

Ostrich & Cheetah

Graphic Analysis of Motion

To quantify motion in a straight line, define the following terms:

- Scalar & vector
- Distance & displacement
- Speed & velocity
- Average & instantaneous
- Acceleration

Answer the following questions in your notes:

1. Ostrich graph – a **position vs. time** graph
 - a. Describe the motion of the ostrich in each constant-slope section in terms of *distance*, *displacement*, *speed*, *velocity*, and *acceleration*. (It might be helpful to come back to this after you finish b-v.)
 - b. Where is the ostrich at $t = 40$ s?
 - c. Where is the ostrich at $t = 70$ s?
 - d. Where is the ostrich at $t = 35$ s?
 - e. When is the ostrich at $x = 25$ m?
 - f. When is the ostrich at rest?
 - g. Find the slope for each segment (including units).
 - h. What does the slope of the line of a *position* vs. *time* graph tell you?
 - i. What was the ostrich's *speed* between 30-40 s?
 - j. Where is the slope = 0?
 - k. What does slope = 0 mean?
 - l. What was the *speed* between 0-20 s?
 - m. What is the slope between 40-70 s?
 - n. What does a positive slope mean in terms of motion?
 - o. What does a negative slope mean in terms of motion?
 - p. What does it mean to cross the *time*-axis?
 - q. *Velocity** is a *speed** with a direction! It is therefore called a _____ quantity.
 - r. From 0-30 s, the ostrich moves _____ (toward/away) from the starting point.
 - s. From 40-70 s, the ostrich moves _____ (toward/away) from the starting point.
 - t. Calculate the total *distance* traveled by the ostrich.
 - u. Calculate the total *displacement* of the ostrich.
 - v. Extend the line below the *time*-axis. Describe the motion if the line extends below the *time*-axis.

*when not specified as average, assume instantaneous

2. Cheetah graph – a **velocity vs. time** graph

- a. Describe the motion of the cheetah in each constant-slope section in terms of *distance*, *displacement*, *speed*, *velocity*, and *acceleration*. (It might be helpful to come back to this after you finish b-t.)
- b. What does the slope of the line of a *velocity* vs. *time* graph tell you?
- c. What happens during the first two seconds?
- d. Calculate the slope from 0-2 s.
- e. Calculate the slope from 2-3 s.
- f. Calculate the slope from 3-5 s.
- g. Calculate the slope from 5-6 s.
- h. What does a positive slope mean in terms of motion?
- i. What does a negative slope mean in terms of motion?
- j. What does a zero slope mean in terms of motion?
- k. Where was the cheetah at rest? (Why isn't the answer $t = 2$ s to $t = 3$ s?)
- l. What does it mean to cross the *time*-axis?
- m. Describe the motion if the line extends below the *time*-axis.
- n. Calculate the area under the line for time 2-3 s. (Include units!)
- o. Calculate the *distance* traveled for time 2-3 s. (use $x = v_{\text{avg}} \Delta t$)
- p. What does the area under the curve mean in terms of motion?
- q. What was the *displacement* during the first 2 s?
- r. Does the area under the curve above the *time*-axis mean something different than the area under the curve below the *time*-axis?
- s. How can you determine the total *distance* traveled by the cheetah?
- t. How can you determine the *displacement* traveled by the cheetah?