Problem Set 1

Stuyvesant Physics Team

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1 Vectors

1. A fly flies to the diagonally opposite corner of a 3.00m×3.70m×4.30m room. What is the magnitude of its displacement vector?

2. Point B is 25km east of point A. Starting from point A, a person walks 24km in a direction 15° south of east and then walks 8.0km due north. How far is the camel then from point B?

3. If $\vec{B}$ is added to $\vec{A} = 3.0\hat{i} + 4.0\hat{j}$, the result is a vector in the positive direction of the y axis with a magnitude equal to that of $\vec{A}$. What is $|\vec{B}|$?

4. Vector $\vec{A}$ has a magnitude of 6.00m, and vector $\vec{B}$ has a magnitude of 7.00m. If $\vec{A} \cdot \vec{B} = 14.0$, what is the angle between $\vec{A}$ and $\vec{B}$?

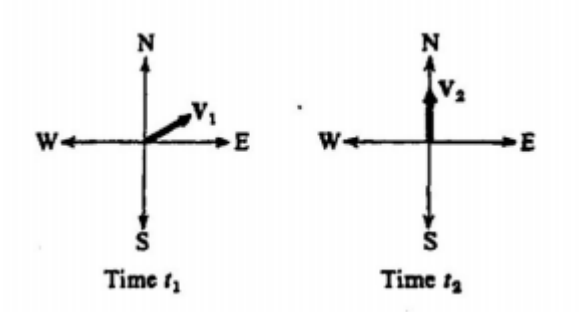
2 1D Kinematics

1. A 500kg sports car accelerates uniformly from rest, reaching a speed of 30m/s in 6s. During these 6 seconds, what is the distance that the car travelled?

2. Starting from rest, a vehicle accelerates uniformly at the rate of $4.0 m/s^2$ for 5.0s. What is the speed of the vehicle at the end of that interval?

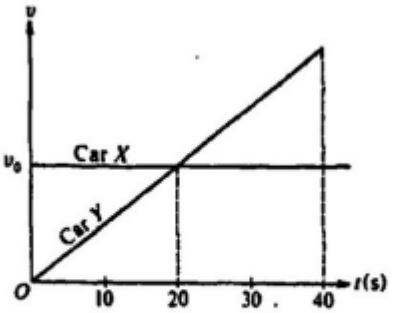
3. A body moving in the positive x direction passes the origin at t=0. Between t=0 and t=1s, the body has a constant velocity of 24m/s. At t=1s, the body is given a sudden constant acceleration of $-6 m/s^2$. What is the x position of the body at t=11s?

4. Vectors V_1 and V_2 shown below have equal magnitudes. The vectors represent the velocities of an object at times t_1 and t_2, respectively. In which direction is the average acceleration of the object between time t_1 and t_2 directed?



a) zero b) directed north c) directed west d) directed northeast e) directed northwest

5.



At time $t = 0$, car X traveling with speed v_0 passes car Y, which is just starting to move. Both cars then travel on two parallel lanes of the same straight road. The graphs of speed v versus time t for both cars are shown above.

16. Which of the following is true at time $t = 20$ seconds?

(A) Car Y is behind car X.
(B) Car Y is passing car X.
(C) Car Y is in front of car X.
(D) Both cars have the same acceleration.
(E) Car X is accelerating fester then car Y.