The S-Shaped Curve

Let's consider a trip to the store, stripped down to its simplest components:

- You start at rest (v = 0).
- You accelerate at a constant rate (a = constant), up to your cruising speed.
- You continue driving to the store at your cruising speed (v = constant; a = 0).
- You then have to brake (deaccelerate *or* decelerate *or* negative acceleration - all mean the same thing) at a constant rate (a = -(constant)) until you come to a stop.
- At the store, you are parked (v = 0; a = 0).

Each of these comments defines what happens on the graphs of **d vs. t**, **v vs. t** and **a vs. t**. In particular, we find that there are only three choices:

- There is no motion (**d vs. t** is flat-lined; **v vs. t** and **a vs. t** are zero).
- There is uniform motion (**d vs. t** is linear; **v vs. t** is a flat-line, **a vs. t** is zero).
- There is constant acceleration (**d vs. t** is a parabolic curve, **v vs. t** is linear, **a vs. t** is a flat-line).

The S-Shaped Curve is so named because of the shape of the **d vs. t** graph. If you can remember how these three graphs look and how each of the time regions relate to each other, then you know nearly everything that we need to know about graphs.

The Return Trip

Returning from the store gives us two choices for point of view of the graphs:

- We can look at the return trip in terms of the *position*, or how far we are from the starting place. This point of view worries about *direction*. In this case, the three graphs are *position* versus time, *velocity* versus time and *acceleration* versus time.

- We can look at the return trip in terms of the *distance* we have traveled, just like the odometer on your car. In this case the three graphs are *distance* versus time, *speed* versus time and *acceleration* versus time.

These graphs are sketched below to show the difference. Note the use of negative values for velocity and acceleration. It is important to always be aware of what negative velocities and negative accelerations imply.