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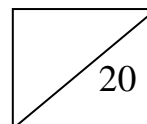
**Aspley State High School**  
**Year 10 Extension Mathematics – JMA007**  
**Assignment**

**Semester 2, 2009**

**Time: 2 weeks**

**Date given :** Week beginning Oct 12<sup>th</sup>  
**DUE DATE:** Week beginning Oct 26<sup>th</sup>

**Marks:**



Name: \_\_\_\_\_

Teacher: \_\_\_\_\_

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**DESIGNING A WATER FEATURE**

Have you noticed that a jet or stream of water follows the path of a parabola? We can model the path of a water drop in a thin water stream by finding a quadratic equation of the form  $y = a(x - b)^2 + c$  which matches it.

Consider a thin stream of water rising from an outlet at the surface of a pool that reaches a maximum height of 20m before hitting the surface of the pool again 4 m away.

**Tasks:**

**Part A**

1. Draw a sketch of the path of a water drop in this stream of water. Assume that the surface of the pool lies along the  $x$ -axis and that the path of the water drop starts at the origin  $(0,0)$ .
2. Explain what  $x$  and  $y$  represent in this situation.
3. What are the co-ordinates of the turning point of the parabola? Explain what this point represents.
4. Using the formula for a parabola:  $y = a(x - b)^2 + c$ , substitute the values of  $b$  and  $c$  for this case.
5. Use another piece of information from your sketch to find the value of  $a$ .
6. Write the quadratic equation you have found which represents the path of the water drop. Express your answer in the form  $y = ax^2 + bx + c$ .

**(2½,1,1½,1,2,2 = 10 marks)**

**Part B**

Now it is time to be creative.

Imagine three water streams clustered together with water rising at different angles and heights from the same outlet to form a spectacular water feature. Use the steps above to design your own water feature, drawing the graphs (on the same set of axes). Find also the corresponding equations which model **each** stream of water in your feature. (Assume they all start from the origin of a Cartesian plane)

**(6 marks)**

**Part C**

Your final task is to design a water feature with at least three streams where the streams **do not** start from the one point.

**Use a graphics calculator to show your design to your teacher. Explain** how you used the calculator to determine the equations for each of the water streams and how you graphed your design on the calculator.

**(4 marks)**