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STUDENT VERSION
Wet Cloth Drying

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STATEMENT

A very common phenomenon is the drying of a face cloth or wash cloth. As time goes on the mass of the water in the cloth decreases. But at what rate does it decrease? What physical assumptions might you make to build a differential equation for $W'(t)$, the rate of change in the mass of the wash cloth over time. That is, what could you put on the right hand side of (1)?

$$W'(t) = \quad ? \tag{1}$$

We conducted an experiment for you and collected data for which you can build a differential equation model for $W(t)$ the mass (in grams) of the water in the cloth at time t (in minutes). The apparatus we used is shown in Figure 1. This data is found in a spreadsheet under "Additional materials" in the same place where you found the Modeling Scenario, 1-107-S-ClothDry-StudentVersion. Figure 2 shows a plot of this data.

Activities

1. Build a mathematical model for $W'(t)$, being sure to state all your assumptions.
2. Solve your model differential equation for $W(t)$ and play with the parameter values to obtain some plots of $W(t)$ vs. t. Compare your plots to the data.
3. Use the data to determine the best values of your parameters and plot your resulting model along with the data to compare your model with the data.
4. Look at the shape of the data and improve your model, perhaps explaining the change in the nature of the shape of the plot in Figure 2.

Figure 1. Apparatus used to collect data for drying cloth. Cloth is suspended over wire coat hanger stand taped to an Ohaus Scout Pro scale which is connected to a computer via Vernier Software to record data (mass of configuration in grams) over time. In our case this was every 7 minutes.

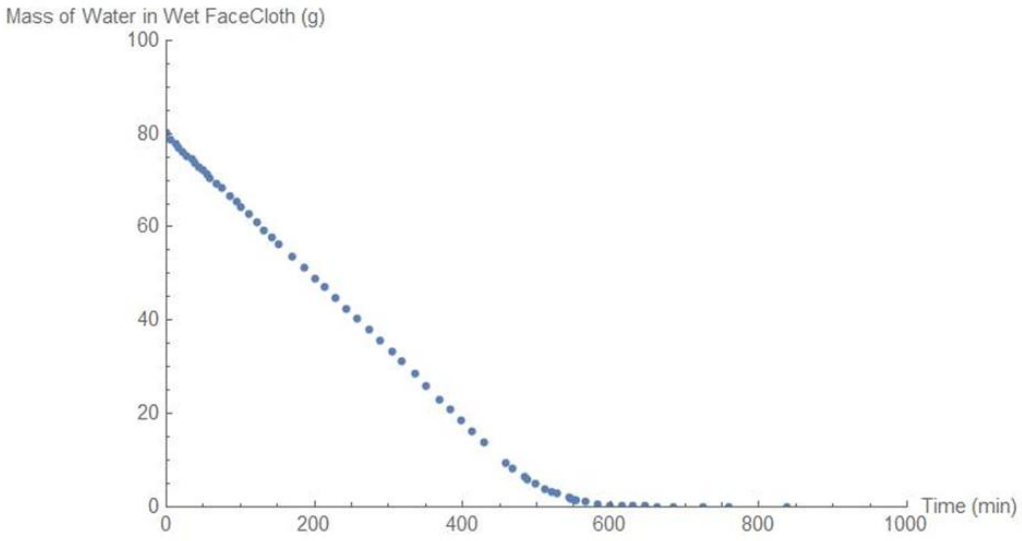

Figure 2. Plot of the data from collection of mass of water in wet cloth.

5. Discuss (perhaps conduct your own experiment) other configurations of the cloth in the evaporation process which might prove interesting.