Kinematics
Using the Kinematics Equations

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Last time

- more about graphs of kinematic quantities
- kinematic equations

Overview

- practice using kinematic equations

Using the Kinematics Equations

Example Drag racers can have accelerations as high as 26.0 m/s^2. Starting from rest ($\vec{\mathbf{v}}_i = 0$) with that acceleration, how much distance does the car cover in 5.56 s?

Before we start answering...

Using the Kinematics Equations

Process:

1. Identify which quantity we need to find and which ones we are given.
2. Is there a quantity that we are not given and are not asked for?
    1. If so, use the equation that does *not* include that quantity.
    2. If there is not, more that one kinematics equation may be required or there may be several equivalent approaches.
3. Input known quantities and solve.

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[1] OpenStax Physics

Using the Kinematics Equations

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What equation should we use?

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$$\overrightarrow{\Delta \boldsymbol{r}} = \vec{\mathbf{v}}_\mathbf{i} t + \frac{1}{2} \vec{\mathbf{a}} t^2$$

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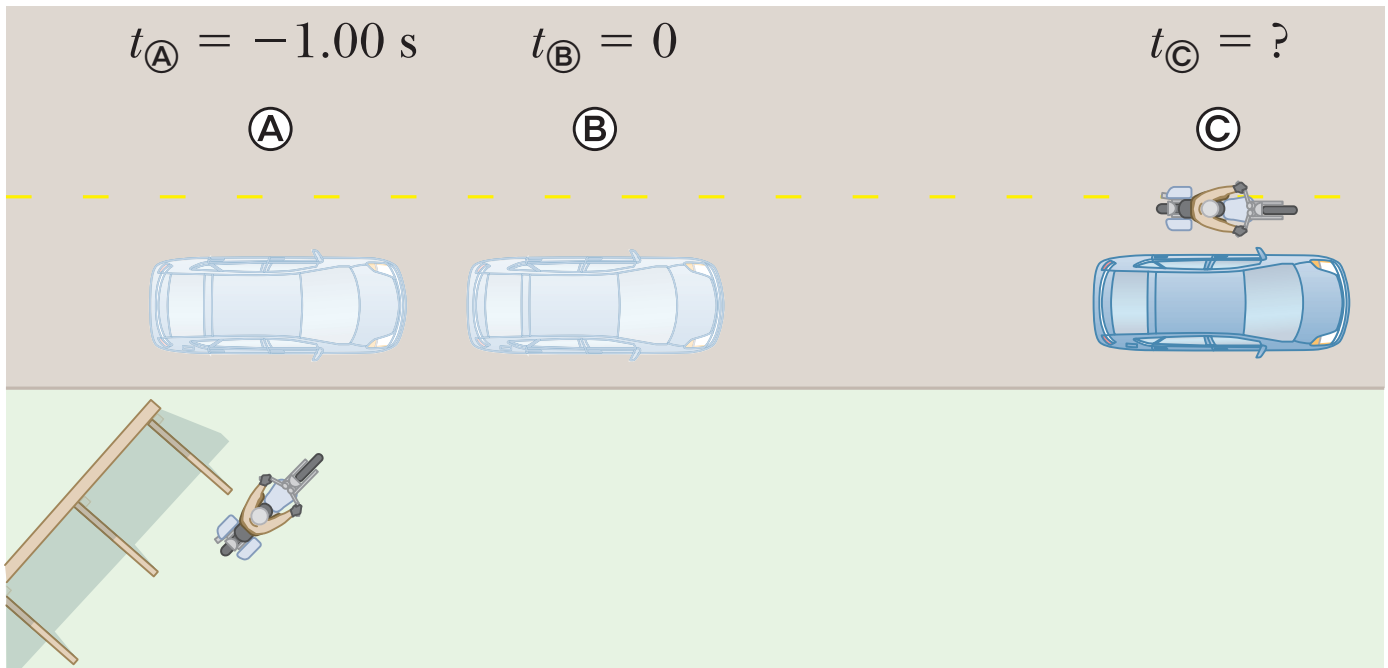
$$\begin{aligned} \Delta x &= \frac{1}{2} a_x t^2 \\ \Delta x &= \frac{1}{2}(26.0 \text{ ms}^{-2})(5.56 \text{ s})^2 \\ &= \underline{402 \text{ m}} \end{aligned}$$

[1] OpenStax Physics

Using the Kinematics Equations, Ex 2.8

A car traveling at a constant speed of 45.0 m/s passes a trooper on a motorcycle hidden behind a billboard. One second after the speeding car passes the billboard, the trooper sets out from the billboard to catch the car, accelerating at a constant rate of 3.00 m/s^2. How long does it take the trooper to overtake the car?



[1] Serway & Jewett, pg 39.

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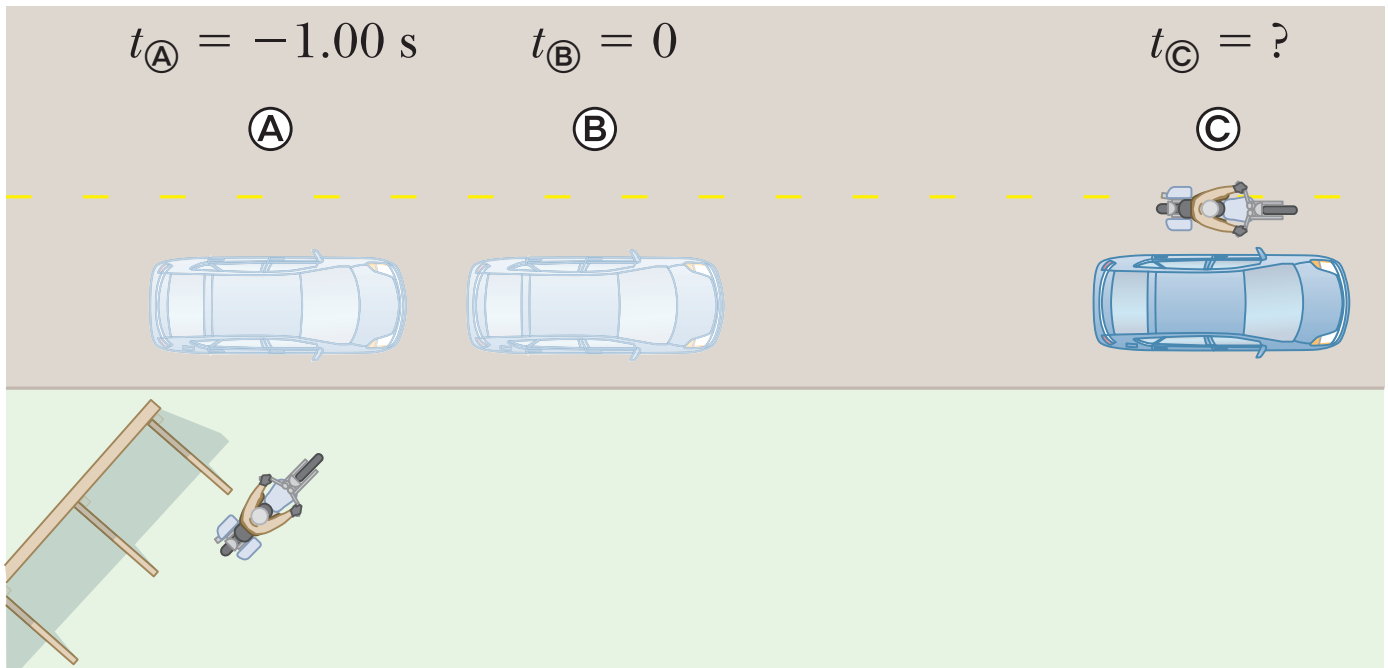

Answer: $t = 31.0$ s

[1] Serway & Jewett, pg 39.

Summary

- using the kinematic equations

Assignment due Thursday, Jan 16.

(Uncollected) Homework Serway & Jewett,

- Ch 2, onward from page 49. Probs: 53, 56