1. Consider a vehicle powered by converting the mass of one kilogram (2.2 pounds) of nuclear fuel completely into energy. Determine how many gallons of gasoline would be required by a conventional engine in order to do the same job. If you express a mass in kilograms, and take the velocity of light as $3 \times 10^8$ meters per second, the energy in Einstein's expressions will come out in joules. A gallon of gasoline delivers approximately $1.1 \times 10^8$ joules when it is burned in the conventional way.

2. A clock on a rocket passes you with a speed of $v = .98c$.
   (a) What is the value of $\gamma$?
   (b) According to your watch, how long does it take the moving clock's second hand to make one complete revolution?
   (c) How long does a meter stick on the rocket appear to be to you?

3. The star $\alpha$-Centuri is 4 light years from earth.
   (a) To an observer on earth, how long (time) does it take a light beam to reach $\alpha$-Centuri?
   (b) The rocket travels at $v = .98c$. To an observer on the rocket, how long does she claim $\alpha$-Centuri is from earth?
   (c) How much time does she claim it takes for her to go from earth to $\alpha$-Centuri? (Be careful with this one!)
   (d) If an observer could travel at the speed of light, how much time would she claim it took to reach $\alpha$-Centuri? (This is a good one!)

4. How fast must Velma move past Mort if Mort is to observe her spaceship's length to be reduced by 50%? If Velma is flying over the United States (about 5000 km wide) at this speed, how wide will she observe the United States to be?

5. A meter stick with a rest-mass of 1 kg moves lengthwise past you. Your measurements show it to have a mass of 2 kg. How long is this meter stick relative to you?

6. The correct equation for addition of speeds is
   \[ v = \frac{v' + u}{1 + \frac{uv}{c^2}} \]
   Consider the rocket and platform approaching each other at a relative speed of 90% the speed of light. A projectile on the rocket is launched towards the platform at a speed relative to the rocket of 0.7c. What speed does the platform observer see for the projectile? Make sure you clearly label what $v'$, $u$, and $v$ are for this problem.