W1.11-H

"Will the passenger catch the train?"

NICE NUMBERS

A late passenger, sprinting at 5 m/s, is 18 m away from the rear end of a train when it starts out of the station with an acceleration of 0.25 m/s^2. Note: the platform is infinite in length.

(a) When will the person be next to the rear of the train?
(b) Sketch at position verses time graph for the above situation. (No numbers)
(c) What is the greatest acceleration the train can have and still have the person reach the rear?
(d) What is the smallest velocity that the passenger can have to just catch the train if it has an acceleration of 0.25 m/s^2?
    i. At what time will the passenger catch the train at this speed?
    ii. How far will he have run?

W1.11-H

"Will the passenger catch the train?"

NICE NUMBERS

A late passenger, sprinting at 5 m/s, is 18 m away from the rear end of a train when it starts out of the station with an acceleration of .25 m/s^2. Note: the platform is infinite in length.

(a) When will the person be next to the rear of the train?
(b) Sketch at position verses time graph for the above situation. (No numbers)
(c) What is the greatest acceleration the train can have and still have the person reach the rear?

$$\vec{s}_{f_{train}} = \vec{s}_{0\,train} + \vec{v}_{0_{train}}(t) + 1/2(\vec{a}_{train})t^2 = \vec{s}_{0\,passenger} + \vec{v}_{0_{passenger}}(t) + 1/2(\vec{a}_{passenger})t^2 = \vec{s}_{f_{passenger}}$$

$$\left[\left(1/2(\vec{a}_{train})t^2\right) - \left(1/2(\vec{a}_{passenger})t^2\right)\right] + \left[\left(\vec{v}_{0_{train}}(t)\right) - \left(\vec{v}_{0_{passenger}}(t)\right)\right] + \left[\vec{s}_{0_{train}} - \vec{s}_{0_{passenger}}\right] = 0$$

$$\left[\left(1/2(\vec{a}_{train})\right) - \left(1/2(\vec{a}_{passenger})\right)\right]t^2 + \left[\left(\vec{v}_{0_{train}}\right) - \left(\vec{v}_{0_{passenger}}\right)\right](t) + \left[\vec{s}_{0_{train}} - \vec{s}_{0_{passenger}}\right] = 0$$

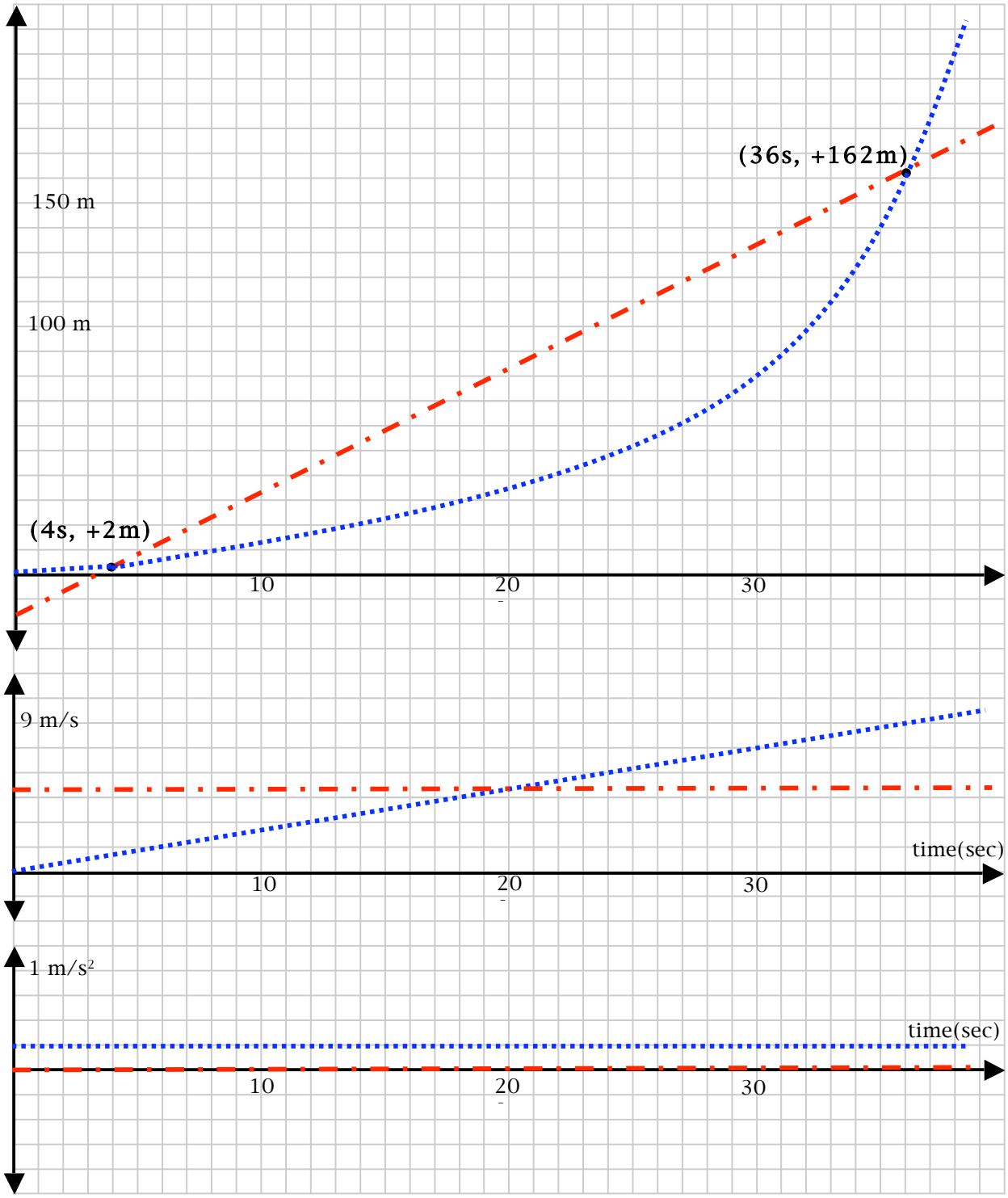
$$At^2 + B(t) + C = 0$$

$$A = \left[\left(1/2(\vec{a}_{train})\right) - \left(1/2(\vec{a}_{passenger})\right)\right] \qquad B = \left[\left(\vec{v}_{0_{train}}\right) - \left(\vec{v}_{0_{passenger}}\right)\right] \qquad C = \left[\vec{s}_{0_{train}} - \vec{s}_{0_{passenger}}\right]$$

$$t = \frac{-\left[\left(\vec{v}_{0_{train}}\right) - \left(\vec{v}_{0_{passenger}}\right)\right] \pm \sqrt{\left[\left(\vec{v}_{0_{train}}\right) - \left(\vec{v}_{0_{passenger}}\right)\right]^2 - 4\left[\left(1/2(\vec{a}_{train})\right) - \left(1/2(\vec{a}_{passenger})\right)\right]\left[\vec{s}_{0_{train}} - \vec{s}_{0_{passenger}}\right]}}{2\left[\left(1/2(\vec{a}_{train})\right) - \left(1/2(\vec{a}_{passenger})\right)\right]}$$

$$t = \frac{5m/s \pm 4m/s}{.25m/s^2} \qquad t = 4\,\text{sec} \qquad t = 36\,\text{sec}$$

W1.11-H


150 m
100 m
(36s, +162m)
(4s, +2m)
10
20
30
9 m/s
time(sec)
10
20
30
1 m/s²
time(sec)
10
20
30