# PHYS 1110-02 Quiz 1

You may use an 8.5"×11" note sheet written on both sides and a calculator. You have 50 minutes.

Please write your answers in the boxes provided. Show your work outside the boxes.

1. You were told on the second day of class that the formula for average velocity is displacement divided by duration, $v_{avg} = \Delta x / \Delta t$. In terms of the base SI units of m, kg, and s, what is the SI unit of average velocity?

2. The quantity momentum is defined as mass multiplied by velocity, *mv*. In terms of the base SI units of m, kg, and s, what is the SI unit of momentum?

3. Astronomers commonly use two distance units to describe the great distances between objects outside our Solar System: *light-years* and *parsecs*. A light-year is $9.460 \times 10^{15}$ meters, and a parsec is $3.094 \times 10^{16}$ meters. The bright star Arcturus is measured to be a distance of 11.25 parsecs from us. What is that distance in light-years?

4. A velocity vector's (*x*, *y*) components are (–7.00 m/s, 1.00 m/s).

   a. What is the magnitude of this vector?

   b. What is the direction of this vector, as degrees counterclockwise of the +*x* axis?

5. Ada, a cyclist, coasts up a hill with a constant acceleration, slowing down at a constant rate. She reaches the top of the hill without coming to a stop.

a. In the space below, sketch a position-time graph for Ada coasting to the top of the hill.

b. In the space below, sketch a velocity-time graph for Ada during that same time interval.

c. In the space below, sketch an acceleration-time graph for Ada during that time interval.

Make sure that all three graphs are consistent with the description of Ada's motion and with each other.

6. In the situation described in the previous problem, initially Ada's speed is 12.0 m/s, the top of the hill is 120 meters ahead, and her constant rate of slowing down is –0.30 m/s².

    a. How fast is Ada traveling when she reaches the top of the hill?

    b. How much time does it take for Ada to coast to the top of the hill?

7. A villager visits a friend who lives on the opposite side of a small lake. He takes a total of 525 seconds to walk along the path illustrated in the diagram.

    a. What was the length of the path he traveled?

Villager's house

100 m

300 m

300 m

Friend's house

50 m

300 m
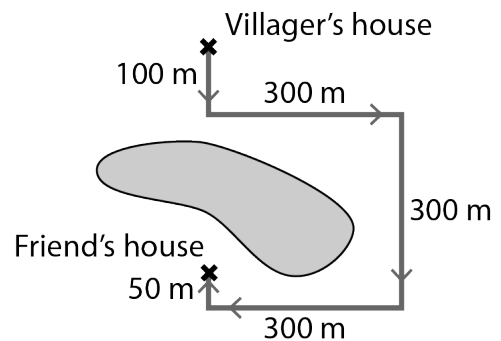
    b. What is the distance from the villager's house to his friend's house?

    c. What was the villager's average speed during his walk to his friend's house?

d. What was the villager's average velocity during his walk to his friend's house?

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7. A steel ball in a teaching lab rolls along the floor with a speed of 2.25 m/s in the direction –40° counterclockwise of the +x axis. What are the x- and y-components of its velocity?

x-component

y-component

8. A displacement vector has the (x, y) components (3.50 m, –2.40 m). When this vector is multiplied by the scalar value 7.00, what is the result?

9. A test subject stands in a field marked in an (x, y) grid. He runs along a displacement vector whose components are (25 m, 40 m). A short time later, he walks from there along a displacement vector whose components are (–30 m, 10 m). What are the components of the displacement vector beginning where he started and finishing where he finished?

10. A particular right triangle is characterized by sides of lengths $A$, $B$, and $C$, and by interior angle $\theta$. Side $A$ is the hypotenuse of the triangle, and side $C$ is opposite angle $\theta$.
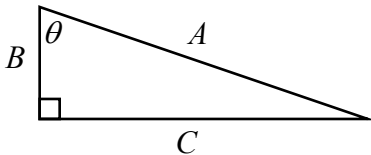


a. Tell me the ratio of side lengths that equals sin $\theta$.

b. Tell me the ratio of side lengths that equals cos $\theta$.

c. Tell me the ratio of side lengths that equals tan $\theta$.

d. Tell me the relationship between the lengths $A$, $B$, and $C$.