Scale Factor, Area, and Perimeter

MATH NSPIRED

TEACHER NOTES

Math Objectives

- Students will change the scale factor of similar triangles to make relative comparisons of the areas and perimeters.

Vocabulary

- scale factor
- dilate
- area
- perimeter

About the Lesson

- If the premade .tns file is used, the student activity can be conducted in approximately 30 minutes. If the file is constructed, the estimated time is about 50 minutes.

- If you are planning for students to create the file, take time to follow directions prior to facilitating the process with students. If using the premade .tns file, investigate the directions and work through the movements prior to facilitating with students.

- This activity assumes that students understand that corresponding sides of similar figures are in proportion, as well as the effect of scale factor on the lengths of the sides of the result of a dilated triangle.

- Students might work independently or with a partner to complete this investigation.

- If creating this .tns file, you may want to fix the number of digits displayed to 3 to avoid clutter on the screen. This can be done by pressing (⌂ on) **>Settings… > Document Settings.** Press ▼ until you select Float 3. Then press (enter). Then press (enter) again.

TI-Nspire™ Navigator™ System

- Use Screen Capture to observe students' work as they proceed through the activity.
- Use Live Presenter to have a student illustrate how he/she used a certain tool.
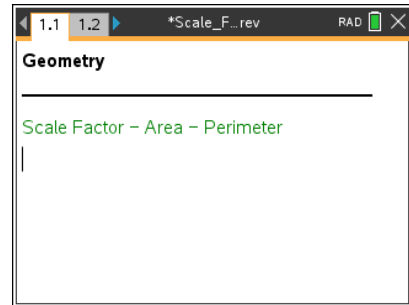
TI-Nspire™ Technology Skills:
- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:
- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing (ctrl) **G**.

Lesson Materials:
Create Instructions
Scale_Factor_Area_Perimeter_Create.pdf

Student Activity
Scale_Factor_Area_Perimeter_Student.pdf
Scale_Factor_Area_Perimeter_Student.doc

TI-Nspire document
Scale_Factor_Area_Perimeter.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

> **Tech Tip:** If students experience difficulty dragging a point, check to make sure that they have moved the arrow until it becomes a hand (✋). Press (ctrl) [≫] to grab the point and close the hand (✊).

Move to page 1.2.

Δ*AB'C'* was constructed by dilating Δ*ABC* through point *A* with the given scale factor of 2. Therefore, Δ*ABC* ~ Δ*AB'C'*.
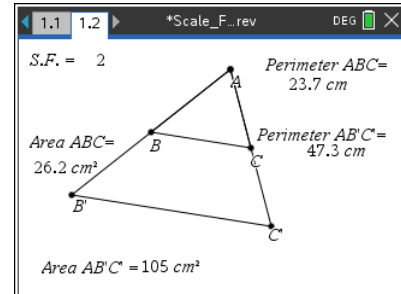
1. Move point *A*. Describe the changes that occur as you move the point.

    Answer: The lengths of the sides of the triangles change. The measures of the angles of the triangles change. The perimeter and area change. Some students might observe more specific information about the perimeter and area.

> **Teacher Tip:** Use the Clickpad or Touchpad to move over point *A*. When the open hand is over *A,* press (tab) until the words *point A* appear. Then press (ctrl) [≫] to drag *A.*

2. Suppose that point *A* is moved such that the measure of $\overline{AB}$ is 5, $\overline{BC}$ is 7, and $\overline{AC}$ is 4. What would the measures be for each of the corresponding segments on Δ*AB'C'*? Justify your answer.

    Answer: *AB'* = 10, *B'C'* = 14, *AC'* = 8
    The ratio of one side of Δ*AB'C'* to its corresponding side of Δ*ABC* = 2, the scale factor.
    $$\frac{AB'}{AB} = \frac{B'C'}{BC} = \frac{C'A}{CA} = \frac{2}{1}, \frac{10}{5} = \frac{14}{7} = \frac{8}{4} = \frac{2}{1}$$

3. Complete the table below by moving point *A* to three locations.

> **Teacher Tip:** To make the creation of the .tns file simple, the perimeter and area measures are not labeled. It may be necessary to have a discussion about which measures were taken on which triangle. If students construct the .tns file themselves, then this discussion may not be necessary.

Sample Answer:

Scale Factor 2	Similar Δ's Pair 1	Similar Δ's Pair 2	Similar Δ's Pair 3
Perimeter Δ*ABC*	9.34 cm	7.70 cm	10.58 cm
Perimeter Δ*AB'C'*	18.68 cm	15.40 cm	21.16 cm
Area Δ*ABC*	3.97 cm^2	1.59 cm^2	4.94 cm^2
Area Δ*AB'C'*	15.90 cm^2	6.36 cm^2	19.76 cm^2

4. Use the measurements recorded in the table above to make relative comparisons of the perimeters of Δ*ABC* and Δ*AB'C'*.

    Answer: The perimeter of Δ*AB'C'* (18.68, 15.40, 21.16) is two times the perimeter of Δ*ABC* (9.34, 7.70, 10.58). This holds true for each pair.

5. Use the measurements recorded in the table to make relative comparisons of the areas of Δ*ABC* and Δ*AB'C'*.

    Answer: The area of Δ*AB'C'* (15.90, 6.36, 19.76) is four times the area of Δ*ABC* (3.97, 1.59, 4.94). This holds true for each pair.

6. Predict what will happen to the relative comparisons of the perimeters and areas if the scale factor is changed.

    Answer: The multiplier will change. The perimeter of Δ*ABC* multiplied by the scale factor will equal the perimeter of Δ*AB'C'*. The area will change by multiplying by the scale factor twice.

7. To complete the table below, do the following:

   a. Change the scale factor to 3 and move point *A* to three different locations.

   b. Change the scale factor to $\frac{3}{4}$ and move point *A* to three different locations.
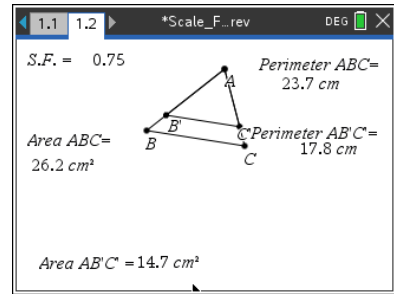
To change the scale factor, move the cursor over the current scale factor of 2 located in the upper-left corner of the screen. Double-click. The cursor is now inside the text box. Press (del) and type the new scale factor. Then press (enter).

<u>Sample Answer:</u>

Scale Factor 3	Similar Δ's Pair 1	Similar Δ's Pair 2	Similar Δ's Pair 3
Perimeter Δ*ABC*	9.60 cm	9.11 cm	7.56 cm
Perimeter Δ*AB'C'*	28.79 cm	27.32 cm	22.67 cm
Area Δ*ABC*	4.23 cm^2	3.70 cm^2	1.22 cm^2
Area Δ*AB'C'*	38.09 cm^2	33.29 cm^2	10.97 cm^2

Scale Factor $\frac{3}{4}$	Similar Δ's Pair 1	Similar Δ's Pair 2	Similar Δ's Pair 3
Perimeter Δ*ABC*	7.56 cm	9.12 cm	11.27 cm
Perimeter Δ*AB'C'*	5.67 cm	6.84 cm	8.45 cm
Area Δ*ABC*	1.22 cm^2	3.70 cm^2	4.31 cm^2
Area Δ*AB'C'*	0.69 cm^2	2.80 cm^2	2.43 cm^2

> **Teacher Tip:** You may want to ask students which scale factor in question 7 is an enlargement and which is a reduction.

8. Using the perimeter and area measurements recorded for Δ*ABC* above for Similar Δ's Pair 1, give the following measurements for Δ*AB'C'* if the scale factor is 5.

   <u>Answer:</u> Perimeter Δ*AB'C'* = 48 cm; Area Δ*AB'C'* = 105.75 cm^2

9. Make a conjecture about the relative comparison of the perimeters of the similar triangles if the scale factor is *r*.

    Answer: The perimeter of Δ*AB'C'*, the scaled triangle, will be *r* times the original perimeter.

10. Make a conjecture about the relative comparison of the areas of the similar triangles if the scale factor is *r*.

    Answer: The area of Δ*AB'C'*, the scaled triangle, will be r^2 times the original area.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

• The comparison of the perimeters of two similar figures if the scale factor is *r*.

• The comparison of the areas of two similar figures if the scale factor is *r*.

Extension

Explore another triangle that is created with the center of dilation outside the triangle.

Discussion Questions:

• Would the conjectures made in questions 9 and 10 hold true for similar triangles created by dilating a triangle with the center of dilation outside the triangle?

• Would the conjectures made in questions 9 and 10 hold true for other similar polygons?