

PHSX 343: Assignment 3

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Problem 1

a) Homework3/homework 3.PNG

To help get the location of the ship let's write the line it follows. Through simple geometry we get $ct = -\frac{4}{3}x + \frac{64}{3}$. Since light always travels with a slope of 1, event B will arrive at $ct = 16$. Event C happens half an hour later, at $t = 16.5$. Using a new line for the light leaving C, $ct = x + 16.5$, the intercept becomes $x = 2.07$, $ct = 18.6$. We can do our best to draw a quadratic deceleration to $ct = 24.6$ as the ship comes in to land.

b)

$$x = x_0 + vt + \frac{1}{2}at^2 \rightarrow -2.07(c * hr) = -0.750c(6hr) + \frac{1}{2}a(6hr)^2$$

$$-2.07 = -0.750(6) + \frac{1}{2}a(36hr) \left(3600 \frac{s}{hr}\right) \left(\frac{1}{c}\right)$$

$$\frac{2c * (-2.07 + 0.75(6))}{(36)(3600)} = a \left[\frac{m}{s^2}\right]$$

$$a \approx 1.12 \times 10^4 \frac{m}{s^2} \approx 1.15 \times 10^3 g$$

Problem 2

a) Homework3/homework 3.1.PNG

b) The two clocks will not necessarily read the same time as all our rules pertain to inertial frames, but the P frame is accelerating back towards $x = 0$, so it is not inertial.

c) • Coordinate Time:
O and A define a coordinate time as they are both inertial and one at each event

Q is also defines a coordinate time as it is present at each event and traveling at a constant speed.

P does not define a coordinate time as it is not an inertial frame

- Proper Time:

O and A do not define a proper time as they are different clocks at different events

Q and P each independently define proper time as they are each at the event and are one clock. The definition does not include needing to be inertial.

- Δ/c :

Q is the only clock that defines $\frac{1}{c}$ time as it is the only clock that is at both events and is inertial.

Problem 3



Homework3/homework 3.2.PNG

$$v = \frac{1500m}{2.00 \times 10^{-6} * c} = 2.5c$$

To be at both the origin and event A, something would have to travel 2.5 times the speed of light, so a light pulse could not travel between the two.