Understanding Distance, Velocity, and Acceleration

Ok...let's keep it simple. In this short "lesson" we will measure distance in **miles** and time in **hours**.

Distance is the easiest of the three concepts. It is simply how far we go. Suppose we travel from Berlin to Gorham. We will have traveled a distance of about 6 **miles**. Notice the "label" on a distance problem is simply **miles**. We could also say that the distance from Gorham to Berlin is negative 6 miles! We call these **directed distances**. Of course the total round trip distance would be 12 miles. To get total distance, you add the absolute values of the directed distances. $|6| \quad | \quad 6| \quad 12.$

Now, as we travel from Berlin to Gorham our "**velocity**" will probably vary along the way due to traffic conditions, traffic lights, speed limits, etc. Velocity is basically a measure of how fast we are going at a certain time. Velocity also indicates "direction". So for example, we might say that at a certain moment during our journey our velocity is $40\frac{mi.}{hr.}$. We read this as "40 miles per hour." Since it is positive $40\frac{mi.}{hr.}$ that means we are heading in the direction of Gorham. If we forgot something and headed back to Berlin, we might say that our velocity is now something like $30\frac{mi.}{hr.}$. That means we are traveling "30 miles per hour" towards Berlin. The negative sign indicates the direction is back towards Berlin.

Now, not to confuse the issue, but if we introduce the word **speed**, that means we are only interested in how fast we are going and the direction is irrelevant. So in the first case our speed would be $40\frac{mi.}{hr.}$ and in the second case our speed would have been $30\frac{mi.}{hr.}$.

Finally, **acceleration**. Acceleration is labeled $\frac{\frac{mi.}{hr.}}{hr.}$ or more commonly written $\frac{mi.}{hr.^2}$. We read this as either "miles per hour per hour" or "miles per hour squared". Acceleration is an indication of how our velocity is changing as we drive along. If we are getting faster as we travel from Berlin to Gorham, the accelerartion is positive. If we are slowing down as we travel from Berlin to Gorham, the acceleration is negative. Here is an example. Let's say we are headed for Gorham at a speed of $10\frac{mi.}{hr.}$. That means our velocity is **positive** $10\frac{mi.}{hr.}$. Now, let's say our acceleration is $2\frac{mi.}{hr.^2}$. That means for each extra hour traveling, our speed (velocity) increases by $2\frac{mi.}{hr.}$. So, after one hour we would be traveling at a **rate** of $12\frac{mi.}{hr.}$, then after another hour it would be $14\frac{mi.}{hr.}$. Of course after all that time, we would be well past Gorham!

Now here is a critical thinking question for you. Suppose we were traveling **towards** Berlin at a **speed** of $50\frac{mi.}{hr.}$ and had an acceleration of $20\frac{mi.}{hr.^2}$. Would we be slowing down or getting faster?