PH2102 Problem Set 1

Q 1) Agent X is on a secret mission to the star α-Centauri, 4.5 light-years away. Enemy agent Y, desperate to stop her, manages to plant a time bomb, set to go off six months after take-off, on X's interstellar ship. Agent X manages to discover the bomb immediately after take off - but unfortunately her mission to α-Centauri is critical and can not be aborted - and the technology to defuse the bomb is available only back on earth. How fast must the ship travel so that X can land safely back home after a round trip before the bomb goes off? Assume that the (brief) periods of acceleration during take-off, turnaround (at α-Centauri) and landing have no effect on the bomb. Also assume that the ship's speed with respect to earth is the same on both halves of the journey

Q 2) Alice has two clocks - one at her origin and another 8 light-hours away - which she has synchronized. Bob rushes past her (in the direction of the second clock) on a rocket ship at a speed of $0.8c$ at the moment her furst clock (the one at her origin) is showing 0, and sets his own clock to 0 at that instant. What do Bob's and Alice's clocks show when he is just beside the second clock? From these clock readings calculate the speed of Alice's clocks as observed by Bob. *Do not assume that Alice's speed is 0.8c in the other direction - show that this follows from Bob's measurements.*

Explain how Bob can reach the conclusion that Alice's clocks are running slow compared to his own - despite your answer to the last part!