Week 2-Problems

2-1 Which is larger, 60 miles per hour or 88ft per second? Why?

2-2 The Earth rotates once every 24 hours about its axis. If you think of Earth as being a sphere of radius 6400 km, where on Earth would your speed be (i) maximum (ii) zero?

2-3 In order to qualify for an automobile race where the track is 300km, a racer must maintain a speed of 65 mph. A racer travels the first half at a constant speed of 55mph. What constant speed will she need in the second half in order to qualify? Why?

2-4 Which vector is larger, $\underset{\rightarrow}{r} = 5\text{m}\,\hat{x}$ or $\underset{\rightarrow}{r} = -5\text{m}\,\hat{x}$? Why?

2-5 Calculate the magnitudes of the vectors

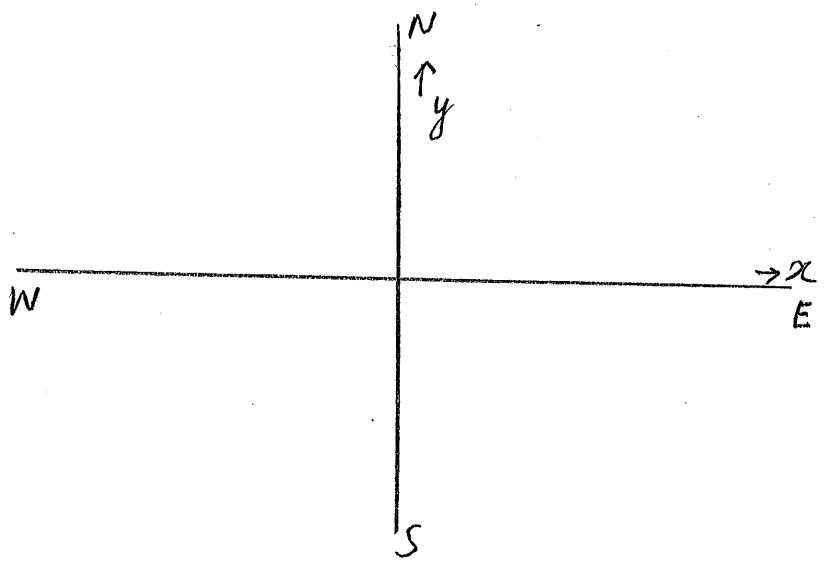
$\underrightarrow{r_1} = 3\text{m}\,\hat{x} + 4\text{m}\,\hat{y}$

$\underrightarrow{r_2} = -3\text{m}\,\hat{x} - 4\text{m}\,\hat{y}$

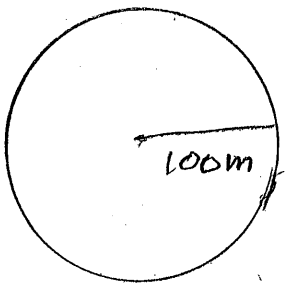
$\underrightarrow{r_3} = 1\text{m}\,\hat{x} + 2\sqrt{2}m\hat{y} + 4\text{m}\,\hat{z}$

$\underrightarrow{r_4} = 1\text{m}\,\hat{x} + 4\text{m}\hat{y} - 2\sqrt{2}m\hat{z}$

2-6 Sarah starts from 0. She first walks 25m directly north. Then 50m due north-east and then 70m directly south. Calculate her total displacement vector.

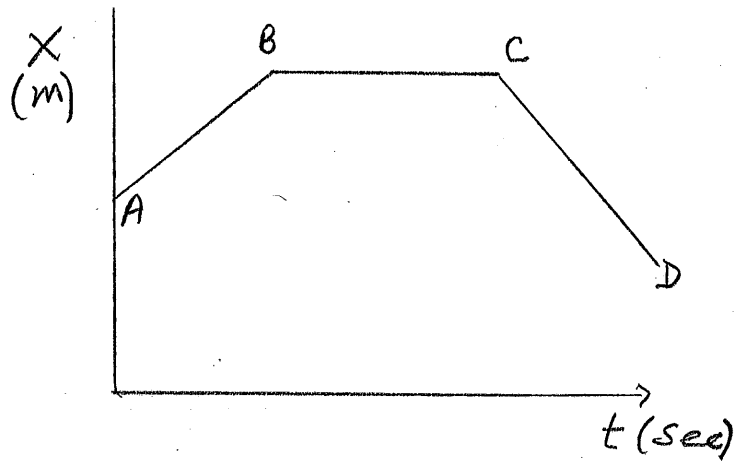


2-7 A person walks on a circular track of diameter 200m. If she takes 5 minutes to go around once, what is her average (i) speed (ii) velocity? Why?



2-8 You drive on interstate 95 from Washington to New York. On the outward journey you travel half the time at 56km/h and the other half at 88km/h. On return you travel half the distance at 56km/h and the other half at 88km/h. What is your average speed for (i) Washington to New York (ii) New York to Washington (iii) complete trip?

2-9 The graph shows the position of a particle. State for each interval if velocity is positive, zero, or negative.

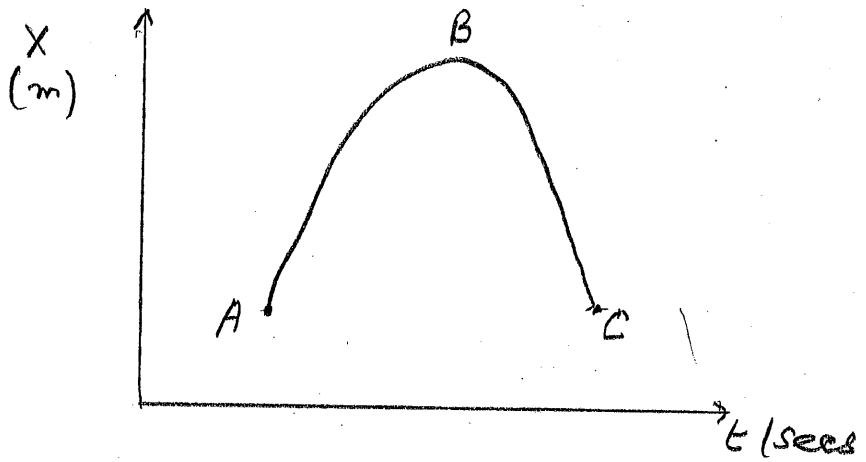


2-10 The graph shows x as a function of time.
State (i) if the velocity is positive or negative between (a) A → B and (b) B → C

(ii) if the acceleration id positive or negative

(iii) Average velocity between A and C

(iv) At what point is the instantaneous velocity equal to zero.



2-11 You are traveling on a level road at 55mph. When you notice that there is a deer some 170 meters ahead of you. You immediately apply the brake. If your maximum deceleration is $2m/s^2$ and your reaction time is 1/3 sec, can you avoid hitting the deer?

2-12. An object has a constant acceleration of $5m/s^2\,\hat{x}$. If its present velocity is $-10m/s\,\hat{x}$, what is the velocity (i) 2.5s earlier and (ii) 2.5s later?

2-13. An aircraft needs a velocity of 200mph $\hat{x}$ for take off. If the runway is 1.1km long, what is the minimum acceleration required starting from rest?

2-14. The position vector of an object is given by the equation $\underset{\sim}{x} = (5+3t-4t^2)\,\hat{x}$ where distances are in meters and times in seconds. (i)What are the position, velocity, and acceleration of this object at t=5 seconds? (ii) At what times will this object be at position x=0?