec{BD} = \vec{BA} + \vec{BC}$, then determine its coordinates.
- ***c.*** Show that (*BD*) is parallel to $x'Ox$, then compute the area of triangle *BCD*.

8- Consider the point *M*, the midpoint of [*BC*], in triangle *ABC*.

- ***a.*** If *G* is the centroid of triangle *ABC* then,
  - ***i.*** Prove that: $\vec{GB} + \vec{GC} = 2\vec{GM}$.
  - ***ii.*** Deduce that: $\vec{GA} + \vec{GB} + \vec{GC} = \vec{0}$.
- ***b.*** Let *I* be any point in the given plane. Prove that $\vec{IA} + \vec{IB} + \vec{IC} = 3\vec{IG}$.

9- Let *M* and *N* be the respective midpoints of [*BC*] & [*AM*] in triangle *ABC*. (*BN*) cuts [*AC*] at a point *I*, the parallel drawn through *A* to (*BN*) cuts (*CB*) at a point *E*.

- ***a.*** Draw a figure.
- ***b.*** Prove that *B* is the midpoint of [*EM*].
- ***c.*** Use Thales' property to prove that: $\frac{AI}{AC} = \frac{1}{3}$.
- ***d.*** Show that: $\vec{AE} + \vec{MC} = \vec{AB}$.

10- Given a triangle *ABC*.

- ***a.*** Plot the points *M* and *N* so that: $\vec{AM} = \vec{BC}$ and $\vec{NB} = \vec{AC}$.
- ***b.*** Show that $\vec{NA} = \vec{BC}$.
- ***c.*** Deduce that *A* is the midpoint of [*MN*].

11- Given a circle $C(O; R\,cm)$ and diameter [*BC*], let *A* be a point of (*C*) so that $CA = R\,cm$.

1) ***a-*** Draw a figure then locate *D*, the image of *B* by the translation of $\vec{AC}$.
   b- Determine the nature of quadrilateral *ABDC*? Justify your answer.
2) ***i-*** Locate the point *M* so that; $\vec{CM} = \vec{CO} + \vec{CA}$.
   ii- Locate the point *N* so that; $\vec{ON} = \vec{OA} + \vec{OC}$.
   iii- Deduce that $\vec{DN} + \vec{CA} = 3\vec{OA}$.
3) Prove that *A* is the midpoint of [*MN*].

12- Let I be a point on a circle (c) with diameter $[EF]$. And designate by J the symmetric of E with respect to I.

a. Prove that triangle EFJ is isosceles.

b. Let K be the image of I by the translation of $\overrightarrow{EF}$. Compare the vectors $\overrightarrow{IJ}$ & $\overrightarrow{FK}$.

c. Deduce the nature of quadrilateral $IFKJ$.

d. Construct G such that $\overrightarrow{EG} = \overrightarrow{FE} + \overrightarrow{FK}$.

e. What does point I represent with respect to $[GK]$? Justify your answer.

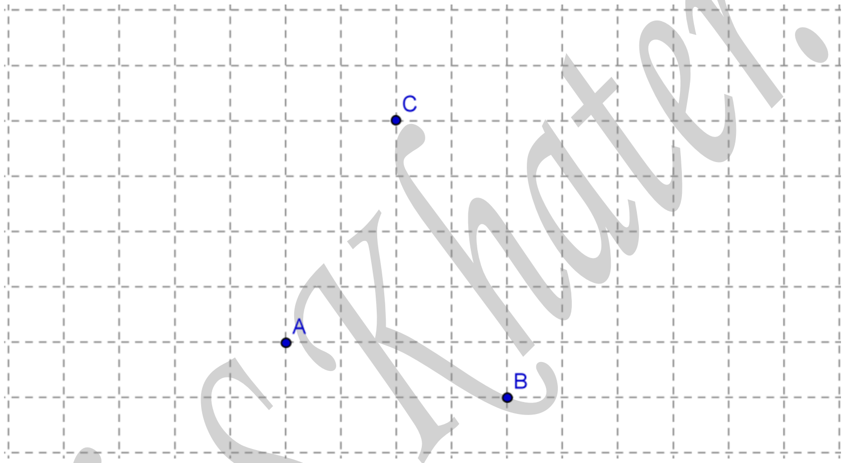
13- Locate the missing points on the adjacent grid so that:

$a)\ \overrightarrow{AR} = \overrightarrow{BA} + \overrightarrow{BC}$.

$b)\ \overrightarrow{BN} = -\overrightarrow{CA}$.

$c)\ \overrightarrow{AJ} = \overrightarrow{AN} + \overrightarrow{AC}$.

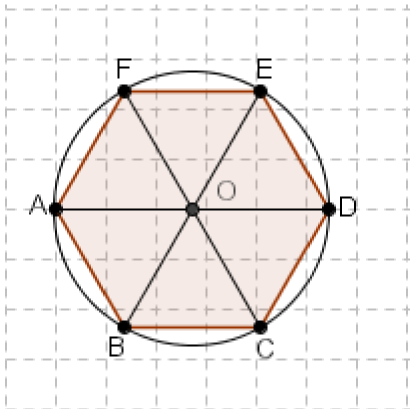
$d)\ \overrightarrow{AI} + \overrightarrow{BI} = \overrightarrow{0}$.



14- $ABCDEF$ is a regular hexagon with center O.

i. Correct false statements if there is any:

	True	False	Correction
$\overrightarrow{AF} = \overrightarrow{BO}$			
$\overrightarrow{OA} = \overrightarrow{OB}$			
$\overrightarrow{AF} + \overrightarrow{FO} = \overrightarrow{BC}$			
$\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{FD}$			



ii. Complete the following:

a. $\overrightarrow{FE} = \overrightarrow{A\ldots} = \overrightarrow{O\ldots} = \overrightarrow{B\ldots}$. $\overrightarrow{OE} = \overrightarrow{O\ldots} + \overrightarrow{\ldots D}$. $\overrightarrow{OF} + \overrightarrow{OD} = \overrightarrow{\ldots O}$.

b. The translate of B by the translation with vector $\left(\overrightarrow{AF} + \overrightarrow{FE}\right)$ is the point …..

c. F is the translate of O by the translation with vector $\overrightarrow{\ldots A}$.

15- Consider the parallelogram $ABCD$.

a. Construct the points E, F, G and H defined by:

$$\overrightarrow{DE} = \frac{5}{4}\overrightarrow{DA};\quad \overrightarrow{AF} = \frac{6}{5}\overrightarrow{AB};\quad \overrightarrow{BG} = \frac{5}{4}\overrightarrow{BC};\quad \overrightarrow{CH} = \frac{6}{5}\overrightarrow{CD}.$$

b. Express the following vectors as a linear combination of $\overrightarrow{AB}$ & $\overrightarrow{AD}$.

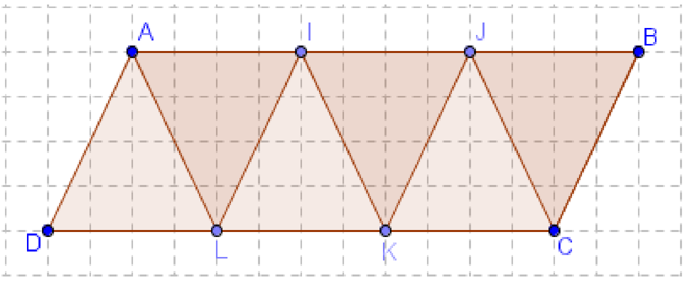
$i.\ \overrightarrow{EF}$. $ii.\ \overrightarrow{HG}$.

c. Deduce the nature of quadrilateral $EFGH$.

16- Consider the parallelogram $ABCD$, so that $AB = 6cm$ & $BC = 2cm$.

I and J are two points of $[AB]$ so that $AI = IJ = 2cm$.

K and L are two points of $[CD]$ so that $DL = LK = 2cm$.



➢ Indicate the correct answer(s).

	a	b	c	d
$\vec{AI} = ...$	$\vec{KC}$	$\vec{AD}$	$\vec{DL}$	$\vec{JB}$
$\vec{AL} = ...$	$\vec{AI} + \vec{JC}$	$\vec{DA} + \vec{DL}$	$\vec{IJ} + \vec{JK}$	$\vec{AD} + \vec{DL}$
$\vec{AJ} = ...$	$\vec{KB} + \vec{AL}$	$\vec{IJ} + \vec{AL}$	$\vec{AI} + \vec{DL}$	$2\vec{LC}$
$\vec{IL} = ...$	$\vec{DA}$	$\vec{BC}$	$\vec{JC}$	$\vec{IK}$

17- In an orthonomral system of axes $x'ox$, $y'oy$, consider the points $A(5;3)$, $C(-3;-3)$ and the circle (n) of diameter $[AC]$ and center I.

1) Plot the points ***A*** and ***C***, and draw the circle (n).

2) Determine the coordinates of the point ***I*** and the radius of the circle (n). (1pt)

3) Consider the point ***B***(-3;3)

- ***i.*** Prove that the straight lines (***AB***) & (***CB***) are parallel to the coordinate axes, then find their equations.
- ***ii.*** Deduce the nature of triangle ***ABC***.
- ***iii.*** Show that ***B*** belongs to the circle (n).

4) Determine the equation of the tangent (***d***) to the circle (n) at ***B***.

5) Let ***S*** be the translate of ***I*** by the vector translation $\vec{BI}$.

- ***i.*** Construct ***S*** then calculate its coordinates.
- ***ii.*** Deduce the nature of the quadrilateral ***ABCS***.

6) Find the equation of (d') the translate of (d) under the translation with vector $\overrightarrow{BC}$.

18- In the reference frame $x'Ox$, $y'Oy$ consider the points $R(2,3), S(c-2,3)$ & $N(-1,2)$, the vector $\vec{u}(2-a, b+1)$ the family of the straight lines: $(d_m): x - 2mx + y = m + 1$

1. Determine the numerical values of a & b, so that $\vec{u} = 2\overrightarrow{RN} - 3\overrightarrow{NS}$ where, $c = 2$.
2. Determine the locus of the point S as c varies.
3. Determine the real value of m, if (d_m):
   - a. Passes through the point $A(-2,1)$.
   - b. Is parallel to straight line $(l): -3x + y + 1 = 0$
4. Find the equation of the straight line (Δ) the image of (RN) by the translation of $\overrightarrow{NA}$.