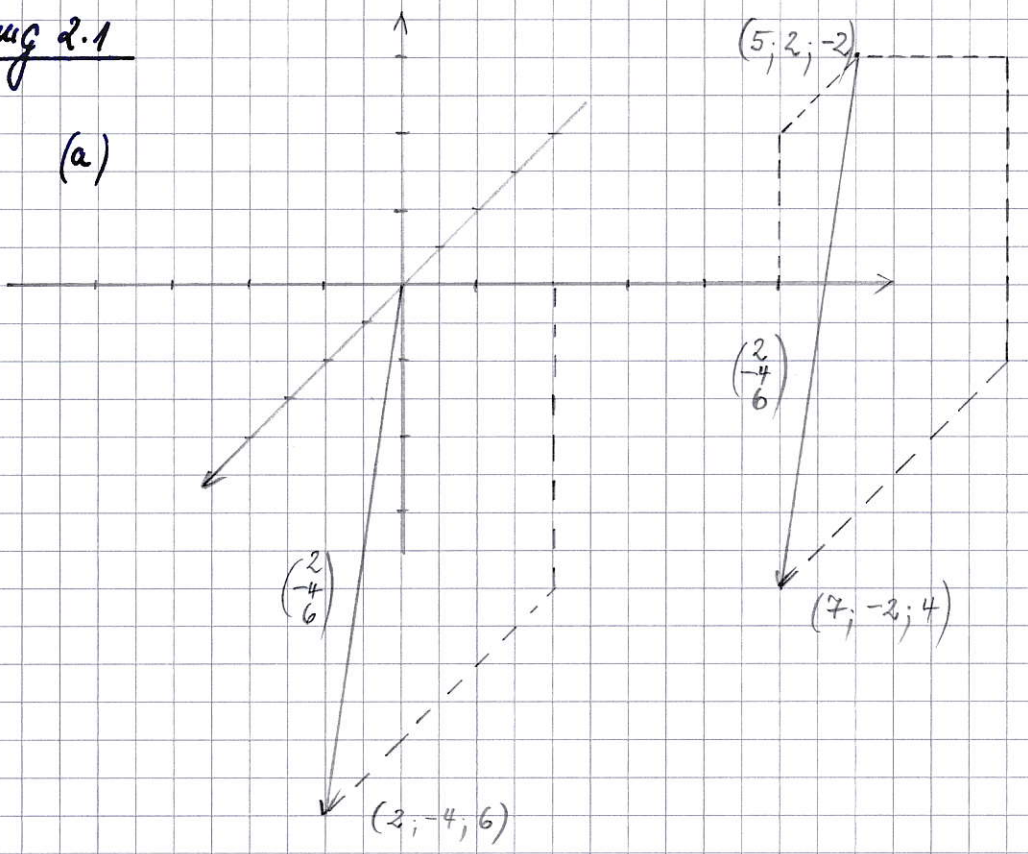
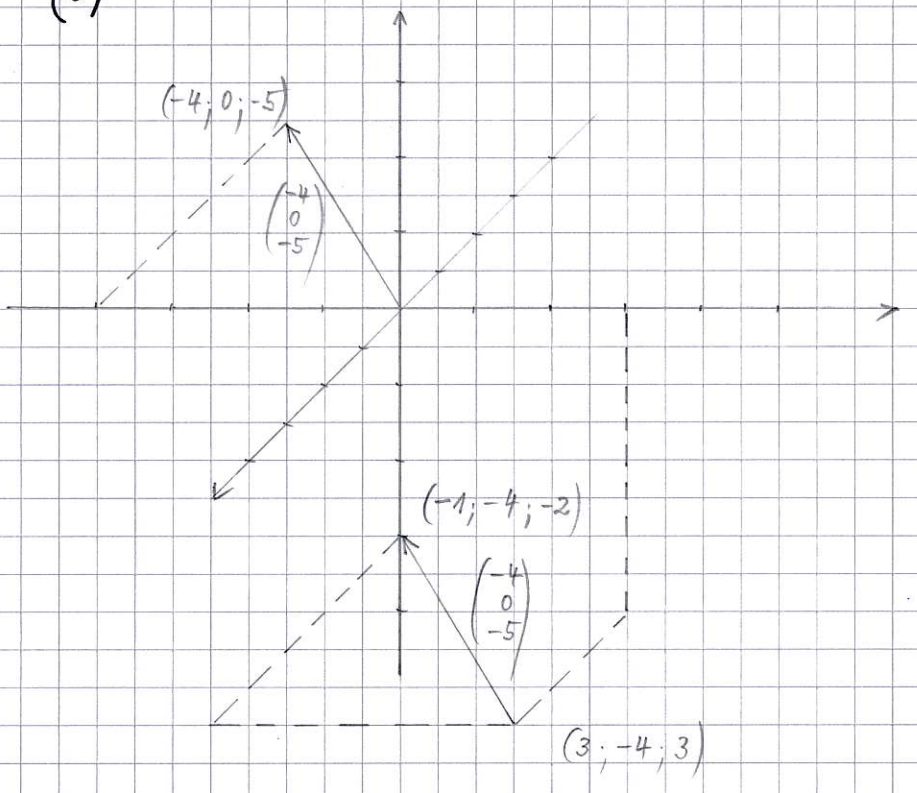
Цвиц 2.1

(a)

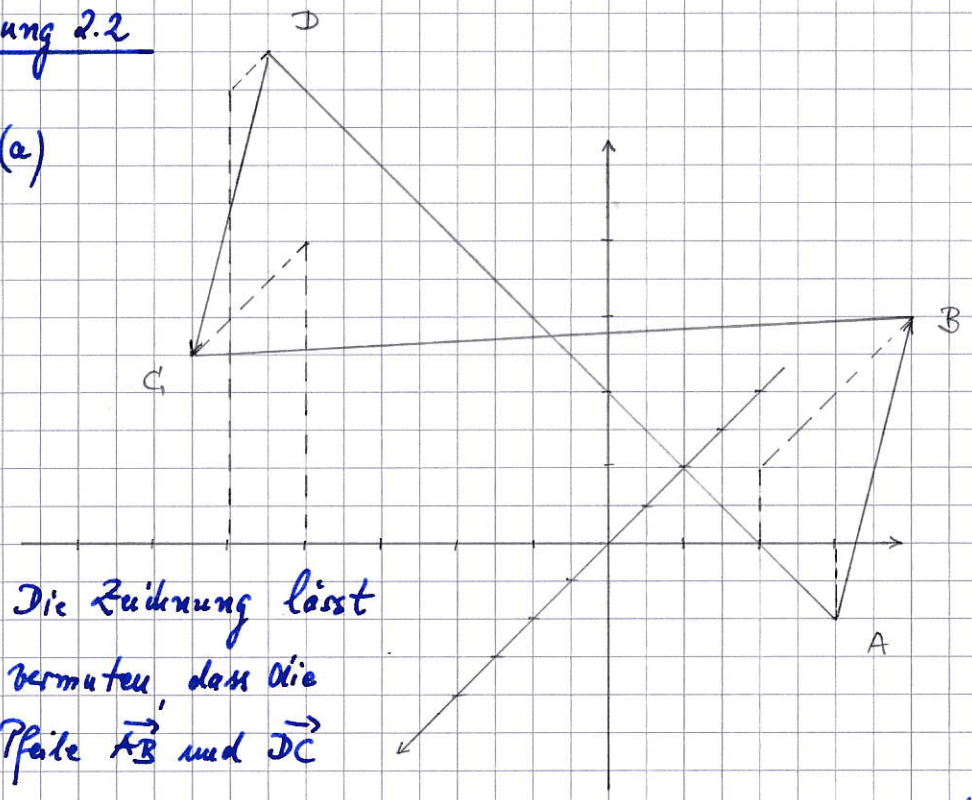


(b)



Übung 2.2

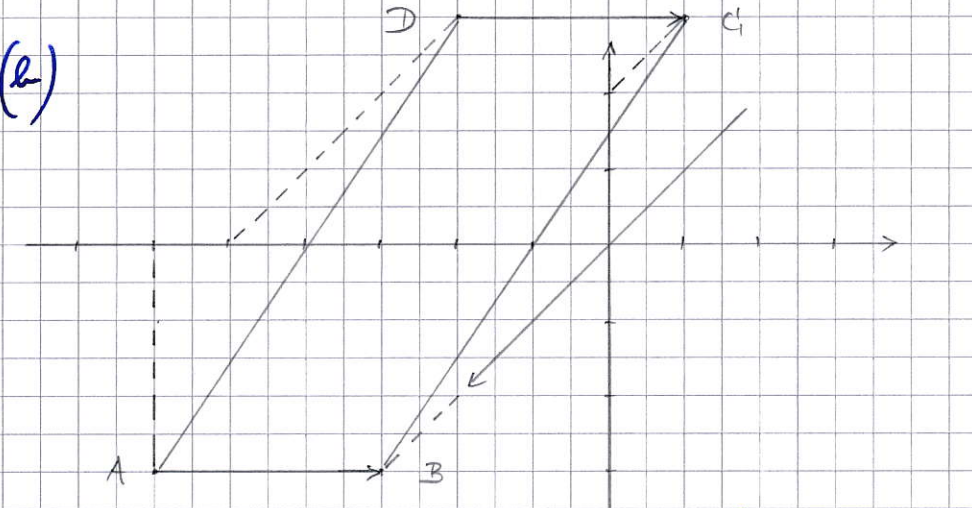
(a)



Die Zeichnung lässt vermuten, dass die Pfeile $\overrightarrow{AB}$ und $\overrightarrow{DC}$ gleich lang und parallel, aber entgegengesetzt orientiert sind.

$$\overrightarrow{AB} = \begin{pmatrix} 2-3 \\ 1-(-1) \\ -4-0 \end{pmatrix} = \begin{pmatrix} -1 \\ 2 \\ -4 \end{pmatrix} \qquad \overrightarrow{CD} = \begin{pmatrix} -4-(-5) \\ 4-6 \\ 3-(-1) \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 4 \end{pmatrix}$$

(b)



Die Zeichnung lässt vermuten, dass die Vektoren $\overrightarrow{AB}$ und $\overrightarrow{CD}$ identisch sind.

$$\overrightarrow{AB} = \begin{pmatrix} -1-(-6) \\ -1-(-3) \\ 4-0 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \\ 4 \end{pmatrix} \qquad \overrightarrow{CD} = \overrightarrow{DC} = \begin{pmatrix} 0-(-5) \\ 2-0 \\ -2-(-6) \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \\ 4 \end{pmatrix}$$

Übung 2.3

(a) $\overrightarrow{AB} = \begin{pmatrix} 5-4 \\ -1-2 \\ -3-(-1) \end{pmatrix} = \begin{pmatrix} 1 \\ -3 \\ -2 \end{pmatrix}$ Sei $D := (x;y;z)$

Dann muss gelten: $\begin{pmatrix} 1 \\ -3 \\ -2 \end{pmatrix} = \overrightarrow{CD} = \begin{pmatrix} x-(-3) \\ y-(-3) \\ z-6 \end{pmatrix}$

Es folgt: $x+3=1 \Rightarrow x=-2$, $y+3=-3 \Rightarrow y=-6$, $z-6=-2 \Rightarrow z=4$ $\quad D=(-2;-6;4)$

$\overrightarrow{AC} = \begin{pmatrix} -3-4 \\ -3-2 \\ 6-(-1) \end{pmatrix} = \begin{pmatrix} -7 \\ -5 \\ 7 \end{pmatrix}$ $\quad \overrightarrow{BD} = \begin{pmatrix} -2-5 \\ -6-(-1) \\ 4-(-3) \end{pmatrix} = \begin{pmatrix} -7 \\ -5 \\ 7 \end{pmatrix}$

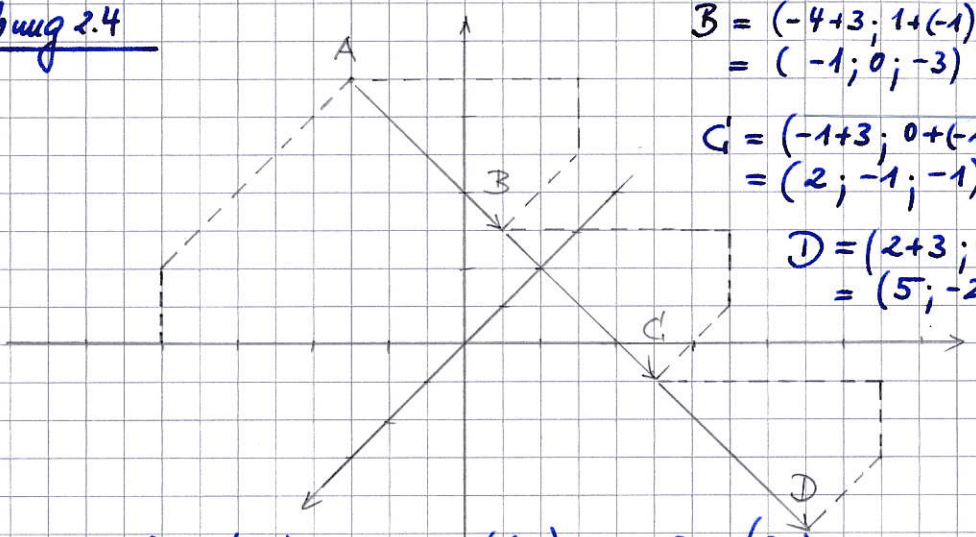
(b) $\overrightarrow{AB} = \begin{pmatrix} -3-3 \\ 2-(-6) \\ 3-4 \end{pmatrix} = \begin{pmatrix} -6 \\ 8 \\ -1 \end{pmatrix}$ Sei $D = (x;y;z)$

Dann muss gelten: $\begin{pmatrix} -6 \\ 8 \\ -1 \end{pmatrix} = \overrightarrow{CD} = \begin{pmatrix} x-2 \\ y-0 \\ z-(-5) \end{pmatrix} =$

Es folgt: $x-2=-6 \Rightarrow x=-4$, $y=8$, $z+5=-1 \Rightarrow z=-6$ $\quad D=(-4;8;-6)$

$\overrightarrow{AC} = \begin{pmatrix} 2-3 \\ 0-(-6) \\ -5-4 \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \\ -9 \end{pmatrix}$ $\quad \overrightarrow{BD} = \begin{pmatrix} -4-(-3) \\ 8-2 \\ -6-3 \end{pmatrix} = \begin{pmatrix} -1 \\ 6 \\ -9 \end{pmatrix}$

Übung 2.4



$B = (-4+3;\ 1+(-1);\ -5+2) = (-1;0;-3)$

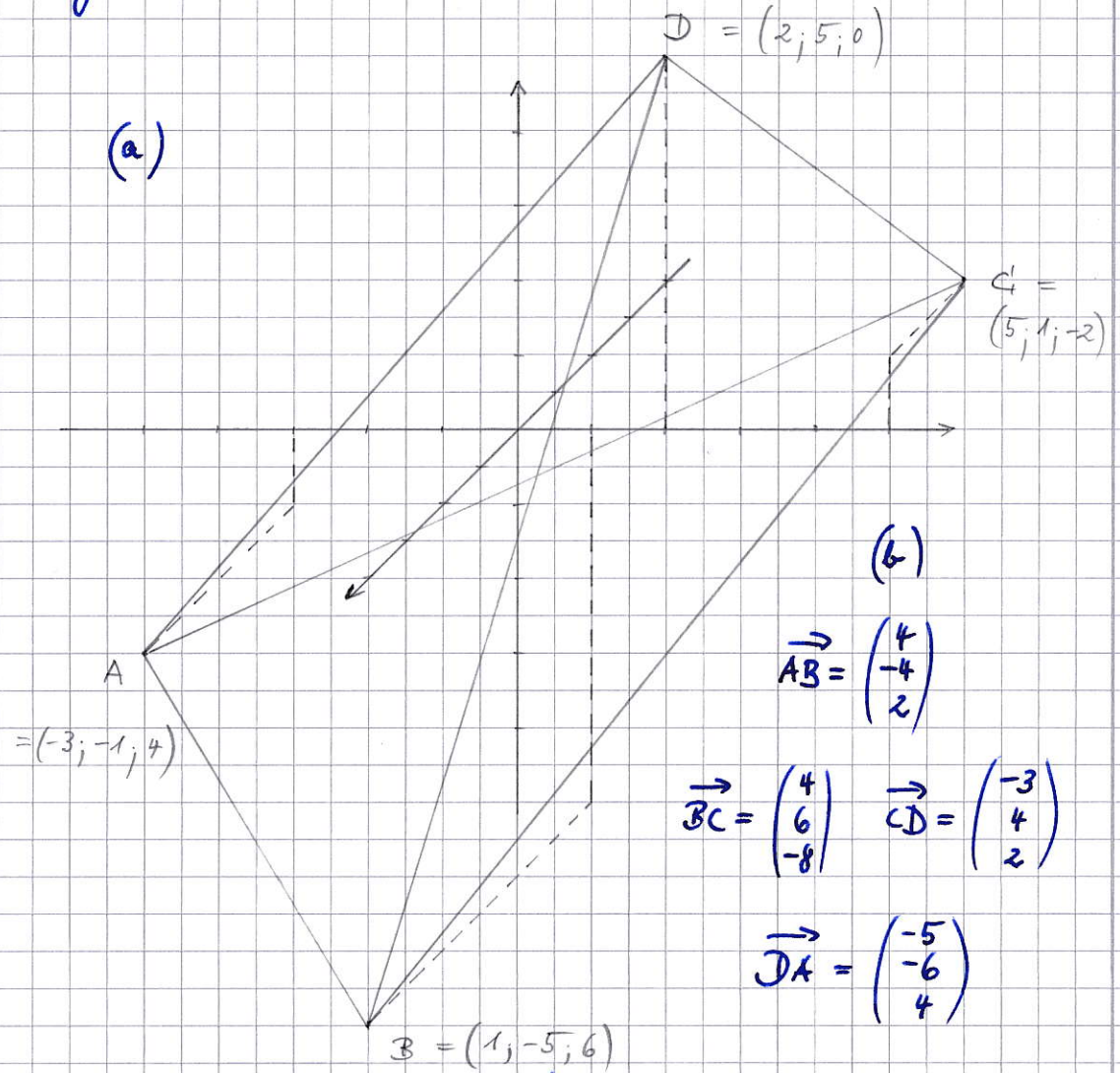
$C = (-1+3;\ 0+(-1);\ -3+2) = (2;-1;-1)$

$D = (2+3;\ -1+(-1);\ -1+2) = (5;-2;1)$

$\overrightarrow{AB} = \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix}$ $\quad \overrightarrow{AC} = \begin{pmatrix} 6 \\ -2 \\ 4 \end{pmatrix}$ $\quad \overrightarrow{AD} = \begin{pmatrix} 9 \\ -3 \\ 6 \end{pmatrix}$

Übung 2.5

(a)



(b)

$\overrightarrow{AB} = \begin{pmatrix} 4 \\ -4 \\ 2 \end{pmatrix}$

$\overrightarrow{BC} = \begin{pmatrix} 4 \\ 6 \\ -8 \end{pmatrix}$ $\overrightarrow{CD} = \begin{pmatrix} -3 \\ 4 \\ 2 \end{pmatrix}$

$\overrightarrow{DA} = \begin{pmatrix} -5 \\ -6 \\ 4 \end{pmatrix}$

(c) Verschiebung zu $\overrightarrow{AB} = \begin{pmatrix} +4 \\ -4 \\ 2 \end{pmatrix}$

$A' = (1; -5; 6)$ $B' = (5; -9; 8)$ $C' = (9; -3; 0)$ $D' = (6; 1; 2)$

Verschiebung zu $\overrightarrow{BC} = \begin{pmatrix} 4 \\ 6 \\ -8 \end{pmatrix}$

$A' = (1; 5; -4)$ $B' = (5; 1; -2)$ $C' = (9; 7; -10)$ $D' = (6; 11; -8)$

Verschiebung zu $\overrightarrow{CD} = \begin{pmatrix} -3 \\ 4 \\ 2 \end{pmatrix}$

$A' = (-6; 3; 6)$ $B' = (-2; -1; 8)$ $C' = (2; 5; 0)$ $D' = (-1; 9; 2)$

Verschiebung zu $\overrightarrow{DA} = \begin{pmatrix} -5 \\ -6 \\ 4 \end{pmatrix}$

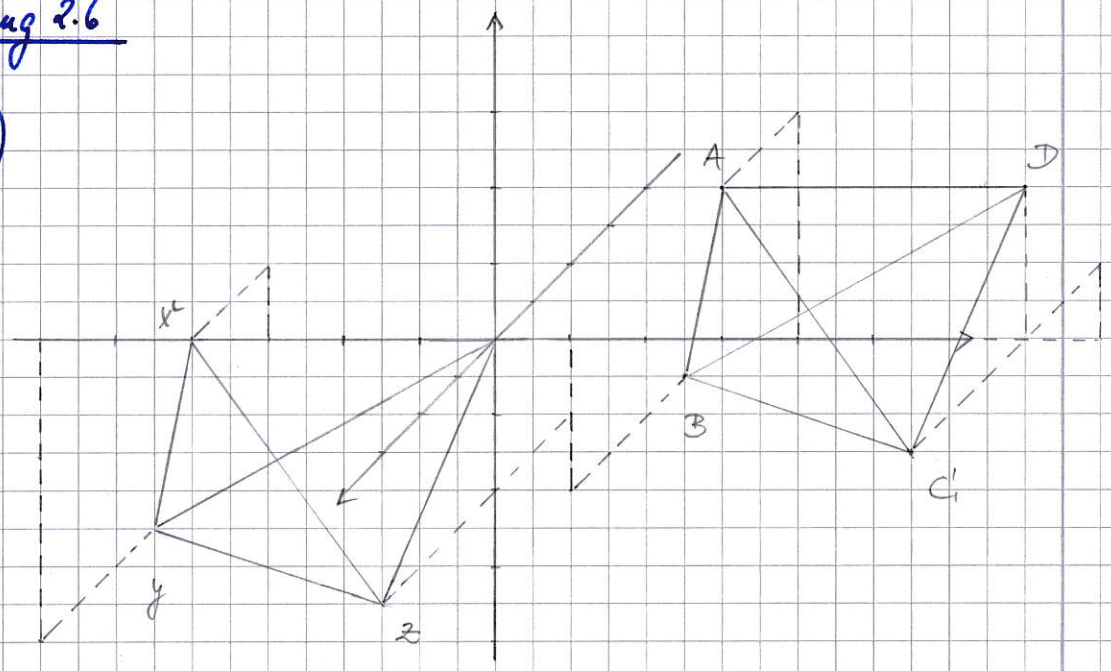
$A' = (-8; -7; 8)$ $B' = (-4; -11; 10)$ $C' = (0; -5; 2)$ $D' = (-3; -1; 4)$

(d) $P = (3; -3; -1)$ $Q = (7; -7; 1)$ $R = (11; -1; -7)$ $S = (8; 3; -5)$

$T = (3; -3; -1) = P$!

Übung 2.6

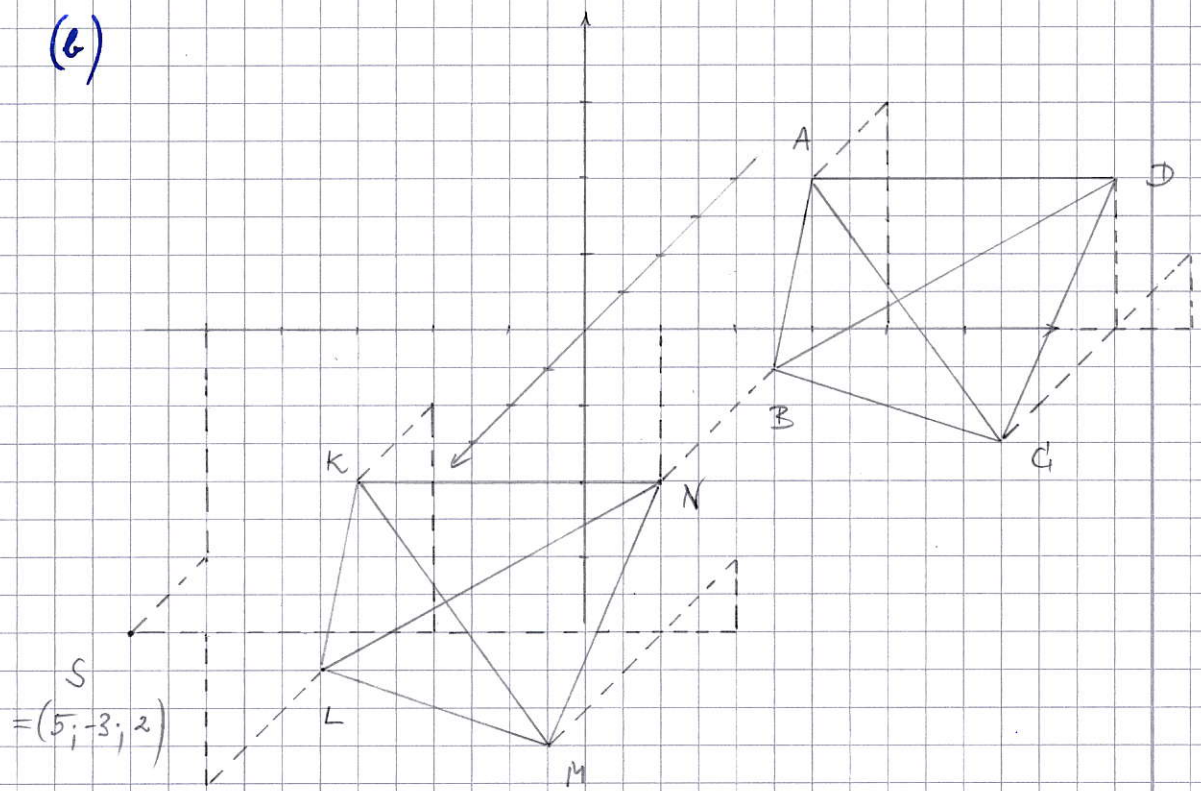
(a)



$\vec{DA} = \begin{pmatrix} -3 \\ 1 \\ 2 \end{pmatrix}$ $x = (-3; 1; 2)$ $\vec{DB} = \begin{pmatrix} -6 \\ -4 \\ -3 \end{pmatrix}$ $y = (-6; -4; -3)$

$\vec{DC} = \begin{pmatrix} 1 \\ -1 \\ 5 \end{pmatrix}$ $z = (1; -1; 5)$

(b)



$K = (5+4; -3+3; 2+2) = (9; 0; 4)$ $L = (5+1; -3-2; 2-3) = (6; -5; -1)$

$M = (5+8; -3+1; 2+5) = (13; -2; 7)$ $N = (5+7; -3+2; 2+0) = (12; -1; 2)$