Homework 4.

1.18
A worker is to paint the walls of a square room 8.00 ft high and 12.0 ft along each side. What surface are in square meters must she cover?

1.50
How many significant numbers are in the following numbers?
a) 78.9 +/-0.2
b) 3.788×10^9 .
c) 2.46×10^6 .
d) 0.0053

2.6.
The position of a particle moving along the x-axis varies in time according to the expression $x=3t^2$, where x is in meters and t is in seconds. Evaluate its position
a) at t= 3.00 s
b) at 3.00s + Δt
c) evaluate the limit of $\Delta x / \Delta t$ as Δt approaches zero to find the velocity at t=3.00 s.

2.10
A hare and a tortoise compete in a race over a course 1.00km long. The tortoise crawls straight and steadily at its maximum speed of 0.200 m/s toward the finish line. The hare runs at its maximum speed of 8.00 m/s toward the goal for 0.800 km and then stops to tease the tortoise . How close to the goal can the hare let the tortoise approach before resuming the race, which the tortoise wins in a photo finish? Assume that, when moving, both animals move steadily at their maximum speeds.

2.40
A golf ball is released from rest from the top of a very tall building. Neglecting air resistance, calculate
a) the position and
b) the velocity of the ball after 1.00, 2.00 and 3.00 seconds.

4.1
1. A motorist drives south at 20.0 m/s for 3.00 min, then turns west and travels at 25.0 m/s for 2.00 min, and finally travels northwest at 30.0 m/s for 1.00 min. For this 6.00-min trip, find (a) the total vector displacement, (b) the average speed, and (c) the average velocity. Let the positive x axis point east.

4.2

2. A golf ball is hit off a tee at the edge of a cliff. Its x and y coordinates as functions of time are given by the following expressions:

$$x = (18.0\ \text{m/s})t$$

and $$y = (4.00\ \text{m/s})t - (4.90\ \text{m/s}^2)t^2$$

(a) Write a vector expression for the ball's position as a function of time, using the unit vectors $\hat{\mathbf{i}}$ and $\hat{\mathbf{j}}$. By taking derivatives, obtain expressions for (b) the velocity vector **v** as a function of time and (c) the acceleration vector **a** as a function of time. Next use unit-vector notation to write expressions for (d) the position, (e) the velocity, and (f) the acceleration of the golf ball, all at $t = 3.00$ s.

4.5

At t=0, a particle moving in the xy plane with constant acceleration has a velocity of
$\mathbf{V}_i$ =3.00**i**-2.00**j** m/s and it is at the origin. At t=3.00s, the particle's velocity is
V =9.00**i**+7.00**j** m/s.
Find a) the acceleration of the particle and b) its coordinates at any time t.

Use the equations of motion, but stick to the vector notation.

4.10

To start an avalanche on a mountain slope, an artillery shell is fired with an initial velocity of 300 m/s at 55 degrees above the horizontal. It explodes on the mountainside 42.0 s after firing. What are the x and y coordinates of the shell where it explodes, relative to its firing point?

4.19

19. A place-kicker must kick a football from a point 36.0 m (about 40 yards) from the goal, and half the crowd hopes the ball will clear the crossbar, which is 3.05 m high. When kicked, the ball leaves the ground with a speed of 20.0 m/s at an angle of 53.0° to the horizontal. (a) By how much does the ball clear or fall short of clearing the crossbar? (b) Does the ball approach the crossbar while still rising or while falling?

4.58

58. A quarterback throws a football straight toward a receiver with an initial speed of 20.0 m/s, at an angle of 30.0° above the horizontal. At that instant, the receiver is 20.0 m from the quarterback. In what direction and with what constant speed should the receiver run in order to catch the football at the level at which it was thrown?

4.67

67. A skier leaves the ramp of a ski jump with a velocity of 10.0 m/s, 15.0° above the horizontal, as in Figure P4.67. The slope is inclined at 50.0°, and air resistance is negligible. Find (a) the distance from the ramp to where the jumper lands and (b) the velocity components just before the landing. (How do you think the results might be affected if air resistance were included? Note that jumpers lean forward in the shape of an airfoil, with their hands at their sides, to increase their distance. Why does this work?)

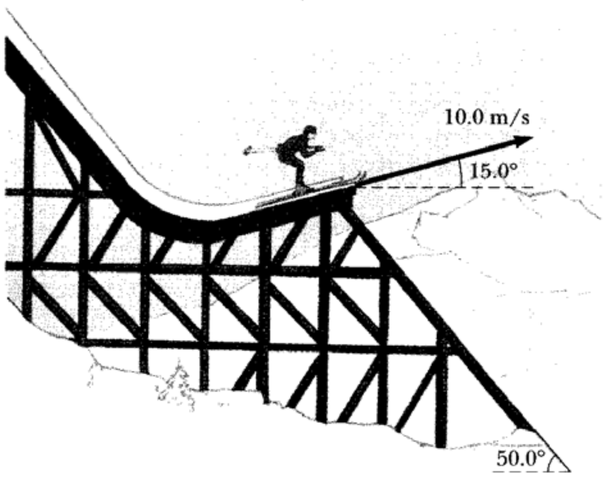

Figure P4.67

4.21

21. A playground is on the flat roof of a city school, 6.00 m above the street below. The vertical wall of the building is 7.00 m high, to form a meter-high railing around the playground. A ball has fallen to the street below, and a passerby returns it by launching it at an angle of 53.0° above the horizontal at a point 24.0 meters from the base of the building wall. The ball takes 2.20 s to reach a point vertically above the wall. (a) Find the speed at which the ball was launched. (b) Find the vertical distance by which the ball clears the wall. (c) Find the distance from the wall to the point on the roof where the ball lands.

4.54

54. A basketball player who is 2.00 m tall is standing on the floor 10.0 m from the basket, as in Figure P4.54. If he shoots the ball at a 40.0° angle with the horizontal, at what initial speed must he throw so that it goes through the hoop without striking the backboard? The basket height is 3.05 m.

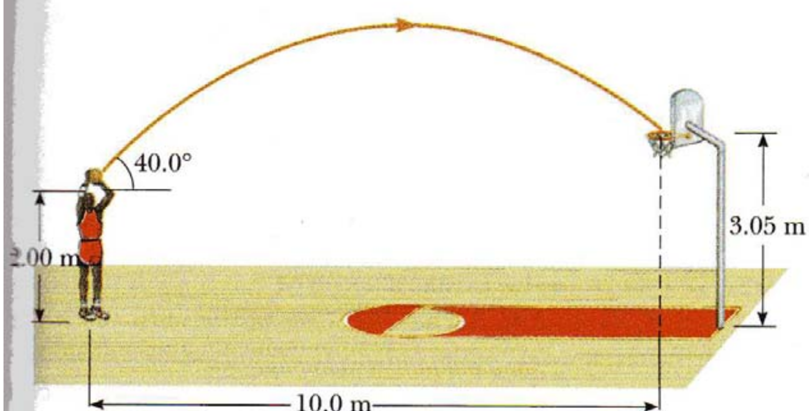

Figure P4.54