There's a Hole in the Bottom of the...Bottle

Strands:

Number & Operations	
Algebra	X
Measurement	X
Geometry	
Data & Probability	X

Materials:

- Empty 2-liter soda bottle with cap
- Scissors
- Masking tape
- Black marker
- Ruler
- Water
- Timing device (stopwatch on a cell phone)
- Graph paper

Where?

Outside	X
Inside	X
On-line	
On-site	

What happens when you uncover the hole? How will the water flow? Discover the effect of gravitational pull on water. Alter the air pressure in the bottle. What role does air pressure play on the flow of water from the bottle?

1. Peel the label off the 2-liter bottle. Make a dime-sized hole on the side of the bottle near the bottom. Place a small piece of masking tape over the hole.
2. Stick one long piece of masking tape along the side of the bottle, from bottom to top. Do not cover the hole with this piece of tape.
3. Fill the bottle with water and screw the cap on tightly. Mark the height of the water on the long piece of masking tape. Stand the bottle next to a sink or somewhere that the water can flow freely.
4. Remove the small piece of masking tape from over the hole; do not loosen the cap on the bottle. Mark the height of the water on the masking tape every 5 seconds until the water stops flowing out.
5. Measure the height of the water at each of your marks. Create a table representing the height of the water at each time you marked the tape. Plot the points, (elapsed time, height), on a coordinate grid.
   a. Describe the graph that is created.
   b. What can you conclude about the rate at which the water flows out based on the shape you see? Explain.
   c. Write an equation for the height of the water in terms of the elapsed time.
6. Is there error in your data? If so, explain how the error was created and how it may affect your graph and your conclusions.

Extensions:

For each of the following, predict what differences you might see before you repeat the experiment. Collect the data and record it in a table. Graph the data on the grid you used in problem 5 using different colors. Explain your results and conclusions.

7. Repeat the experiment. This time, loosen the cap of the bottle when you remove the masking tape from the hole.
8. Repeat the experiment using different sized bottles.
9. Repeat the experiment with different sized holes.