Sand is flowing through an hourglass. The hourglass is made up of two right circular cones with base radius 4 inches and height 6 inches. When all of the sand ends up in the lower cone, it reaches to a height of 3 in.

1. How much sand is there in the hourglass (in cubic inches)?

2. If you were to flip the hourglass over, how high would the sand be in the cone? This will be different than the previous answer, because it is now resting against the point of the cone instead of the base.

3. As the sand drains into the lower cone, the height of the sand in the upper cone reaches 2 in above the tip. At this moment, the height is decreasing at a rate of 1 inch per minute. How fast is the height of the sand in the bottom cone increasing at this moment?

   Hint: You'll want to write equations for the volume of sand in both the top and bottom cones as a function of the height. Then, you can use related rates, along with the fact that the rate of sand leaving the top cone is the same as the rate of sand entering the bottom cone in order to get this answer.