1. Consider two events in the S frame, where $ct_1 = 3$ and $ct_2 = 10$.

   (a) Calculate $c\Delta t$.
   (b) Provide values of x_1 and x_2 that would lead to interval being *timelike*. Give actual numbers.
   (c) Provide values of x_1 and x_2 that would lead to interval being *spacelike*. Give actual numbers.
   (d) Provide values of x_1 and x_2 that would lead to interval being *lightlike*. Give actual numbers.

2. True or False: Two events are spacelike. The two events are therefore causally related. (That is, one can be the cause of other to happen.)

3. Finish the problem from the end of class on Friday. Calculate $p_{initial}$ and p_{final} in the second (unprimed) frame.

   Is momentum conserved?

4. Block A of mass 1.6kg moves to the right at 4m/s on a frictionless, horizontal track. Block B of mass 2.1kg moves to the left at 2.5 m/s. Blocks A and B collide. After the collision, block B is moving at 3.12 m/s to the right.

   (a) Calculate the velocity of A after the collision.

   (b) Was this an elastic or inelastic collision? Show a calculation to support your answer.

   (-3.38 m/s. elastic... you'll have to come up with the calculation)

5. Consider the relativistic form of momentum $p = \gamma_\mu mu$, where $\gamma_\mu = \frac{1}{\sqrt{1-(u/c)^2}}$.

   Show that the classical momentum is recovered in the limit that $u/c \ll 1$.

6. What does it mean for a physical property to be invariant? To answer, provide a definition of invariant and an example of a property that is invariant. (For example, is the length of an object invariant?)

   How about conserved? Provide a definition for conserved and an example of a physical property that is conserved.

7. Make bulleted list of main ideas we covered in special relativity. For each item, write a short phrase or sentence describing the idea *and* an equation. You should have 10 ± 3 items.

8. A few things to recall about electromagnetic (EM) waves from introductory physics:

   (a) Calculate the wavelengths of a
   100MHz FM radio wave
   5 GHz Wifi signal
   1 EHz x-ray

   (b) Classically, what properties determine the rate at which an EM wave transports energy? Does it depend on speed, frequency, wavelength, electric field strength, or.... ? An equation is helpful. (You can look this up. It's best to look up the intensity which has units of power/area [W/m^2].)

9. Try out the blackbody radiation app. What temperature results in the peak appearing at 450nm (blue)? 600nm (yellow)? 700nm (red)?

10. The human eye is sensitive to wavelengths of 400nm to 700nm. What is the corresponding range of photon energies? Give this in Joules.

    from Wolfson

11. Find the energy in electron volts (eV) of a
    (a) 1 MHz radio photon
    (b) 3×10^{18}Hz x-ray

    from Wolfson

12. Play around with the photoelectric effect app. You should be able to change the wavelength and the intensity (brightness, photon density).

    (a) What will increase the number of electrons ejected?
    (b) What will increase the energy of the ejected electrons?