Kinematics Test Review

FOR THE TEST, BE ABLE TO:
- Calculate the average velocity and the instantaneous velocity of an object.
- The average acceleration and the instantaneous acceleration of an object.
- Determine the velocity and position at any time when given a position or velocity graph.
- Determine the distance traveled when given a velocity vs. time graph.
- Determine the average and instantaneous acceleration when given a velocity vs. time graph.
- Apply the equations for uniformly accelerated motion.
- Perform vector addition (subtraction) using vector analysis (breaking vectors into x and y components).
- Solve projectile motion problems.
- For this test (and all hereafter) INCLUDE PROPER UNITS.

KNOW HOW TO USE:

$v = v_o + at$

$x = x_o + v_o t + 1/2 at^2$

$v^2 = v_o^2 + 2a(x - x_o)$

average velocity $= (v + v_o)/2$

acceleration of gravity $= 9.8$ m/sec^2 $= 32.2$ ft/sec^2

SAMPLE PROBLEMS:

1. A space craft travelling at 3250.0 m/sec suddenly fires its retro rockets (pointed forward) and the craft starts to slow down at 10.000 m/sec^2. What is the velocity of the spacecraft when the displacement of the craft is +215.00 km relative to the point where the retro rockets begin to fire? [2502.5 m/sec]

2. A person walks 27 degrees north of east for 4.5 km. Then, the person walks 39 degrees west of north for 8.4 km. What is the man's displacement from his starting point? [8.7 km, 8.5 degrees west of north]

3. An astronaut in space experiences the accelerations from three planets as shown below. What is the resultant acceleration acting on the astronaut? [6.36 m/sec^2, 37.5 degrees above the negative x-axis.]
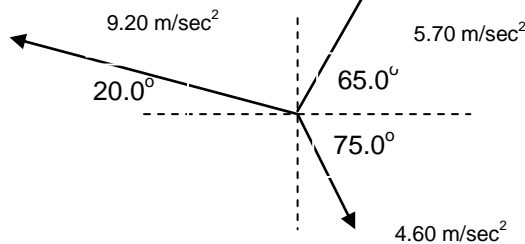
4. A cucumber, traveling at 9.70 m/sec accelerates at –1.80 m/sec^2. How long will it take to get back to the starting point? [10.8 seconds]

5. Myron Wondergaim jogs one lap (440.0 yards) in 2.00 minutes 8.00 seconds. What is his speed in ft/sec? What is his average velocity? [10.3 ft/sec, 0 ft/sec]

6. Travelling at 370.0 m/sec, how long will it take a bullet to travel 147 m to its target? [.397 sec]

7. A man walks 340.0 ft at 2.80 ft/sec, and travels another 340.0 ft at 3.80 ft/sec.
    a.) How long does it take him to cover the 680.0 ft? [211 sec]
    b.) What, then, is his average speed for the trip? [3.22 ft/sec]
    c.) Why isn't his average speed 3.30 ft/sec? Explain.

8. A car cruises steadily at 62.0 ft/sec. 247 feet behind, a patrol car cruises at 89.0 ft/sec. When and where will the patrol car overtake the other? [9.15 sec at 567 ft from the car's start]

9. A man jogs along at 1.70 m/sec. An attack dog, 21.0 m behind, waits for 6.00 seconds, and then takes off at 2.50 m/sec. When and where will contact be made? [45.0 sec at 97.5 m from where the dog starts]

10. How fast will an ostrich egg be falling 6.00 seconds after it is dropped? Assume it is dropped from a height sufficient to allow it to continue to fall after 6.00 seconds. [58.8 m/sec]

11. Noel Ivator jumps straight up at 7.20 m/sec. How long will he remain in the air? [1.47 sec]

12. A rock is fired from a slingshot at 29.0 m/sec, 41.0 degrees above the horizontal. How far away does it land? [85.0 meters]

13. A golf ball leaves the tee, striking the ground 3.70 seconds later 221 feet away. At what angle and with what speed did the ball take off? Remember, the acceleration of gravity here is 32.2 ft/sec^2. [44.9 degrees, 84.4 ft/sec]

14. Freddy Frog makes a super leap at 35.0 ft/sec at an angle of 40.0 degrees to the horizontal. How high up a wall, 20.0 feet away, will Freddy land? He sticks to the vertical wall. [7.88 feet]

15. Bill Melater kicks a rock off the top of his apartment building. It strikes the window of another building 14.0 m away. The window is 19.0 m below the place where Bill kicked the rock off, so how fast was it moving when it left Bill's foot? Assume a horizontal initial velocity. [7.11 m/sec]