Project 1: Measuring Temperature & Newton's Law of Cooling
Pound Cake Experiment Data

Wendy Hines shared with us her experience of making pound cake with her daughter Elly. Wendy and Elly made pound cake awhile ago and measured the temperature of the pound cake at regular time intervals (see Section 4.1: Pound Cake Complications). Below is the data they collected. You might find it helpful to look at their data when answering your questions about the cooling of pound cake.

Time (mins)	Temperature of Cake (C)
0	96
5	96
10	93
15	88
20	81
25	76.5
30	73
35	70.5
40	68
45	65.5
50	63.25
55	61
60	59.5
65	57.75
70	56
75	54.5
80	53.5
85	51.5
90	50
95	49
100	48

Wendy mentioned a few things that affected the cooling of the cake:

1. She forgot to turn the oven off for awhile and so that was keeping the room temperature higher. The room temperature dropped a bit when she finally did turn the oven off.

2. Wendy's husband, who was watching the Superbowl in the basement and drinking a lot of beer, was in charge of the times. A little while after the 4th reading, Wendy went down there and said, "Hasn't it been 5 minutes yet?" and he said, "What?! I was supposed to keep doing it?"

3. Wendy opened the back door to take out the beer bottles to the recycling tub and this let into the house a lot of cold air.

4. The cake wasn't cool enough before Elly had to go to bed. So, they cut the cake with the thermometer still in it. (This shouldn't have made too much of a difference since they cut the cake far from the thermometer and pound cake is very thick.)

5. Elly banged into the thermometer with her arm and pushed it very askew.

Normally, of course, the experiment would have been done in a carefully controlled environment and we would have been able to use the data to get some more accurate information about the cooling rate for this type of pound cake. Then we could use that to generate a model for the temperature of pound cake, maybe even in more complicated environments. Then if we found a random pound cake sitting on the sidewalk, we could use our model to estimate what time that the pound cake came out of the oven.

Notice how the data for the pound cake behaves quite differently than that for the coffee experiment for the first 5 or 10 minutes. What do you think of this? Do you think it's because of the inaccuracies of the experiment or because there is something intrinsically different about how a pound cake cools at first versus how a cup of coffee cools at first? Explain.