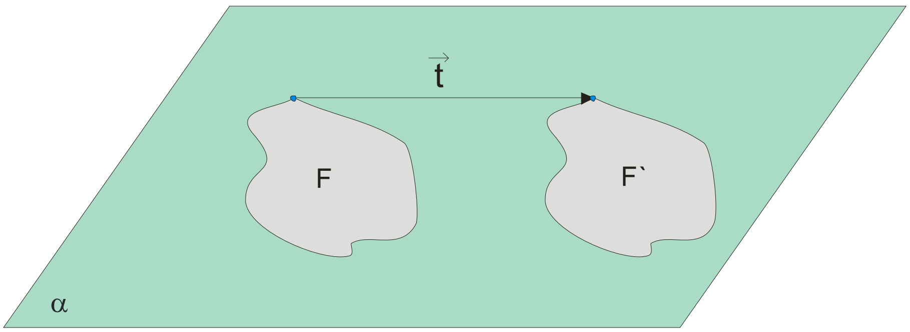
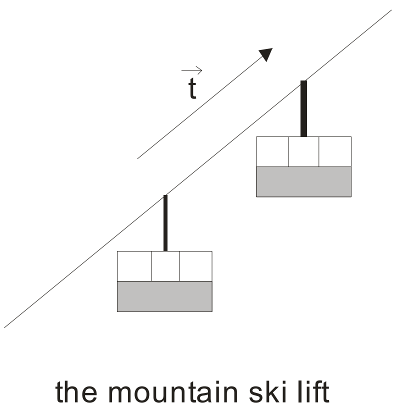
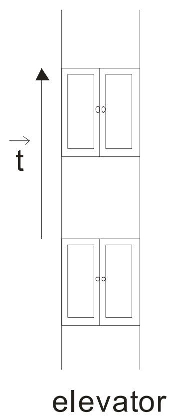
# Translation

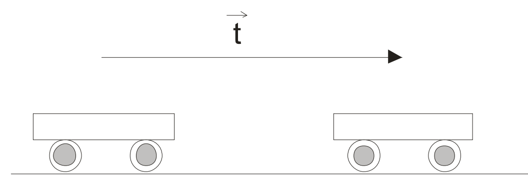
Given a figure $F$ and a vector $\vec{t}$ in the plane $\alpha$. If $F`$ is set of all points in which the translation $T_{\vec{t}}$ mapped points figure $F$, then we say that we have **translation** $T_{\vec{t}}(F) = F`$.




The movement of many objects in the environment associated with the translation. For example:

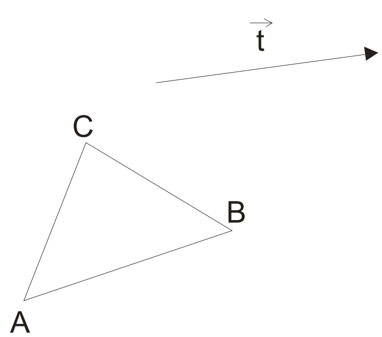



Example 1.

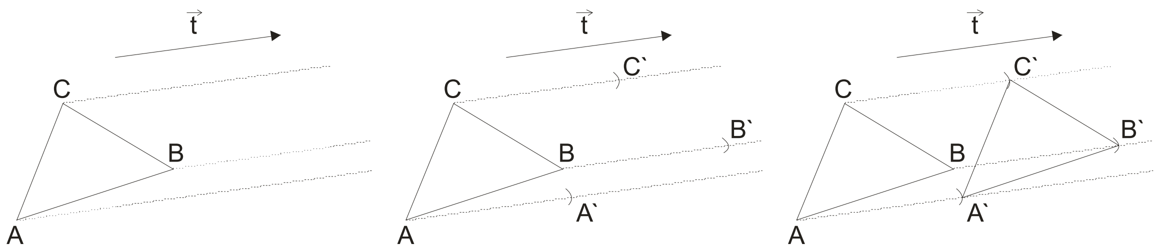
**Given the triangle ABC and translation vector $\vec{t}$ ( on picture). Determine the image of this triangle resulting translation of vector $\vec{t}$ .**



**Solution:**

**How's it going process of translation?**

First, in the direction parallel with translation vector, draw line from each vertex figures given, in this case of the triangle ABC ( picture 1.)




picture 1. picture 2. picture 3.

Length of translation vector transfer to the parallrl lines ( picture 2.)

Mark this points with A`, B`, C` and merge ( picture 3.)

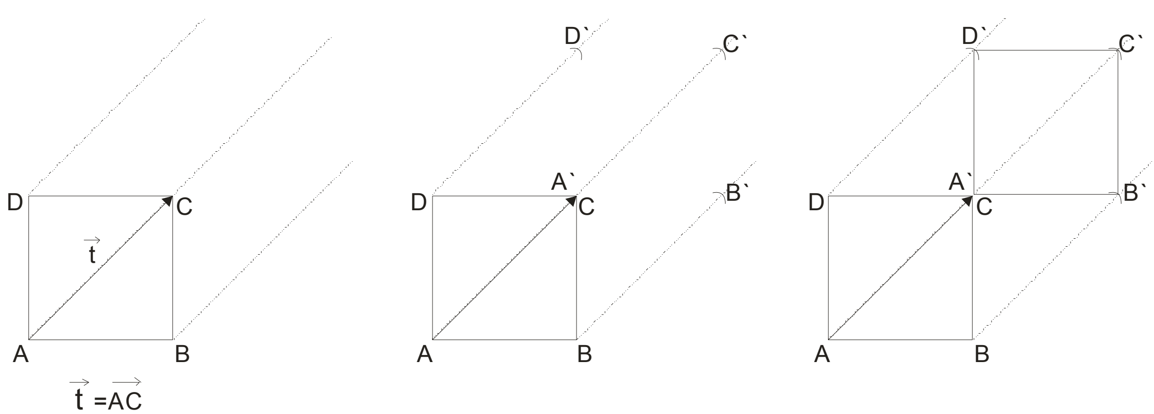
Example 2.

**Given square ABCD. Determine its image caused by the translation:**

a) **Vertex A reflects in vertex C**
b) **Vertex A reflects in the midle point on BC**
c) **Vertex B reflects in the intersection of diagonal.**

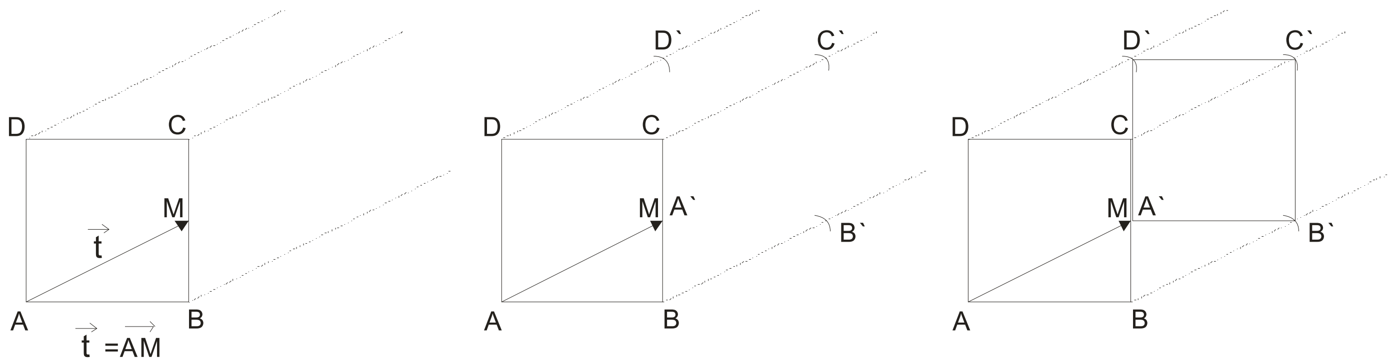
**Solution:**

**a)**




picture 1. picture 2. picture 3.

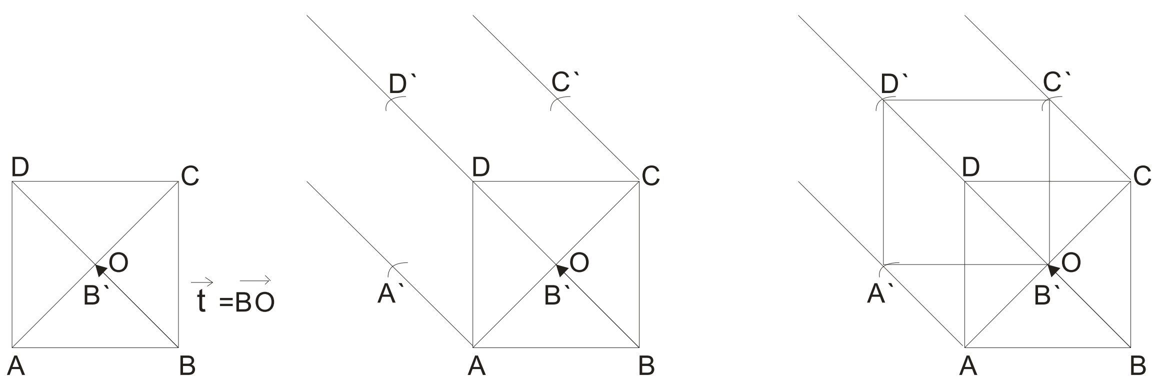
**b)**




picture 1. picture 2. picture 3.

Mark the middle of the page BC with M. Then the translation vector $\vec{t} = \overrightarrow{AM}$ .

**c)**




picture 1. picture 2. picture 3.

Draw diagonal intersection and mark it with O. Translation vector is $\vec{t} = \overrightarrow{BO}$ and will be $B` \equiv O$.......

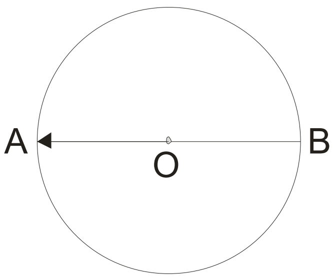
primer 3.

**We have circle k (O, r) with a diameter AB. Determine its image caused by the translation**

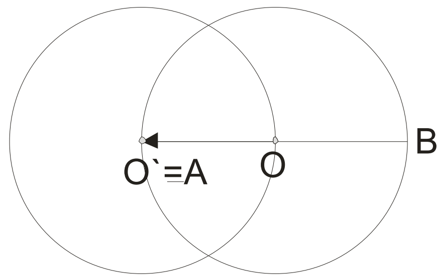
**a) point O to point A**
**b) point A at the center of radius OB**
**c) point B at a given point on the circle- M**

**Solution:**

**a)**

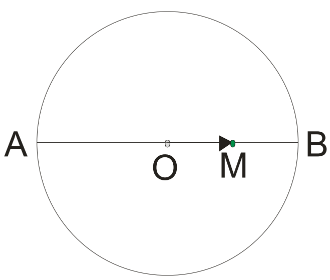



picture 1.

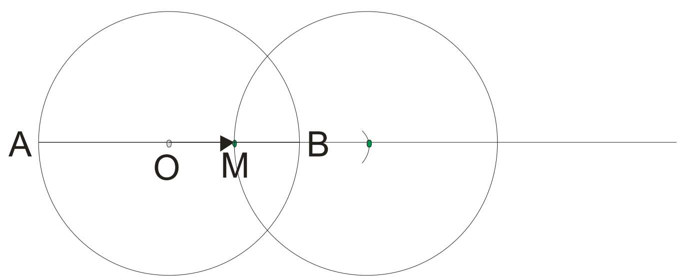



picture 2.

b)

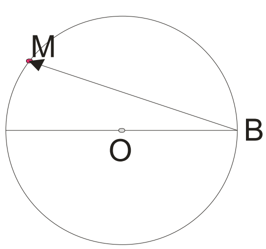



picture 1.

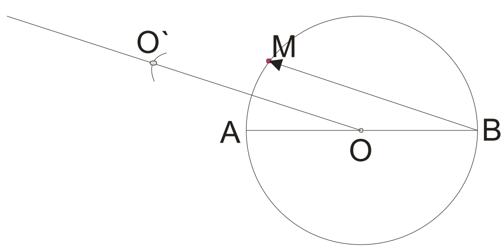



picture 2.

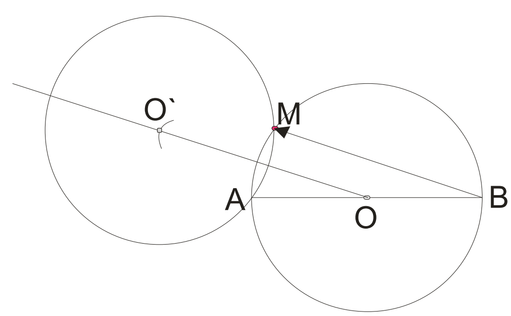
c)




picture 1.




picture 2.

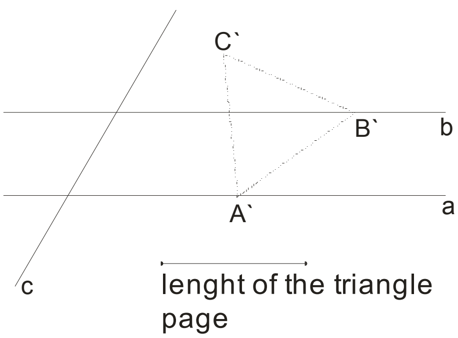



picture 3.

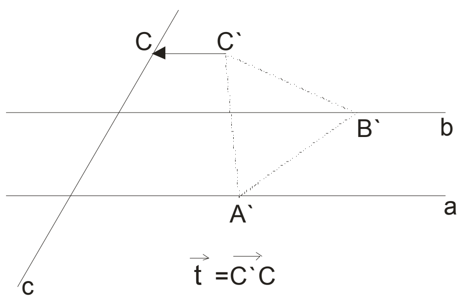
Example 4.

**Construct equilateral triangle of given side *a* with two vertices belonging to two parallel straight lines, and a third vertice that belongs to a third straight parallel line which cut this two parallel lines.**

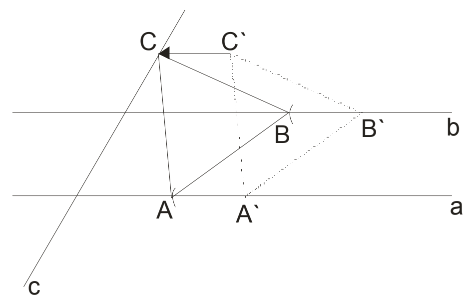
**<u>Solution:</u>**




picture 1.




picture 2.




picture 3.

We took an arbitrary page length of the triangle . On the line **a** take an arbitrary point A`, and from that point cut line b For lenght of the triangle. We have point B`. Point C` we will find as intersection of arcs from A` anb B`.

In this way we get a triangle A`B`C ` ( picture 1.)

Since one requested vertex of triangle must be on the line c, we will translation triangle A `B` C `to vector $\vec{t} = \overrightarrow{C`C}$ that is parallel to the straight lines a and b ( pictures 2. and 3.)

We can see that it was not difficult to solve this task, however ...

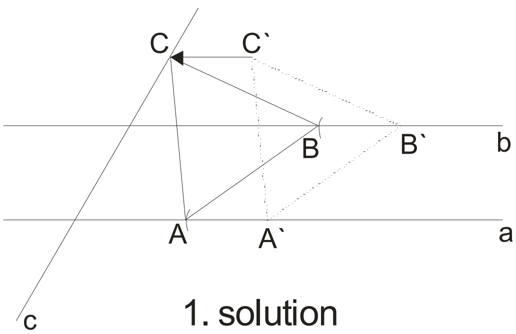
**Here is a very interesting discussion!**

Mark the distance between lines a and b with *d.* In our construction, we took to the length of the triangle side is greater than distance between lines a and b ( we mark *d* )

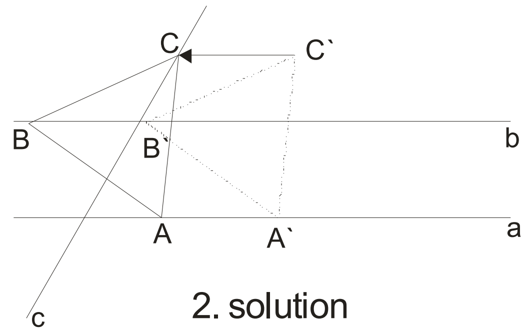
**There are three possibilities:**

i) **if the page length of a triangle is greater than the distance d between lines a and b ( $a > d$ )**

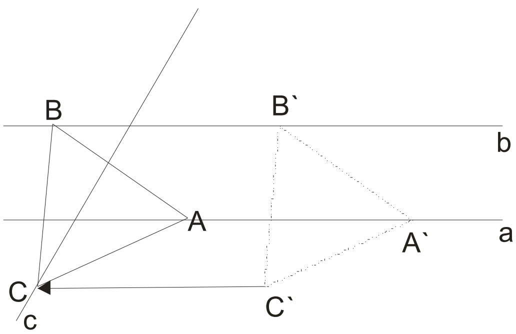
In this situation, the task has 4 solutions:



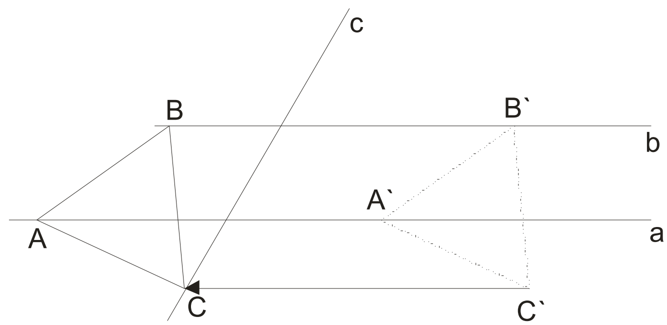

1. solution




2. solution



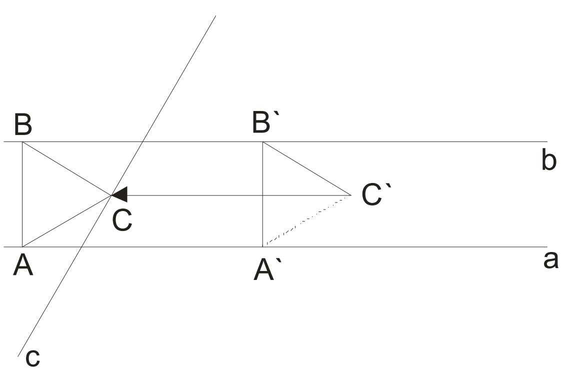

3. solution



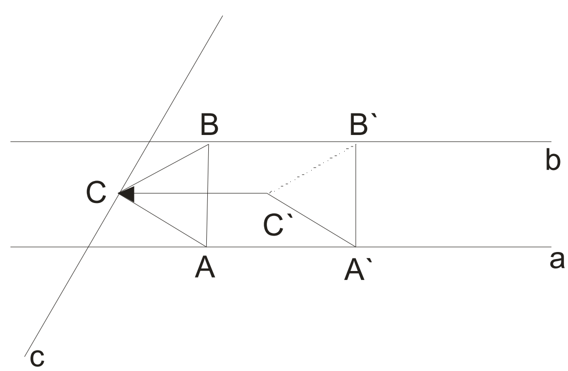

4. solution

ii) **if the page length of a triangle is equal to the distance d between lines a and b ( $a = d$ )**

And here there are two solutions:



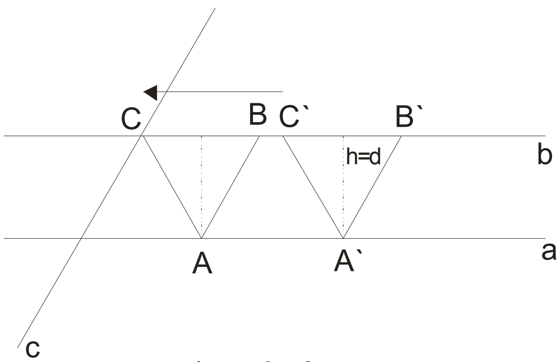

1. solution



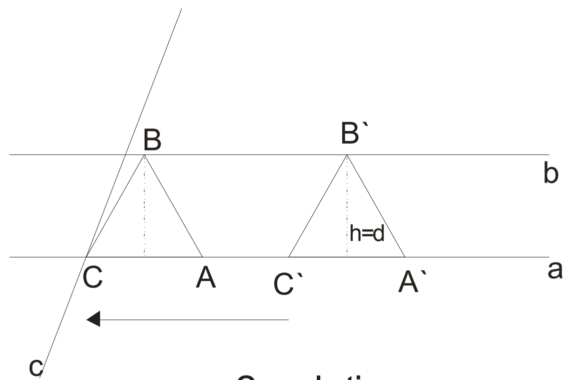

2. solution

iii) **if the height of the triangle is equal to the distance d between lines a and b ( $h = d$ )**

And here there are two solutions:




1. solution




2. solution

Then : $h = \frac{a\sqrt{3}}{2} \rightarrow d = \frac{a\sqrt{3}}{2} \rightarrow a = \frac{2d}{\sqrt{3}} \rightarrow a = \frac{2d}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \boxed{a = \frac{2d\sqrt{3}}{3}}$