Math Objectives

- Students will explain how a change in only the base (or the height) of a rectangle affects its perimeter.
- Students will explain how a change in only the base (or the height) of a rectangle affects its area.

Vocabulary

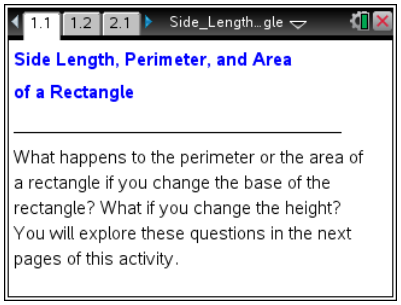
- base
- height
- perimeter
- area

About the Lesson

- In this lesson, students will change the base of a rectangle and observe the corresponding changes in the perimeter and area. They will also change the height of a rectangle and observe the corresponding changes in the perimeter and area.
- As a result students will:
  - Generalize the effect on perimeter when the base (or height) is increased by *n* units.
  - Generalize the effect on area when the base (or height) is increased by *n* units.

TI-Nspire™ Navigator™ System

- Use Screen Capture to observe students' work as they proceed through the activity.
- Use Quick Poll to monitor students' understanding.
- 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
- Manually capture data

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.

Lesson Materials:

Student Activity

- Side_Length_Perimeter_and_Area_of_a_Rectangle_Student.pdf
- Side_Length_Perimeter_and_Area_of_a_Rectangle_Student.doc

TI-Nspire document

- Side_Length_Perimeter_and_Area_of_a_Rectangle.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 cursor (arrow) until it becomes a hand (☜). Press ctrl [ ] to grab the point and close the hand (☜). When finished moving the point, press esc to release the point.

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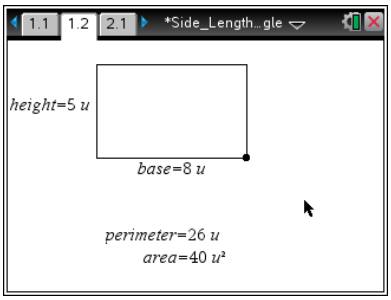

1. Drag the point on the vertex of the rectangle to change the base. Complete the table below. Note that you are changing only the base, and the height remains constant.

Base	*Height*	*Perimeter*	*Area*
8	**5**	**26**	**40**
9	5	**28**	**45**
5	**5**	20	**25**
6	5	**22**	30

2. As the base increases from 8 units to 9 units:
   a. How does the perimeter change?

      Answer: The perimeter increases by 2 units.

   b. How does the area change?

      Answer: The area increases by 5 square units.

3. As the base increases from 5 units to 6 units:
   a. How does the perimeter change?

      Answer: The perimeter increases by 2 units.

   b. How does the area change?

      Answer: The area increases by 5 square units.

4. Choose a value for the base of the rectangle.
   a. Record the data for your base, height, perimeter, and area in the table below.
   b. Move the point to increase the base by 3 units. Record the new measurements for base, height, perimeter, and area.

   Sample Answer:

Base	*Height*	*Perimeter*	*Area*
4	**5**	**18**	**20**
7	**5**	**24**	**35**

5. Use the information in your table from question 4.
   a. Describe the change in the perimeter of the rectangle when the base increased by 3 units.

      Answer: When the base increased by 3 units, the perimeter increased by 6 units.

   b. Describe the change in the area of the rectangle when the base increased by 3 units.

      Answer: When the base increased by 3 units, the area increased by 15 units.

   c. Compare your observations with another student. What observations did you have in common?

      Answer: Discuss student observations and sharing.

   d. Does it matter what base you started with? Explain.

      Answer: It does not matter what size base you start with; If you increase the base by 3 units, the perimeter will increase by 6 units and the area will increase by 15 units. Using the answer from questions 2 and 3, for every increase of 1 unit in the base, the perimeter increases by 2 units, and the area increases by 5 units.

TI-Nspire Navigator Opportunity: *Screen Capture*
See Note 1 at the end of this lesson.

6. What if the base were to increase by *n* units? How would this affect the perimeter and the area?

Answer: If the base increases by *n* units, the perimeter will increase by 2*n* units and the area will increase by 5*n* square units.

Teacher Tip: 5*n* in particular for this rectangle, $h \times n$ in general.

7. Bryson wants to change the height instead of the base to see if the perimeter and area are affected in the same way as when he changed the base. David says Bryson will get different results if he does. Who do you think is correct, and why?

Answer: Bryson is correct, because it does not matter which side is called the base or the height. If one is held constant and the other changes, it would be same as if it were the other way around.

TI-Nspire Navigator Opportunity: *Quick Poll*
See Note 2 at the end of this lesson.

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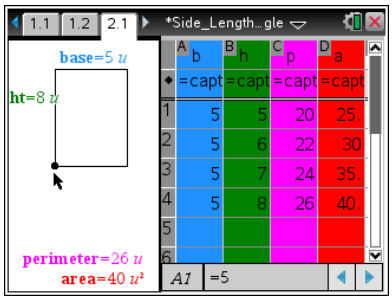

8. Change the value of the height to 5 units. Press ctrl . to capture the data for the base (*b*), height (*h*), perimeter (*p*), and area (*a*). Repeat this process for the heights 6, 7, and 8. Use the spreadsheet to complete the table.

Answer:

b	*h*	*p*	*a*
5	5	20	25
5	6	22	30
5	7	24	35
5	8	26	40

TI-Nspire Navigator Opportunity: *Live Presenter*
See Note 3 at the end of this lesson.

9. a. As you did in questions 2 and 3 when increasing the base by 1 unit, describe the change in the perimeter and the change in the area of the rectangle when the height increased by 1 unit.

Answer: When the height increases by 1 unit, the perimeter increases by 2 units and the area increases by 5 square units.

b. How does this support your response for question 7?

Answer: This supports Bryson's conjecture that it does not matter which side is called the base or the height. If one is held constant and the other changes, it would be same as if it were the other way around.

Extension: What if you decrease the length or width by *n*? What if you increased **both** the length and the width by the same amount? What if you increased **both** the length and the width by different amounts?

Wrap Up

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

- How a change in the base (or the height) of a rectangle affects its perimeter.
- How a change in the base (or the height) of a rectangle affects its area.

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Note 1

Question 5d, *Screen Capture*: Use Screen Capture so that students can compare several pairs of bases at the same time. Drag screens of bases that are three units apart next to each other.

Note 2

Question 7, *Quick Poll*: Have students answer this question using a Multiple Choice A/B Quick Poll. Students can choose *A* if they agree with David or *B* if they agree with Bryson. Discuss students' responses.

Note 3

Question 8, *Live Presenter*: If students are not familiar with capturing data manually, make someone the Live Presenter to demonstrate how to change the height and press ctrl . to capture the data in the spreadsheet.