Scale Factor

ID: 10233

Time required
40 minutes

Activity Overview

In this activity, students will dilate a triangle using a positive integer scale factor. They will measure angles, side lengths, and areas and make a conjecture about the relationship between the measures of the pre-image and image. This conclusion is extended to other scale factors.

Topic: Transformational Geometry

- *Given a center of dilation, a scale factor **k**, and a geometric figure, dilate the figure to discover that angles and shapes are preserved under dilations, but lengths are increased by a factor **k** and areas by **k^2**.*

Teacher Preparation and Notes

- *This activity is designed to be used in a high school or middle school geometry classroom.*
- *This activity is designed to be student-centered.*
- *The term "pre-image" refers to the original figure and the term "image" refers to the figure resulting from the dilation.*
- *If an image triangle does not appear after dilation, it might be off screen. Have students move the pre-image triangle closer to the center of dilation.*
- ***Note:** Measurements can display 0, 1, or 2 decimal digits. If 0 digits are displayed, the value shown will round from the actual value. To change the number of digits displayed:*
  1. Move the cursor over the value so it is highlighted.
  2. Press + to display additional decimal digits or − to hide digits.
- ***To download the SLIDER Cabri Jr. file and student worksheet, go to education.ti.com/exchange and enter "10233" in the keyword search box.***

Associated Materials

- *ScaleFactor_Student.doc*
- *SLIDER.8xv*

Suggested Related Activities

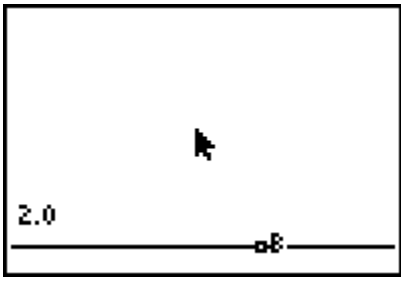
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Dilations (TI-Nspire technology) — 8487*
- *Similarity and Dilations (TI-89 Titanium) — 1288*
- *Transformers (Matrices) (TI-84 Plus family) — 8776*

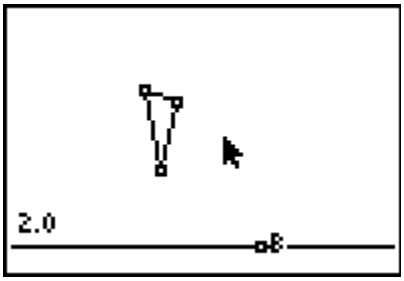
Problem 1 – Scale Factor of 2

Step 1: Students begin the activity by opening the *Cabri Jr.* file **SLIDER**, which shows a slider tool at the bottom of the screen. As point *B* is dragged, the numerical value changes.

Save the file with another name to keep the **SLIDER** file available.

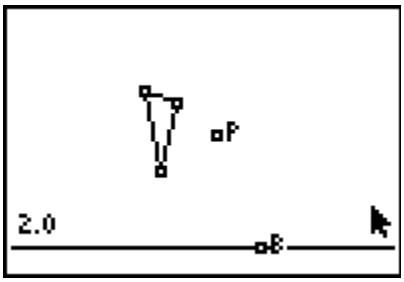


Step 2: Next, students will construct a small scalene triangle on the left half of the screen using the **Triangle** tool.



Step 3: They should select the **Point** tool and create a point in the middle of the screen and label it *P* using the **Alph-Num** tool.

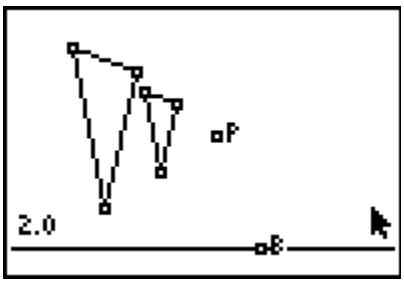
Note: When using the Alph-Num tool, press ENTER to start the label, press the key for the appropriate letter, and then press ENTER again to end the label.



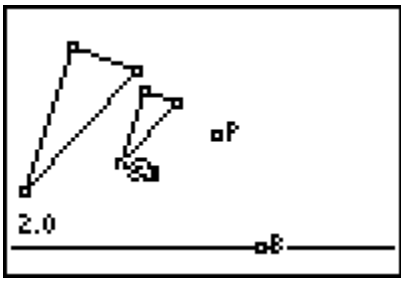
Step 4: A dilation of the triangle should be done using point *P* as the center of dilation and 2.0 as the scale factor.

To do this, select the **Dilation** tool, press ENTER on the triangle, then press ENTER on point *P*, and finally press ENTER on the numerical value 2.0.

Note: Be sure that the whole triangle, not just a side, is highlighted when pressing ENTER. Students should record their observations on their worksheet.

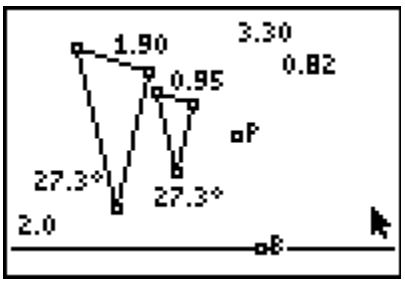


Step 5: Students can grab and drag a vertex of the pre-image (original) triangle.



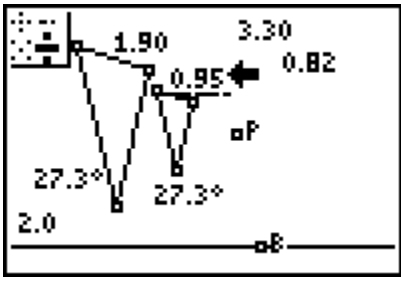
Step 6: They will use the tools in the **Measure** menu to measure:

- a side length of the pre-image triangle and *the corresponding* side length of the image triangle
- an angle of the pre-image triangle and *the corresponding* angle of the image triangle
- the area of the pre-image triangle and the area of the image triangle



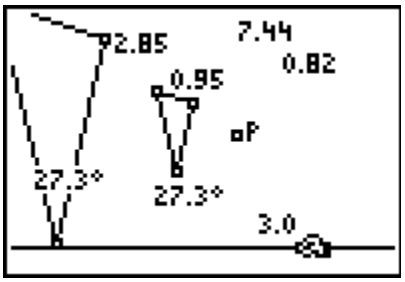
Step 7: To find the ratios of the side lengths, angle measures, and areas, select the **Calculate** tool to divide each of the image triangle's measurements by the pre-image (original) triangle's measurements.

Press [ENTER] on the image measurement.
Press the [÷] key to indicate division.
Press [ENTER] on the pre-image measurement.
Move to a blank area of the screen and press [ENTER] to anchor the calculation.

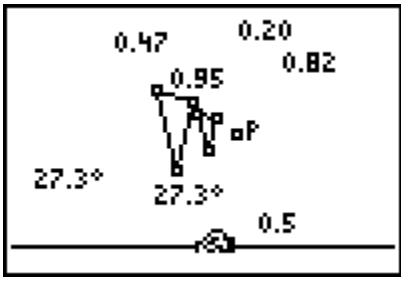


Problem 2 – Other Scale Factors

Step 1: Students should change the scale factor to the value 3.0 by dragging point *B*.



Step 2: Next, they will change the scale factor to a value between 0 and 1.



Step 3: Students should also try a negative scale factor.

Solutions – Student Worksheet

Problem 1

1. The dilation makes triangle that is similar and twice as big.
2. The image triangle changes in the same way that the pre-image triangle changes, so that the two triangles remain similar.
3. The position of the image changes.
4. Sample answers:

Scale Factor = 2	Pre-Image Triangle	Image Triangle
Side Length	0.95	2.85
Angle Measure	27.3°	27.3°
Area	0.82	7.44

5. Length Ratio = 2 Angle Ratio = 1 Area Ratio = 4
6. The length of the image is the length of the pre-image multiplied by the scale factor, and the area of the image is the area of the pre-image multiplied by the scale factor squared.

Problem 2

7. Sample answers:

Scale Factor = 3	Pre-Image Triangle	Image Triangle
Side Length	0.95	1.9
Angle Measure	27.3°	27.3°
Area	0.82	3.30

8. Sample answers:

Scale Factor = 0.5	Pre-Image Triangle	Image Triangle
Side Length	0.95	0.47
Angle Measure	27.3°	27.3°
Area	0.82	0.2

9. It is equal to the scale factor.

10. It remains equal to 1.
11. It is the scale factor squared.
12. The triangles are similar.
13. The triangle is rotated about the center of dilation.
14. Negative dilation.

Additional Practice

1. Length Ratio = 3 Area Ratio = 9
2. Length Ratio = 1.5 Area Ratio = 2.25
3. 30 cm
4. 15°
5. 720 cm^2
6. 4
7. 1
8. 16
9. $5 \times 4 = 20$
10. $90 \div 4^2 = 90 \div 16 = 5.625$