PAL Problem Set 4 for Phys 5A (Vectors and Motion in 1D)

Always explain your answers and show your work.

1. Linus walks north 0.5 km to a boba shop, and then walks another 1.3 km west to get home.

   a. Draw a vector (call it vector $\vec{A}$) representing the first part of Linus' walk.

   b. Draw a vector (call it vector $\vec{B}$) representing the second part of Linus' walk.

   c. Draw and label the vector sum $\vec{A} + \vec{B}$.

   d. Draw and label the vector sum $\vec{B} + \vec{A}$. How does it compare to vector $\vec{A} + \vec{B}$?

   e. How does the magnitude of this vector sum $\left|\vec{A} + \vec{B}\right|$ compare to the sum of the magnitudes ($|\vec{A}| + |\vec{B}|$)? What is the real-world significance of each of these values?

2. A person gets in an elevator on the ground floor and rides it to the top floor of a building. Sketch the velocity versus time graph for this motion.

3. Give an example of a vertical motion with a positive velocity and a negative acceleration. Is the object slowing down or speeding up?

4. Give an example of a vertical motion with a negative velocity and a negative acceleration. Is the object slowing down or speeding up?

5. Certain animals are capable of running at great speeds; other animals are capable of tremendous accelerations. Speculate on which would be more beneficial to a predator - large maximum speed or large acceleration.

6. The figure shows the position-versus-time graphs for two objects, A and B, that are moving along the same axis.
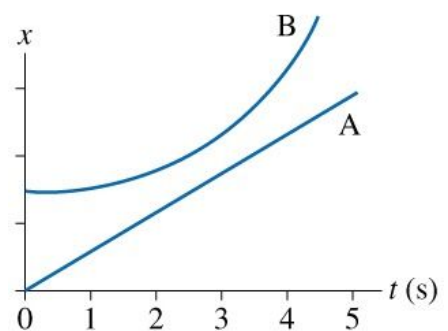
   a. At the instant $t = 1$ s is the speed of A greater than, less than, or equal to the speed of B? Explain.

   b. Do objects A and B ever have the same speed? If so, at what time or times? Explain.

7. Two cars travel on the parallel lanes of a two-lane road. The cars' motions are represented by the position versus time graph shown in the figure. Answer the questions using the times from the graph indicated by letters.

a. Do either of the two cars ever pass the other? If so, when?

b. Do either of the two cars ever comes to a momentary stop? If so, which one and when?

c. At which of the lettered times are the cars moving with nearly identical velocity?
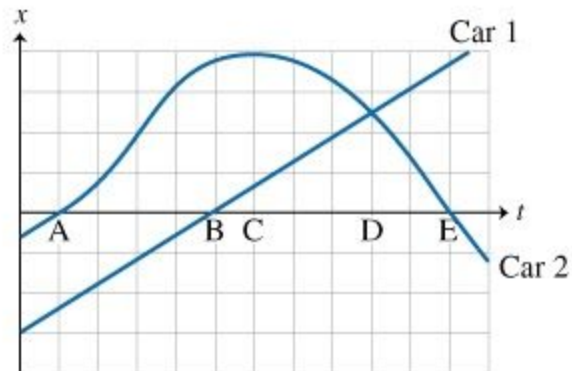
8. A car starts from $x_i = 15$ m at $t_i = 0$ s and moves with the velocity graph shown in the figure.

a. What is car's position at $t = 2$ s?

b. What is car's position at $t = 3$ s?

c. What is car's position at $t = 4$ s?

d. Does the car ever change direction, if so at what time?