MCCARTHY PARK

Situational Problem for Math SN-4

Beurling Academy – Nov 29, 2012

Name:

Grading criteria:

Criterion A: knowledge and understanding   /8

The student…

Consistently makes appropriate deductions when solving challenging problems in a variety of contexts including unfamiliar situations.	Generally makes appropriate deductions when solving challenging problems in a variety of familiar contexts.	Sometimes makes appropriate deductions when solving simple and more-complex problems in familiar contexts.	Attempts to make deductions when solving simple problems in familiar contexts.
8-7	6-5	4-3	2-1

Criterion C: communication in mathematics   /6

The student…

Shows good use of mathematical language. Shows good use of forms of mathematical representation. Shows lines of reasoning that are concise, logical and complete. Moves effectively between different forms of representation.	Shows sufficient use of mathematical language. Shows sufficient use of forms of mathematical representation. Shows lines of reasoning that are clear though not always logical or complete. Moves between different forms of representation with some success.	Shows basic use of mathematical language. Shows basic use of forms of mathematical representation. Shows lines of reasoning that are difficult to follow.
6-5	4-3	2-1

You have been asked to re-design the stream which meanders through McCarthy Park, a large forested park on Canada's west coast.

This page will give you information about the park and requirements for the new stream.

The Park

- The park is rectangular in shape. Its width (East-West) is equal to three times its height (North-South), minus 4 km.
- The park's total area is 160 km^2.
- There is a fountain, called "Origin Fountain," in the exact middle of the park.

The paths

- There are two perpendicular paths which cross the park. Due to your budget, you will not make any changes to these paths.
- "X Path" crosses the park in a straight line from west to east and intersects the fountain.
- "Y Path" crosses the park in a straight line from south to north and intersects the fountain.

The bridges

- Due to your budget, your stream must run under bridges built for the old stream. It may not cross the paths at any other places.
- The bridges are where the old stream intersected with X Path and Y Path. There are two bridges on X Path and one on Y Path.
- If we map the park on a Cartesian plane with (0,0) at the fountain and x, y measured in kilometres, the path of the old stream was:

$$y = -\frac{1}{4}(x + 2)^2 + 4$$

Other stream requirements

- Your stream must run from west to east, and not turn back at any point. (This means that if I took any north-south line across the park, it would only cross the stream once.)
- Your stream must touch all four edges of the park.
- Your stream must run generally north-east until halfway between the western bridge on the X Path and the fountain. Your stream must then run south-east until it crosses under the eastern bridge on the X Path. After this, it can meander north and south but cannot cross the X Path again (there is no bridge!).

Deliverables:

- **Draw a map of the park and your new stream. To do this, you will need:**
    - **The dimensions of the park,**
    - **The layout of the fountain and paths,**
    - **The location of each bridge, and**
    - **Other requirements for your new stream.**
- **Assuming the park is on a Cartesian plane with (0, 0) at the fountain, "study" your stream as a function.**

You may choose to use this page (including the graph) as extra work space – please express your answers on the following pages.
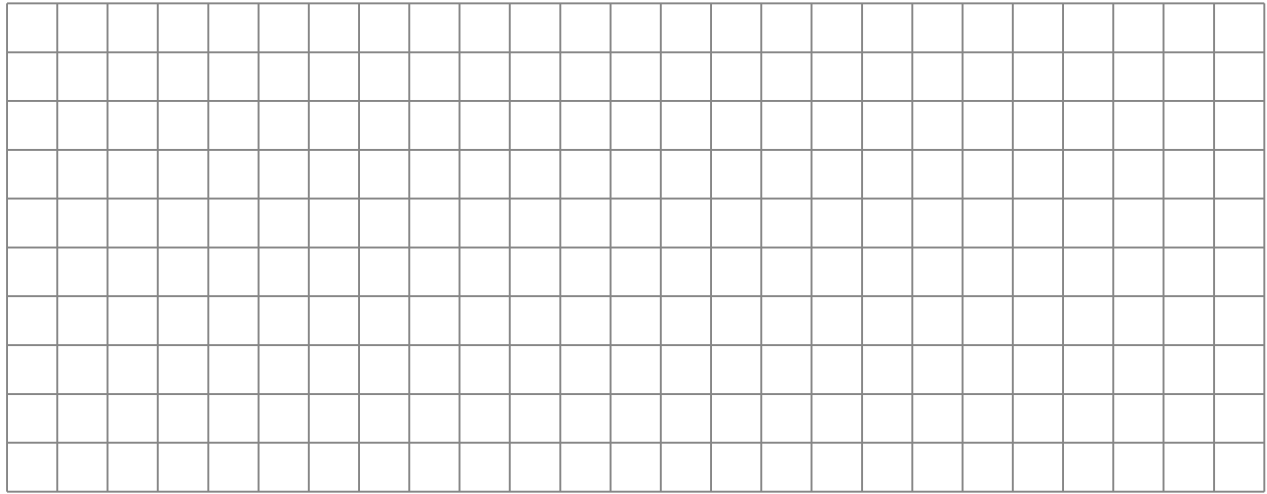
Please show your work and state answers on these pages.

Park dimensions:

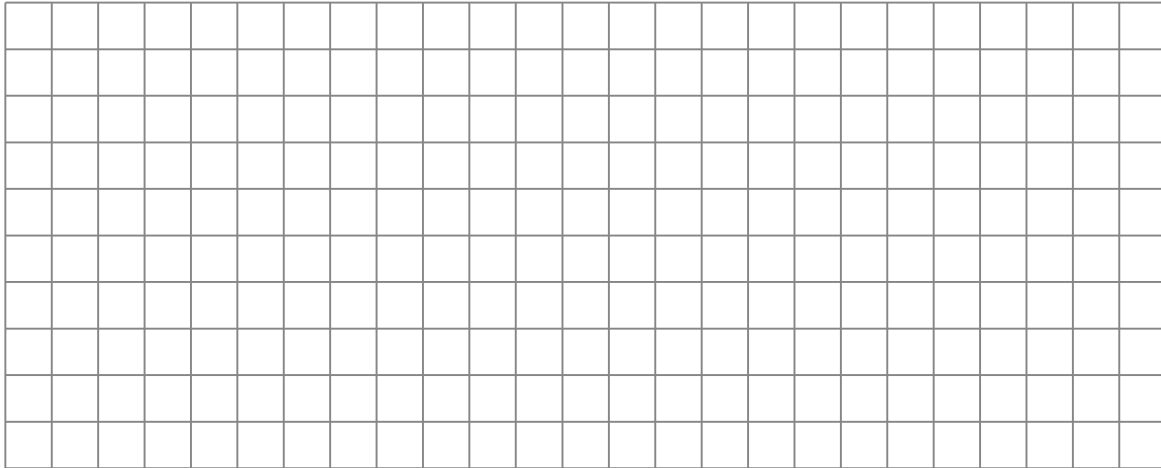What is the width (East-West) and height (North-South) of the park?

Bridges:

Where are the bridges on the X Path? On the Y Path?

The new stream:

Where does your new stream run through the park? On the graph below, draw:
-        the park boundaries
-        the Origin Fountain
-        the X Path and the Y Path
-        the locations of the bridges
-        your new stream

A functional stream?

Once again, assume the park is mapped on a Cartesian plane with the fountain at (0, 0) and with x (east-west distance) and y (north-south distance) measured in kilometers.

Let's consider your stream as a function, $y = stream(x)$. Complete the table below:

$domain =$ $range =$

$zero(s) =$ $y - intercept =$

$extrema$:

$sign$:

$variation$: