

## Dog Run

by Mary Bourassa

### Activity overview

*This activity allows students to investigate the maximum area of a rectangle of fixed perimeter.*

### Concepts

- *Data collection*
- *Scatter plots*
- *Modelling*

### Teacher preparation

*Download the dogrun.tns file and send it to the handhelds.*

### Classroom management tips

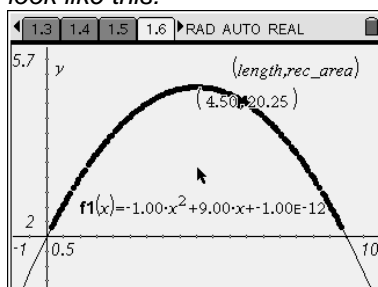
*Students should be able to complete this activity individually. The teacher can get them to change the perimeter of the rectangle before beginning the investigation so that students are working with different values from one another. All questions can be answered on the handheld.*

### TI-Nspire Applications

- *Graphs & Geometry*
- *Lists & Spreadsheet*
- *Calculator*
- *Notes*

### Step-by-step directions

*All of the instructions are contained in the .tns file (see screenshots below). The data collected should look like this:*



*Students should discover that the optimal shape is a square.*

### Assessment and evaluation

- *This activity is intended as an investigation. Teachers may wish to assess whether students have completed the activity.*

Student TI-Nspire Document: *dog run.tns*

1.1 1.2 1.3 1.4 ▶RAD AUTO REAL

**THE DOG RUN**

Optimizing Rectangles

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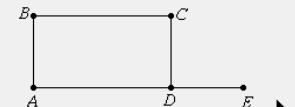
Press **CTRL** and the **right arrow** to move to the next page.

1.1 1.2 1.3 1.4 ▶RAD AUTO REAL

Mr. Peters needs to fence in part of his back yard for his dog. He has bought a certain length of fencing and wants to create a rectangle with the largest possible area. Your job is to create a mathematical model of this situation so that you can prove to him that your answer is the right one.

1.1 1.2 1.3 1.4 ▶RAD AUTO REAL

Perimeter=18.00  
Area=18.30  
AD=5.90 cm



Move point D along the entire length of segment AE and estimate the largest area for

1.1 1.2 1.3 1.4 ▶RAD AUTO REAL

As you moved point D you collected data on the length of the rectangle and its area as shown on the next page.

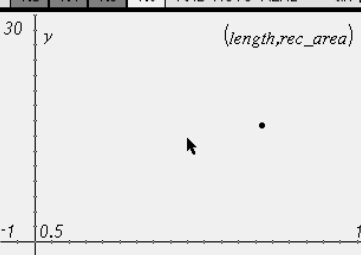
A scatter plot has been created on page 1.6 with length as the independent variable and rec\_area as the dependent variable.

1.2 1.3 1.4 1.5 ▶RAD AUTO REAL

A	length	B	rec_area	C	D	E
1	6.70		15.39			
2						
3						
4						
5						

A1 =6.70489653015

1.3 1.4 1.5 1.6 ▶RAD AUTO REAL **ctrl**



1.4 1.5 1.6 1.7 ▶RAD AUTO REAL

Perform a quadratic regression on the data: from the Statistics menu choose Stat Calculations then Quadratic Regression. Choose length as X-list and rec\_area as Y-list then press ENTER.

0/99

1.5 1.6 1.7 1.8 ▶RAD AUTO REAL

Return to the scatter plot and add the function from the quadratic regression:

- ✓ Press CTRL-G to bring up the entry line.
- ✓ Arrow up to get to  $f1(x)$ .
- ✓ Press ENTER to graph the function.
- ✓ Trace along the function to locate the maximum; press ENTER to mark the point.

1.6 1.7 1.8 1.9 ▶RAD AUTO REAL

**Question**

What are the coordinates of the maximum point?

**Answer**

1.7 1.8 1.9 1.10 ▶RAD AUTO REAL

**Question**

What is the length of the rectangle of maximum area?

**Answer**

1.8 1.9 1.10 1.11 ▶RAD AUTO REAL

**Question**

What is the width of the rectangle of maximum area?

**Answer**

1.9 1.10 1.11 1.12 ▶RAD AUTO REAL

**Question**

What is your conclusion for Mr. Peters?

**Answer**