General Physics (Phys1011)
Worksheet I

Conceptual problems

1. The height of a horse is sometimes given in units of "hands." Why is this a poor standard of length?

2. How many significant figures are in the following numbers?
   A. 78.9 ± 0.2
   B. 2.46×10^6
   C. 3.788×10^9
   D. 0.0053

3. Three vectors **A**, **B**, and **C**, geometrically show that the vector addition is
   i). commutative
   ii). Associative

4. 5. For a ball thrown up ward, what would happen to its velocity as it moves
   i). upward?
   ii). downward?

5. Can the magnitude of a particle's displacement be greater than the distance traveled? Explain.

6. The average velocity of a particle moving in one dimension has a positive value. Is it possible for the instantaneous velocity to have been negative at any time in the interval? (Suppose the particle started at the origin $x = 0$). If its average velocity is positive, could the particle ever have in the $-x$ region of the axis?

7. If an object's average velocity is nonzero over some time interval, does this mean that its instantaneous velocity is never zero during the interval? Explain your answer.

8. Is it possible for the velocity and the acceleration of an object to have opposite signs?Explain!

9. If you know the position vectors of a particle at two points along its path and also know the time it took to move from one point to the other, can you determine the particle's instantaneous velocity? Its average velocity? Explain.

10. Under what circumstances would a nonzero vector lying in the $x-y$ plane have components that are equal in magnitude?

11. Can an object accelerate if its speed is constant? Can an object accelerate if its velocity is constant?

12. How can you throw a projectile so that it has zero speed at the top of its trajectory?

13. A stone is thrown vertically upward from the roof of a building. Does the position of the stone depend on the location chosen for the origin of the coordinate system? Does the stone's velocity depend on the choice of origin? Explain your answers.

14. A child throws a marble into the air with an initial speed vi. Another child drops a ball at the same instant. Compare the accelerations of the two objects while they are in flight.

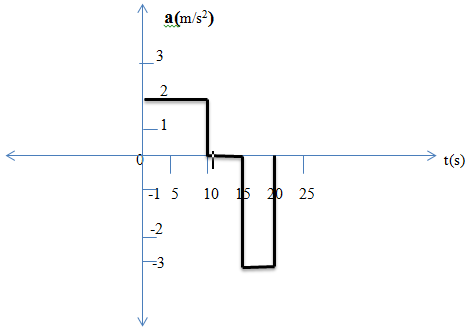
Workout

1. The radius of a circle is measured to be $(10.5 \pm 0.2)m$. Calculate the (a) area and (b) circumference of the circle and give the uncertainty in each value.

2. The length and width of a rectangular room are measured to be $(3.955 \pm 0.005)m$ and width of $(3.05 \pm 0.05)m$. Calculate the perimeter and the area of the floor of the room.

3. A motorcyclist travels $10km53^0$ South of East then $10km37^0$ North of East and finally $10km37^0$ North of West. Roughly, sketch displacement of the motorcyclist and then find the magnitude and direction of the displacement (use: $cos37^0 = 0.8, sin37^0 = 0.6$).

4. Calculate the displacement and average velocity of a ball projected straight up with an initial velocity of $40.0\frac{m}{s}$ during the 3^{rd} second.



5. The position of a moving particle is given by $\vec{r} = 3.0t\hat{i} - 4.0t2\hat{j} + 2.0\hat{k}$ (where t is in seconds and the coefficients have the proper units for $\vec{r}$ to be in meters). What are the magnitude and direction of the particles velocity at $t = 2.00s$?

6. A particle starts from rest and accelerates as shown in figure below,

   (a) Determine particle speed at $t = 10s$ and $t = 20s$

   (b) Calculate the distance traveled in the first $20s$.

7. A ball is thrown directly downward, with an initial speed of $8.00\frac{m}{s}$, from a height of $30.0m$. After what time interval does the ball strike the ground?

8. A car is approaching a hill at $30.0\frac{m}{s}$ when its engine suddenly fails just at the bottom of the hill. The car moves with a constant acceleration of $-2.00\frac{m}{s^2}$ while coasting up the hill. (a) Write equations for the position along the slope and for the velocity as functions of time, taking $x = 0$ at the bottom of the hill, where $vi = 30\frac{m}{s}$. (b) Determine the maximum distance the car rolls up the hill.

9. A projectile is fired up an incline (incline angle Φ) with an initial speed vi at an angle θi with respect to the horizontal ($\theta i > \Phi$), as shown below. (a) Show that the projectile travels a distance d up the incline, where

$$d = 2v_i^2 cos\theta_i sin(\theta_i - \phi) g cos^{\phi}$$

   (b) For what value of θ_i is d a maximum, and what is that maximum value?

