

Chapter 1 is basically about simple math that students need for the course.

Chapter 2: One dimensional kinematics for a single object.

The concept of position is introduced. Average and instantaneous velocity and acceleration are defined for one dimensional motion.

The goal of kinematics is to obtain the "equation of motion", which mathematically describes the position of the object as a function of time.

One dimensional kinematics equations are obtained for system with constant acceleration. Applications of these equations are considered.

- Distance: total length of travel
- Displacement: change in position vector
- Average speed is distance/time
- Average velocity is displacement/time
- Instantaneous velocity: average velocity measured over an infinitesimally small time
- Instantaneous acceleration: average acceleration measured over an infinitesimally small time
- Average acceleration: change in velocity divided by change in time
- Deceleration: velocity and acceleration have opposite signs

- Constant acceleration: equations of motion relate position, velocity, acceleration, and time
 - Freely falling objects near surface of the earth: constant downward acceleration of $\vec{a} = -g\hat{y}$.
-

Examples of problems include:

One dimensional motion with constant acceleration,

Free-fall problem and others.

Sample question :

Note:

On the actual test, questions will be in multiple-choice format.

1. One dimensional kinematics for a single object.

Consider a free-fall problem:

Consider up as the $+\hat{y}$ direction.

A rock at the origin ($y=0$) is released from rest at the top of a 100m-tall building. Draw a picture.

1. Find the displacement vector.

2. Find the speed of the rock at impact.

3. Find the time interval of the fall to the ground.

$$1. y_f = -100\text{m}, y_i = 0\text{m}$$

$$\Delta y = -100\text{m} - 0\text{m} = \boxed{-100\text{m}} \hat{y}$$

$$2. v_f^2 = v_i^2 + 2a_y \Delta y$$

$$= 0 + 2(-9.8 \frac{\text{m}}{\text{s}^2})(-100\text{m})$$

$$= 196 \times 100 \frac{\text{m}^2}{\text{s}^2} = 19600 \frac{\text{m}^2}{\text{s}^2}$$

$$|v_f| = \sqrt{19600} = \boxed{44.27 \frac{\text{m}}{\text{s}}} = \text{speed}$$

$$3. v_f = v_i + a_y t_{\text{fall}}, t_{\text{fall}} = \frac{-44.27 \text{ sec}}{-9.8} = \boxed{4.517 \text{ sec}}$$

