Worksheet 18

10 March 2016

1. **Warm up:** Answer the following questions with "True" or "False".

   (a) Every continuous function is differentiable.

   (b) Every constant function is continuous.

   (c) Every polynomial function is continuous.

   (d) Every constant function is a polynomial function.

2. Two cones are attached to the top and bottom of a cylinder, as in the picture below. The height of the cones is h and the height of the cylinder is $3h/2$, and the radius of the cones and cylinder is r.
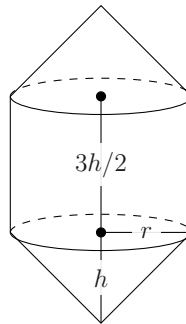

   (a) In terms of h and r, describe the total surface area of the shape.

   (b) In terms of h and r, describe the total volume of the shape.

   (c) Suppose that the total surface area is some fixed number A. Using part (a) above, express h in terms of r and A.

   (d) Rewrite the volume in part (b) with your new expression for h from part (c) above.

   (e) Take the derivative of your answer in part (d) with respect to h.

   (f) Find the maximum values of your volume function from part (d).

   (g) What are the r and h values that give the maximum of the volume function?

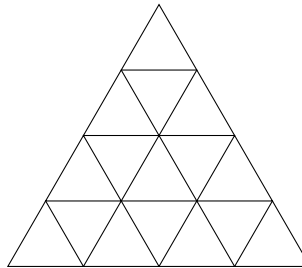3. In this question we're going to construct triangles.
   Step 1: Begin by drawing a simple triangle, with three edges, as below.

   Step 2: Draw three of the triangles in the previous step to draw a new triangle, as below.
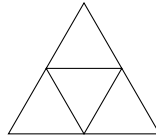
   Step 3: Draw three of the triangles in the previous step for a new triangle, and fill in any holes in the middle with more edges, as below.

   (a) Create a table for the step number and number of edges needed to draw the triangle.

step	1	2	3	4	5
edges needed	3	9			

   (b) For steps 1-5, give the number of edges needed in terms of the number of edges used for the previous step(s). For example, describe the number of edges needed for step 3 using the numbers 9 and 3 (the number of edges needed for the previous steps).

   (c) Can you describe how many edges will be needed for step n?