1 Shooting a Box

Suppose the spaceship is approaching the Earth at $3c/5$ and shoots a box at a speed of $4c/5$ (from the spaceship's perspective).

(a) At what velocity will an Earth-bound observer see the box if it is shot directly **towards** the Earth?

(b) *Sensemaking: Reasonable Value*
Briefly discuss why (or why not) your answer seem reasonable.

2 Zapping with d

Zap the following equations with "d":

(a) $f = 3x^3 - e^{2x}$

(b) $g = \sin(y^2)$

(c) $5z^4 = \ln(p)$

3 Relativistic Explosion

A lump of clay with mass M explodes into two equal pieces m moving directly away from each other.

(a) What is the speed of each of the pieces after the explosion?

(b) *Sensemaking: Check a Special Case*
Conceptually, what would you expect the speed of the lumps to to be if $m = \frac{M}{2}$? Show that your answer to part (a) works for this special case.

(c) What is the relativisic kinetic energy of each of the pieces?

4 Moving Clocks Run Slow

Imagine that you have a light clock with a period T (1 "tick" takes time T).
Another observer moves relative to you with velocity $+V$

(a) Draw a spacetime diagram of 1 tick of the your light clock.

(b) What are the spacetime coordinates of the end of the "tick" of your light clock in:

  (a) Your reference frame?

  (b) The other observer's frame?

(c) Now image that the other observer has an identical light clock. Draw a **new** spacetime diagram of 1 "tick" of the other observer's light clock.

(d) What are the spacetime coordinates of the end of the "tick" of the other observer's light clock in:

(a) The other observer's frame?

(b) Your reference frame?

(e) *Sensemaking: Tell a Conceptual Story*
Imagine that one of your classmates says, "Moving clocks run slow." Do you agree? Explain your reasoning.