2. Sketch the worldline of a particle that moves with a constant acceleration for $t < 0$ and for $t > 0$ and passes through the origin at $t = 0$.

3. Plot the worldline for an automobile that is initially rest at $x = 0$, begins to accelerate at $t = 0$ and maintains a constant acceleration of 3 m/s² until it reaches a final speed of 25 m/s, and then brakes with a constant deceleration of 9 m/s² until it is again at rest.

4. Consider a particle bouncing back and forth elastically (with constant speed) between two rigid walls at $x = 0$ and at $x = L$. Draw the worldline for this particle.

7. Draw the grids of x,t and x',t' axes, as in Fig. 1.8, and on this grid draw the worldline of a particle that bounces back and forth elastically between two "walls" at rest in the spaceship frame at the points $x' = 0$ and $x' = L$. Note that in the reference frame of the spaceship, this particle has constant speed, with $v'_x = \pm v'$.

8. An alien spaceship traveling toward the Earth at 1.5×10^8 m/s (that is, half the speed of light) launches a probe toward the Earth. In the reference frame of the spaceship, the speed of the probe is 2.5×10^8 m/s. According to the Galilean addition law, what is the speed of the probe relative to the Earth? If astronomers on the Earth are observing the spaceship with a telescope, can they see this probe before it hits them?

16. Suppose that in the ether frame the Earth has a velocity **V** and a ray of light approaches the Earth at an angle θ with respect to the direction of the velocity.
(a) Show that in the reference frame of the Earth, the angle of approach of the ray of light is θ', with

$$\tan \theta' = \frac{\sin \theta}{\cos \theta + V/c}$$

(b) This formula gives us the aberration of starlight. If $\theta = 90^0$ (for starlight from a star located directly above the orbit of the Earth), what is the deviation of θ' from 90^0?