

1) A ball rolls along a flat level surface. The position of the ball (in meters) is given by the following: $\mathbf{x(t) = 5t + 5}$. Note that t is measured in seconds.

- a) What is the instantaneous and average velocity of the ball while it is on the level surface?
- b) What is the acceleration of the ball?
- c) How much time does it take the ball to roll 10 m?
- d) How far does the ball roll in 5 seconds?
- e) Sketch a position vs. time graph for the ball while it is rolling.
- f) Sketch a velocity vs. time graph for the ball while it is rolling.

2) A bass swims along a straight line with a velocity given by: $\mathbf{v = v(t) = 3.5\ m/s}$.

- a) What is the acceleration of the fish?
- b) What is the position of the fish as a function of t ?
- c) How much time does it take the bass to swim 5 m?
- d) How far does the bass swim in 3 seconds?
- e) Sketch the position vs. time graph for the bass during this motion.
- f) Sketch the velocity vs. time graph for the bass during this motion.

3) A coin, initially at rest, is dropped from an elevated position and freely falls to the ground with an acceleration of -9.8 m/s^2 .

a) How fast is the coin traveling after 5 seconds?

b) How far does the coin fall after 5 seconds?

c) How much time does it take the coin to fall 10 m?

d) What is the velocity of the coin after it has fallen 10 m?

4) A ball, initially at rest, rolls down a hillside with constant acceleration (down the hill) of 2.5 m/s^2 .

a) How fast is the ball traveling after 5 seconds?

b) How far does the ball travel after 5 seconds?

c) How much time does it take the ball to travel 10 m (down the hill)?

d) What is the velocity of the ball after it has traveled 10 m (down the hill)?

e) What is the average velocity of the ball during this motion?

5) A coin, is tossed upward from an elevated position ($x_0 = 5 \text{ m}$) and freely falls to the ground with a downward acceleration of 9.8 m/s^2 . The coin has an initial upward velocity of 10 m/s .

a) How long does it take the coin to reach its highest point?

b) What is the coin's velocity when it reaches its highest point?

c) How long does it take the coin to reach the ground?

d) What is the velocity of the coin when it reaches the ground?

e) Sketch a position vs. time graph for the coin while it is in the air.

f) Sketch a velocity vs. time graph for the coin while it is in the air.

"Real World" Application

Road & Track magazine test drove a 1995 Corvette Convertible and published the following performance results:

Final Speed (USCS)	40 mph	60 mph	80 mph	100 mph
Speed (SI)	m/s	m/s	m/s	m/s
Time (from rest)	3.0 s	5.5 s	9.2 s	14.5 s

- 1) Convert the above final speed values to SI units and record in the table above.
- 2) What is the acceleration of the Corvette from 0 to 40 mph?
- 3) Treating the acceleration as constant, what is the equation for the position, $x(t)$, of the Corvette as it accelerates from 0 to 40 mph? Assume $x_0 = x(0) = 0$ m.
- 4) What is the displacement of the Corvette as it accelerates from 0 to 40 mph?
- 5) What is the average acceleration from 40 to 60 mph?
- 6) Treating the acceleration as constant, what is the equation for the position, $x(t)$, of the Corvette as it accelerates from 40 to 60 mph?
- 7) How far does the Corvette travel as it accelerates from 40 to 60 mph?
- 8) What is the average acceleration from 0 to 100 mph?
- 9) Using the average acceleration in (7), estimate how long it would take the Corvette to travel $\frac{1}{4}$ mile, starting from rest.
- 10) Estimate the final speed of the Corvette at the end of the quarter mile trial?