

Homework 2 Statements

Tuesday, 11 September 2007

Problem 1 – A-2 Find $\sqrt{401}$ using the binomial approximation. *Hint: First write $(401)^{1/2} = (400 + 1)^{1/2} = (400)^{1/2}(1 + 1/400)^{1/2}$.*

Problem 2 – 4-4 A spacetraveler with 40 years to live wants to see the galactic nucleus at first hand. How fast must the traveler travel? Express your answer in the form $v/c = 1 - \epsilon$, where ϵ is a small number. [We are $8.5 \text{ kpc} = 8.5 \times 10^3 \text{ pc}$ from the center of our galaxy. One parsec (pc) = 3.26 c y .] *Hint: See Appendix A.*

Problem 3 – 4-7 A spaceship leaves the solar system at speed $v = \frac{3}{5}c$, headed for the star Sirius, 10 c y away. Assume that the Sun and Sirius are mutually at rest, and that their clocks have been previously synchronized, both reading zero when the spaceship leaves. (a) What will the clock on Sirius read when the ship arrives? (b) What will the clock on the ship read when it arrives, assuming it began at zero? (c) In the ship's frame of reference, what will the Sun's clock read when the ship arrives?

Problem 4 – 4-10 The Sun and another star are 60 light-years apart and are at rest relative to one another. At time $t = 0$ (on both the Sun clock and the spaceship clock) a spaceship leaves the Sun at velocity $v = \frac{4}{5}c$ headed for the star. Just as the ship arrives, a light-signal from the Sun indicates that the Sun has exploded. (a) Draw a set of three pictures in the rest-frame of the Sun and star for the three important events in the story, *i.e.*, at the time of the ship departure, the Sun explosion, and the ship arrival. Each picture should show the Sun, the star, and the ship. Then answer the following questions, all from the point of view of observers at rest in the Sun-star frame. (b) When the ship arrives, what does the star clock read? (c) When the ship arrives, what does the ship clock read? (d) When the ship arrives, what does the Sun clock read? (e) When the Sun explodes, what do clocks on the Sun, the star, and the ship read?