

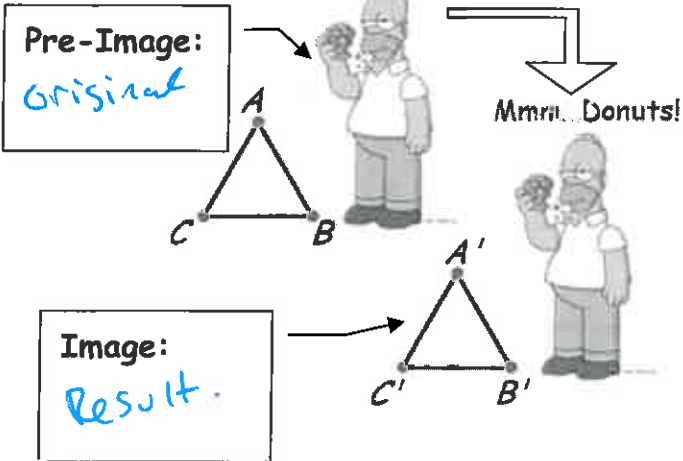
Invariants, Isometry, Translation & Dilation

TRANSFORMATION: Change

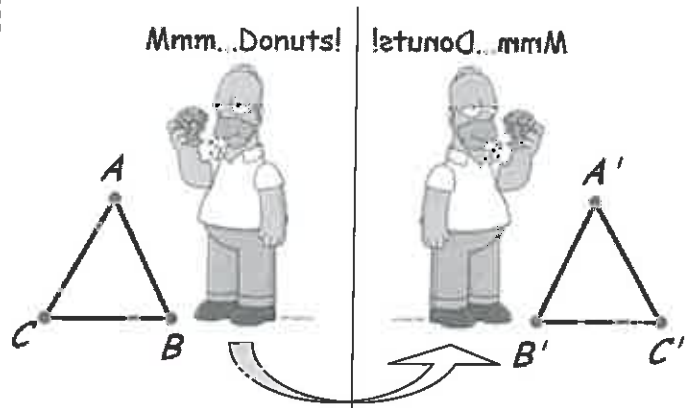
4 Basic Transformations

1. Translation - slide

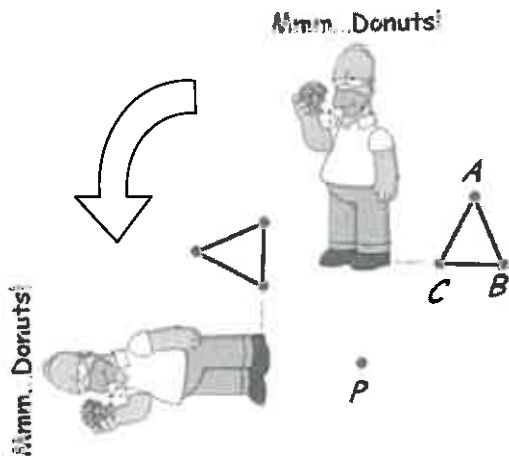
Mmm... Donuts!



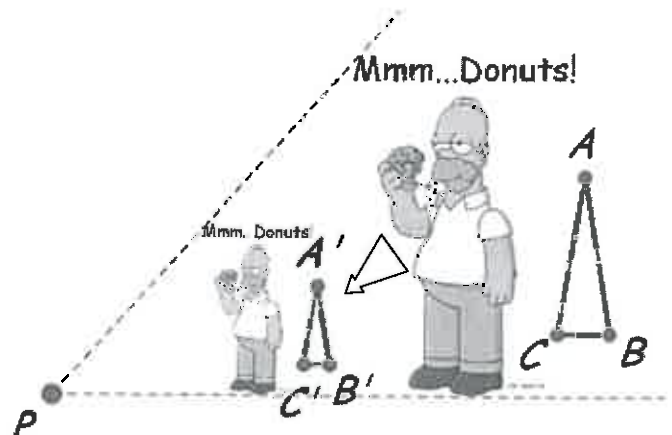
2. Reflection - flip



3. Rotation - turn



4. Dilation - enlarge/shrink

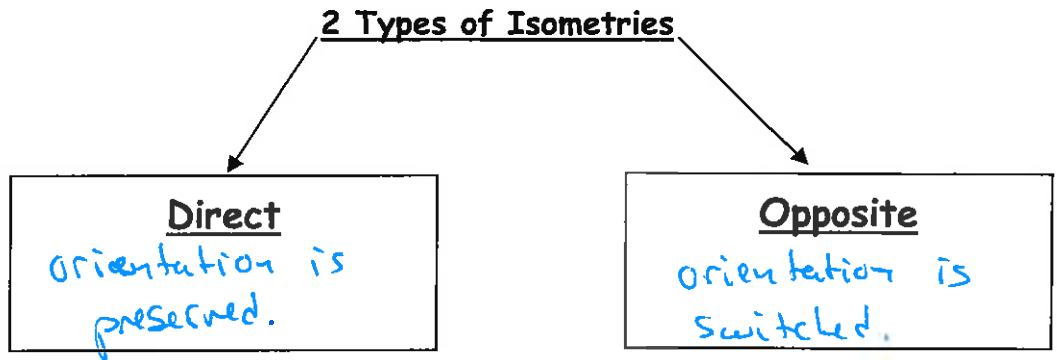


Invariants: Things that do NOT change.

Which properties remain *invariant* under each transformation?

Property	Translation	Dilation	Reflection	Rotation
Distances (segment lengths)	✓		✓	✓
Angle Measure	✓	✓	✓	✓
Colinearity	✓	✓	✓	✓
Parallelism	✓	✓	✓	✓
Orientation (left & right reverse?)	✓	✓		✓

Isometry: Pre-image \cong Image



List under each category the transformations that apply.

Direct Isometry

Translation
Rotation

Opposite Isometry

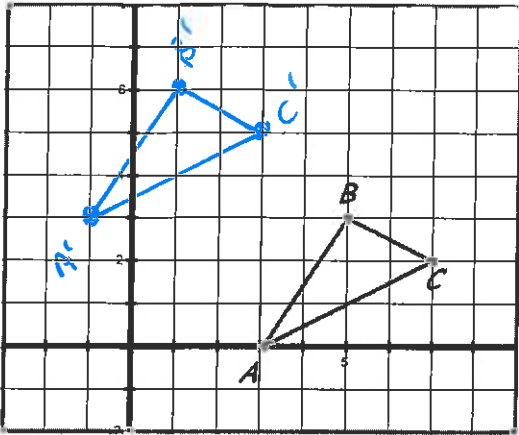
Reflection

Not an Isometry

Dilation

Translation Slide

Example:



Translate $\triangle ABC$ left 4 and up 3 to find the coordinates of the image $\triangle A'B'C'$. Describe the translation using:

$$\begin{aligned} A(3,0) &\rightarrow A'(-1,3) \\ B(5,3) &\rightarrow B'(1,6) \\ C(7,2) &\rightarrow C'(3,5) \end{aligned}$$

Describe the Translation 3 different ways:

Notation: $T_{(-4,3)}$

Mapping: $(x,y) \rightarrow (x-4, y+3)$

Vector: $\langle -4, 3 \rangle$

Examples:

1. What is the image of the point $G(5,-2)$ under the transformation $T_{(2,1)}$?

$$(x,y) \rightarrow (x+2, y+1) \quad G(5,-2) \rightarrow G'(7,-1)$$

2. A translation maps the point $(2,1)$ onto the point $(-3,2)$. Find the image of $(4,-1)$ under the same translation.

$$(x,y) \rightarrow \langle -5, y+1 \rangle$$

$$(4,-1) \rightarrow (-1,0)$$

3. $M'(1, -5)$ is the image of M under the translation $(x,y) \rightarrow (x-4, y+5)$. What are the coordinates of point M ?

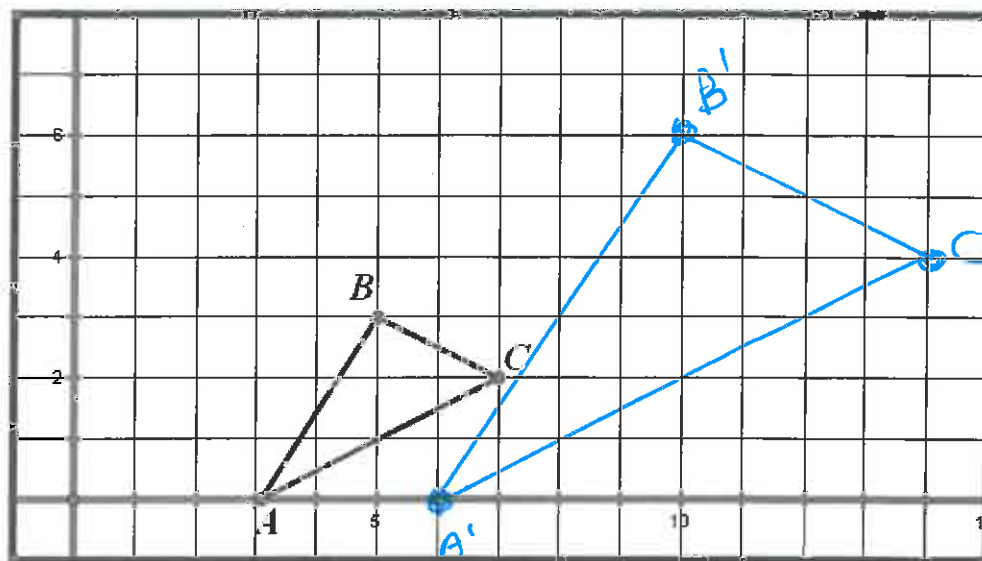
$$M(5, -10)$$

4. True or false: A translation is an example of an Opposite Isometry.

False

Dilation: Enlarge / Shrink

Example:



1. Dilate $\triangle ABC$ by a factor of 2 to find the coordinates of the image $\triangle A'B'C'$.

$$\begin{aligned} A(3,0) &\rightarrow A'(6,0) \\ B(5,3) &\rightarrow B'(10,6) \\ C(7,2) &\rightarrow C'(14,4) \end{aligned}$$

Describe the Dilation using:

Notation: D_2

Mapping: $(x,y) \rightarrow (2x, 2y)$

Examples:

1. Find the coordinates of P' , the image of $P(6,-8)$ under the dilation D_4 .

$$P'(24, -32)$$

2. $B'(-9, 15)$ is the image of point B under the transformation $(x,y) \rightarrow (1/3x, 1/3y)$. Find the coordinates of B .

$$B(-27, 45)$$

3. True or False: *Distance is invariant under dilation, thus dilation is an isometry.*

False

4. True or False: *Orientation is invariant under dilation.*

True