Transformational Geometry Translations

Name Class

Translations Lesson

Student Activity

Transformational Geometry is a way to study geometry by focusing on geometric "movements" or "transformations" and observing/studying properties about these figures.

There are four geometric transformations: < Reflections < Translations < Rotations < Dilations

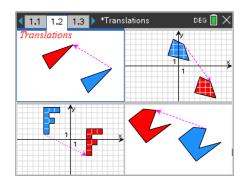
Play - Investigate - Explore - Discover PIED

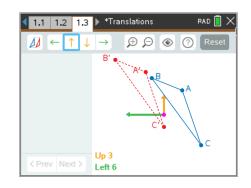
In the figure to the right, ΔABC is translated up 3, to the left 6.

 ΔABC is called the pre-image while $\Delta A'B'C'$ is called the

image (of translation).

 $\Delta A'B'C'$ is read "triangle A prime, B prime, C prime."





Download and install the red TI-Nspire student software and the

Translations TNS file from the website where you obtained this document.

Then you can interact with these figures, too. If you decide not to download the software, or if you cannot, you can still do this activity along with the video.

A conjecture is an opinion or conclusion based on what is observed.

1. What conjecture(s) can you make based upon what you observed about a triangle and its image after being translated?

2. What is another word or phrase for what a translation does?

3. ΔPQR is typically called the	while $\Delta P'Q'R'$ is called the
(of translation).	
$\Delta P'Q'R'$ is read	

4. a) lf a	triangle is translated,	what appears to be	e true about the	angles of the	pre-image and im	lage
triangle	? (please word your a	nswer properly)				

b) If a triangle is translated, what appears to be true about the sides of the pre-image and image triangle? (please word your answer properly)



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Because the corresponding angles and the corresponding sides of the pre-image and image triangles are congruent (have equal measures), the triangles are congruent.

Therefore, a translation is called an **isometry**. An isometry is a transformation that does not change a figure's shape or size. A translation is also referred to as a **rigid motion** because it moves an object but preserves its shape and size (congruence).

We also say that a translation is a **distance-preserving** and an **angle-preserving** transformation.

5. Is a reflection an isometry? Explain.

6. a) If a triangle is translated, what appears to be true about the perimeters of the pre-image and image triangle?

b) If a triangle is translated, what appears to be true about the areas of the pre-image and image triangle?

Grids and Coordinates

7. a) Translate ΔABC to the right 5 units. Draw your answer on the grid below. b) Write the ordered pair for each point:

	A B C
I.1 1.2 1.3 ▶ *Translations RAD X X	
$ \leftarrow \uparrow \downarrow \rightarrow \textcircled{P} \bigcirc \bigcirc \bigcirc \texttt{Reset}$	A' B' C'
Coordinates A (2, 4)	c) Grab and move the vertices of the pre-image triangle.
B(-3,6) C(5,-2)	Write the <i>new</i> ordered pair for each point:
A'(7,4) B'(2,6)	A B C
C'(10, -2) -5	A' B' C'
Right 5	

d) Using the pattern observed in the coordinates, if a point on the pre-image triangle has coordinates (1, 2), what are the coordinates of its corresponding point on the image triangle?

That is, $(1, 2) \rightarrow$ _____ ' \rightarrow ' means "maps to"

e) Similarly, the point (-3, 7) would be translated to? That is, $(-3, 7) \rightarrow$

f) Generalize the pattern. If a point on the pre-image triangle has coordinates (x, y), what are

coordinates of its corresponding point on the image triangle? That is $(x, y) \rightarrow$

Transformational Geometry Student Activity	Translatior		e s
a) Translate ΔABC down 4 units.	b) Write the or	dered pair fo	r each point:
raw your answer on the grid below.	Α	В	C
1.1 1.2 1.3 ▶ *Translations RAD × ✓ ✓ ✓ ✓ ✓ Ø Ø Reset			C'
Coordinates A (2, 4) B (-3, 6)	triangle. Write the <i>new</i>		
C (5, -2) A'(2,0) B'(-3,2) B'(-3,2) B'(-3,2) B'(-3,2) B'(-3,2) B'(-3,2)	A	В	C
C'(5,-6) C'Prev Next >	A'	B'	C'
			alo has coordinatos
, 2), what are the coordinates of its corresponding (2)	ng point on the im	-	•
Using the pattern observed in the coordinates, if (, 2), what are the coordinates of its correspondir nat is, $(1, 2) \rightarrow $ ' \rightarrow ' mea Similarly, the point (-3, 7) would be translated	ng point on the im	nage triangle	?
, 2), what are the coordinates of its correspondir nat is, $(1, 2) \rightarrow _$ ' \rightarrow ' mea Similarly, the point (-3, 7) would be translated	ng point on the im ns "maps to" to? That is, $(-3,$	nage triangle $(7) \rightarrow $?
, 2), what are the coordinates of its correspondin that is, $(1, 2) \rightarrow _ + + + + + + + + + + + + + + + + + +$	ng point on the im ns "maps to" to? That is, (-3, e triangle has co	age triangle $(7) \rightarrow $ ordinates (x)	? , <i>y</i>), what are
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, 2), what are the coordinates of its correspondinates is, $(1, 2) \rightarrow _ \rightarrow '$ means as a similarly, the point $(-3, 7)$ would be translated. Generalize the pattern. If a point on the pre-image pordinates of its corresponding point on the image and up 2 units. The present of the left 3 units and up 2 units. The present of	ng point on the im ns "maps to" to? That is, (-3, e triangle has co e triangle? That i b) Write the or A A'	hage triangle $(7) \rightarrow \$ ordinates (<i>x</i> s (<i>x</i> , <i>y</i>) \rightarrow dered pair fo B B'	? , <i>y</i>) , what are r each point: C
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a, 2), what are the coordinates of its correspondir hat is, (1, 2) → '→' mean Similarly, the point (-3, 7) would be translated Generalize the pattern. If a point on the pre-image bordinates of its corresponding point on the image a) Translate Δ <i>ABC</i> to the left 3 units and up 2 units. raw your answer on the grid below. 1.1 1.2 1.3 ► *Translations	ng point on the im ns "maps to" to? That is, (-3, e triangle has co e triangle? That is b) Write the or A A' c) Grab and mo triangle.	hage triangle $(7) \rightarrow \$ ordinates (x s (x, y) \rightarrow dered pair fo B B' ove the vertions ordered pair	? , <i>y</i>), what are r each point: C ces of the pre-image for each point:

d) Using the pattern observed in the coordinates, if a point on the pre-image triangle has coordinates (1, 2), what are the coordinates of its corresponding point on the image triangle?

That is, $(1, 2) \rightarrow$ _____ ' \rightarrow ' means "maps to"

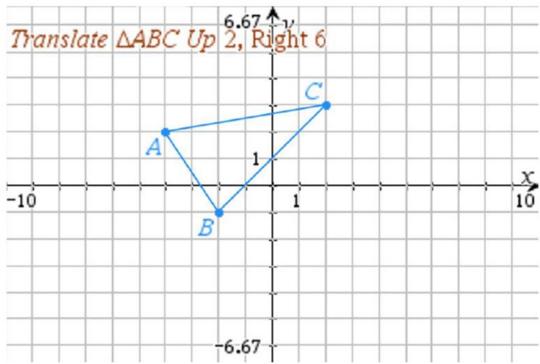
10. Given: ΔDEF is translated to the right 4 units and down 2 units.

- a) If D has coordinates (5, 7), what are the coordinates of D'?
- b) If E has coordinates (-3, -7), what are the coordinates of E'?
- c) If F has coordinates (a, b), what are the coordinates of F'?
- d) If E' has coordinates (1, 6), what are the coordinates of E?
- e) If D' has coordinates (p, q), what are the coordinates of D?

Translate by Hand

11. Translate ΔABC up 2 units, right 6 units, using a straightedge.

Label the vertices appropriately and show the 3 dashed segments that connect corresponding vertices. a)



b) List the coordinates of each of the 6 vertices:

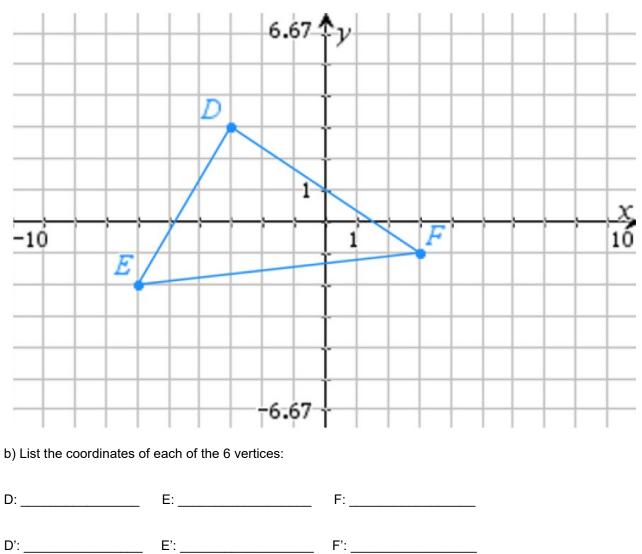
A: _____ B: ____ C: _____ A': ____ B': ____ C': ____

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c) If (x, y) is a point on ΔABC , what are the coordinates of its image on $\Delta A'B'C'$?

d) If (g, h) is a point on $\Delta A'B'C'$, what are the coordinates of its pre-image on ΔABC ?

12. Translate ΔDEF down 3 units, right 5 units, using a straightedge. Label the vertices appropriately and show the 3 dashed segments that connect corresponding vertices. a)



c) If (x, y) is a point on ΔDEF , what are the coordinates of its image on $\Delta D'E'F'$?

d) If (g, h) is a point on $\Delta D'E'F'$, what are the coordinates of its pre-image on ΔDEF ?

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Properties of Corresponding Sides of Translated Triangles

13. Translate ΔABC up 3 units and to the left 6 units, using a straightedge.

a) Look at corresponding sides \overline{AB} and $\overline{A'B'}$. We have already established that these two segments have the same length. What else appears to be true about these two segments?		A
What about \overline{BC} and $\overline{B'C'}$?	-10 -5	0 5 10 C
What about \overline{CA} and $\overline{C'A'}$?	Up 3 Left 6	-5

b) It appears that each pair of corresponding sides is parallel.

If segments (lines) are to be parallel, what must be true about their slopes?

c) Calculate the slope of each pair of corresponding sides. Record your answers as fractions.

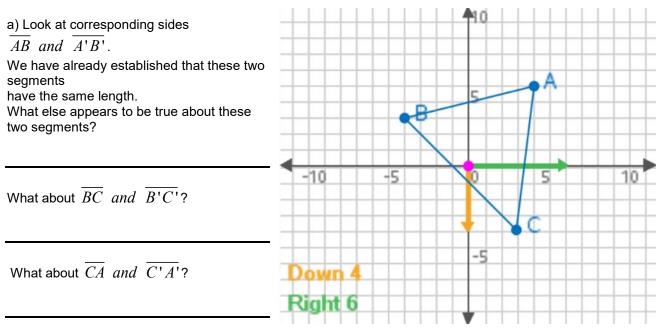
Slope of \overline{AB} =	Slope of $\overline{A'B'}$ =
Slope of \overline{BC} =	Slope of $\overline{B'C'}$ =
Slope of \overline{CA} =	Slope of $\overline{C'A'}$ =

d) Based upon the results in part c above, is each pair of corresponding sides parallel?

e) This is not enough evidence to prove this conjecture for all triangles. We need to investigate more examples. Let's use the technology to do this.

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14. Translate ΔABC down 4 units and to the right 5 units, using a straightedge.



b) Calculate the slope of each pair of corresponding sides. Record your answers as fractions.

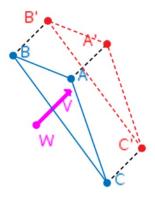
Slope of \overline{AB}	=	Slope of $\overline{A'B'}$	=
Slope of \overline{BC}	=	Slope of $\overline{B'C'}$	=
Slope of \overline{CA}	=	Slope of $\overline{C'A'}$	=

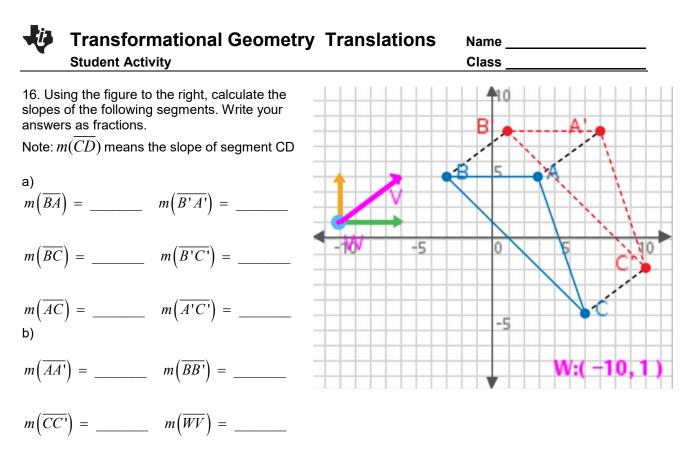
c) Based upon the results in part c above, is each pair of corresponding sides parallel?

Translate by Vector

A vector is a directed line segment which has both length and direction.

15. In the figure at the right, ΔABC is translated by **vector** \overline{WV} . Look at the dashed segments , $\overline{AA'}$, $\overline{BB'}$, $\overline{CC'}$, and the **vector** \overline{WV} . Two things seem to be true about vector \overline{WV} and these three dashed segments. Write two conjectures below.





c) Name the segments that are parallel.

17. Translate ΔDEF by vector \overline{WV} using a ruler. Show these as dashed segments: $\overline{DD'}$, $\overline{EE'}$, $\overline{FF'}$.

