Transformation
T-STEM 2013
New Directions | New Pathways | New Outcomes

Triangle Area Activity

Overview
In this activity, students develop their understanding of area and perimeter including understanding how the two are different. Students will calculate the area and perimeter of triangles. Students will also see how as long as the height and base of a triangle remain constant, the area will remain constant. The TriangleArea virtual instrument, VI, will be used in performing and checking calculations as well as building a visual and conceptual understanding of area and perimeter.

Objectives
Students will be able to:

- Describe the difference between the perimeter and area of a triangle.
- Calculate the perimeter and area of a triangle.

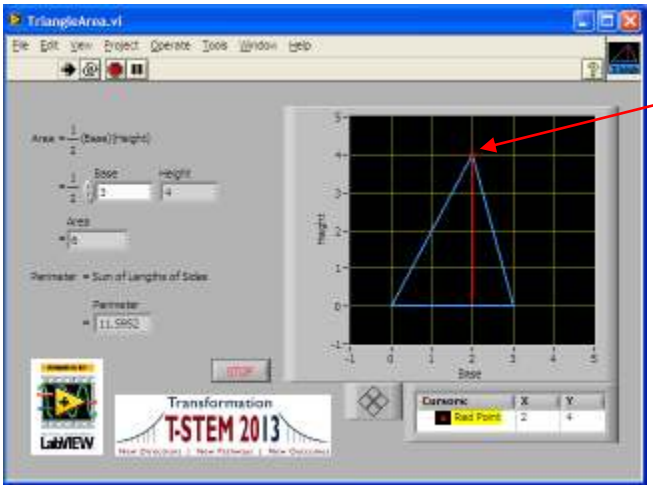
Standards (TEKS)
Geometry 2AB, 4, 5D, 7ABC, 8A

Activity
The area and perimeter of a triangle are similar. They both give some sense of a how large a triangle is. However, the two measurements are quite different. The area of a triangle can be found by taking half of the product of the base and the height. That is, $A = \frac{1}{2}bh$. The perimeter of a triangle is the sum of the lengths of the three sides.

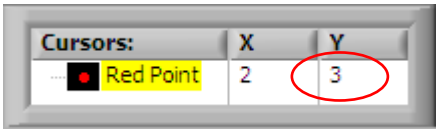
1) Open and run the TriangleArea virtual instrument, VI.

On the TriangleArea VI you will see a control for the base of the triangle and indicators showing the height, area, and perimeter of the triangle. The graph shows the triangle in blue and the height in red. The red point at the end of the dashed height line is a cursor.

You can click and drag on the red point to control the location of the point of the triangle, and, as a result, the triangle's height. To change the location of the red point, you can enter X and Y values into the cursor legend as well.



2) Play with the shape of the triangle by changing the position of the **Red Point**
   a) Click and drag the red point
   b) Note how the height, area and perimeter are affected.
3) Set the values in the VI to the following:
   a) **Base**, *b* = 3
   b) **Red Point**, X = 2 and Y = 2
4) Use the formula, $A = \frac{1}{2}bh$, to calculate the area of a triangle whose base, *b* = 3 and height, *h* = 2.
   a) Compare your answer to the area displayed in the VI.
   b) Are the two values equal? If not, check your work and try again.
5) Find area of a triangle if the base, *b* = 3 and the height,
   a) *h* = 3
   b) *h* = 4
   c) *h* = 5
6) Check your work with the VI.
   a) Change the Y coordinate of the **Red Point** to control the height, *h*.
   b) Use the **Cursor Legend** to change Y coordinate of **Red Point** to 3, 4, and 5.
   c) Fill in table with the area and perimeter.



Base	Height	Area	Perimeter
3	3		
3	4		
3	5		

Since $A = \frac{1}{2}bh$, the area will change when *h* changes.

7) Why do you think the perimeter changes as *h* changes?

Let's see what happens when the height is held constant and different base lengths are used.

8) Set the values in the VI to the following:
   a) **Base**, *b* = 3
   b) **Red Point**, X = 2 and Y = 3
9) Calculate area for a triangle with a height of 3 and base,
   a) *b* = 3
   b) *b* = 4
   c) *b* = 5
10) Check your work with the VI and fill in table.

Base	Height	Area	Perimeter
3	3		
4	3		
5	3		

11) What would happen to the area of the triangle if the X coordinate of the red point were the only thing to change? (Hint: A = 1/2bh. Does changing the X coordinate impact the values of *b* or *h*?)
12) What would happen to the perimeter of the triangle if the X coordinate of the red point were the only thing to change? (Hint: Does changing the X coordinate change the lengths of the sides of the triangle?)
13) Use the VI to investigate your hypotheses.
   a) Set the base to 3 and Y to 4.
   b) Set X to different values and see what happens with area and perimeter.
   c) Make notes in the table below.

Base	X	Y (Height)	Area	Perimeter
3		4		
3		4		
3		4		

14) Do your results agree with your hypotheses? Explain.

The red point can also be controlled with the cursor mover. 

15) Use the controls of the cursor mover to move the red point to the left and right.
   a) Does the area change?
   b) Does the perimeter change?

As you know, the perimeter is the sum of the lengths of the sides. In the VI, the base side lies on the x-axis with one end at the origin, so finding the length of the base side is a simple matter.

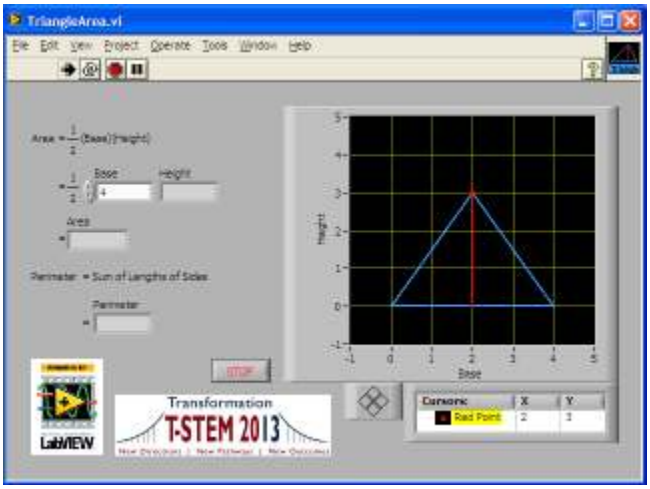
16) How could you find the lengths of the other two sides?

One way to find the lengths is to use the distance formula. The **distance** between two points, (x_1, y_1) and (x_2, y_2), using the distance formula,

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

To use the distance formula, you need the coordinates for the vertices of the triangle. You can get these from the VI.

17) Set the values in the VI to the following:
   a) **Base**, *b* = 4
   b) **Red Point**, X = 2 and Y = 3



18) What are the coordinates of the three vertices of the triangle?
19) Use the distance formula to find the lengths of the three sides of the triangle displayed in the VI. (Hint: Use the distance formula three times.)
20) What is the perimeter of the triangle? Does your answer agree with the perimeter displayed in the VI?
21) Stop the VI. You are done.