

Kinematics Homework Problems

G2.1. A bird can fly 15 km/h. How long does it take to fly 75 km?

Solution:

$$v = \frac{dx}{dt} \Rightarrow \Delta t = \frac{dx}{v} = \frac{75 \text{ km}}{15 \text{ km/h}} = 5 \text{ h}$$

G2.15. A car traveling 90 km/h is 100 m behind a truck traveling 75 km/h. How long will it take the car to reach the truck?

Solution:

$$90 \frac{\text{km}}{\text{h}} = 90 \frac{1000 \text{ m}}{3600 \text{ s}} = 25 \text{ m/s}$$

$$75 \frac{\text{km}}{\text{h}} = 75 \frac{1000 \text{ m}}{3600 \text{ s}} = 20.83 \text{ m/s}$$

Choose the car's initial position $x'_0 = 0$ m. Then the truck's initial position is $x'_0 = 100$ m. Both vehicles move at a constant speed. After time Δt , their position will be the same and the car will have reached the truck. Thus:

$$\begin{aligned} x' &= x'_0 + v' \Delta t = x''_0 = x'_0 + v'' \Delta t \\ \Rightarrow 0 + (25 \text{ m/s}) \Delta t &= 100 \text{ m} + (20.83 \text{ m/s}) \Delta t \\ (25 \text{ m/s} - 20.83 \text{ m/s}) \Delta t &= 100 \text{ m} \\ \Delta t &= \frac{100 \text{ m}}{4.17 \text{ m/s}} = 24 \text{ s} \end{aligned}$$

G2.23. A sports car is advertised to be able to stop in a distance of 55 m from a speed of 100 km/h. What is its acceleration in m/s^2 ? How many g 's is this ($g = 9.80 \text{ m/s}^2$)?

Solution:

Convert units:

$$100 \frac{\text{km}}{\text{h}} = 100 \frac{(1000 \text{ m})}{(3600 \text{ s})} = \frac{1000}{36} \text{ m/s} = 27.8 \text{ m/s}$$

$$v^2 - v_0^2 = 2a\Delta x$$

$$\Rightarrow a = \frac{v^2 - v_0^2}{2\Delta x} = \frac{0 \text{ m/s}^2 - (27.8 \text{ m/s})^2}{2(55 \text{ m})} = -7.0 \text{ m/s}^2$$

$$\Rightarrow a = 0.7143g$$

G2.27. A particle moves along the x axis. Its position as a function of time is given by $x = 6.0t + 8.5t^2$, where t is in seconds and x is in meters. What is the acceleration as a function of time?

Solution:

$$a = \frac{dv}{dt} = \frac{d}{dt} \left(\frac{dx}{dt} \right) = \frac{d}{dt} (6.0 + 2(8.5)t) = 17 \text{ m/s}^2$$

G2.29. A car accelerates from 12 m/s to 21 m/s in 6.0 s. What was its acceleration? How far did it travel in this time? Assume constant acceleration.

Solution:

$$v_i = 12 \text{ m/s}$$

Chapter 13: Integral Domains . learn how to prove abstract algebra theorems and under- .

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Course description: The goal of the course is to introduce the basic concepts of (abstract) algebraic structure and techniques.

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