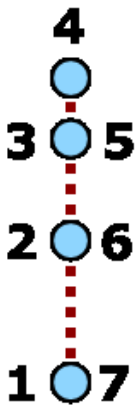
Tutorial problems 2.

Topics:

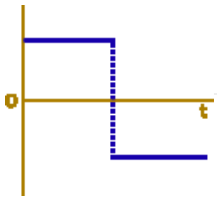
- Motion in one dimension: displacement, velocity, acceleration
- Motion diagrams
- One-dimensional motion with constant acceleration
- Free fall

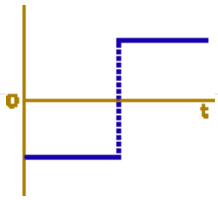
1. A car travels north at 30 m/s for one half hour. It then travels south at 40 m/s for 15 minutes. Find the total distance the car has travelled and its displacement.
2. Wendy walks 10 m in one direction at 2 m/s, then runs 6 m in the same direction at 6 m/s. Next, she stops for 4 seconds, and finally walks in the opposite direction at 4 m/s for 6 seconds. What is Wendy's average speed?
3. An automobile traveling along a straight road increases its speed from 30.0 m/s to 50.0 m/s in a distance of 180 m. If the acceleration is constant, how much time elapses while the auto moves this distance?
4. An automobile manufacturer claims that its product will, starting from rest, travel 0.40 km in 9.0 s. What is the magnitude of the constant acceleration required to do this?
5. A ball is thrown straight up into the air. Its positions at 7 instants of time are shown in the diagram; the maximum height is reached at position 4. At which of the labeled points

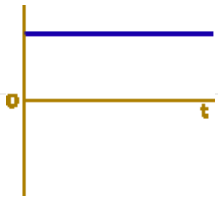


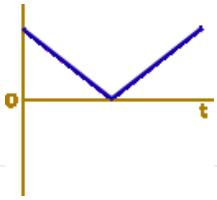
   a. is the **speed** of the ball **largest**?
   b. is the **acceleraton** of the ball **smallest**?

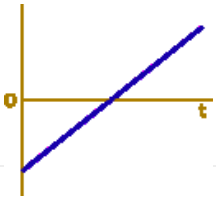
6. A ball is rolled up an incline so that it goes part-way up and then rolls back down.
   a. Which of the graphs below could represent its velocity vs. time from the instant it is released until it returns to where it started?
   b. Which of the graphs could represent its acceleration vs. time?
   c. Describe possible motion for which the graph of velocity vs time is shown in diagram 4.
   d. Describe possible motion for which the graph of displacement vs time is shown in diagram 7?

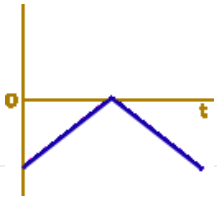
1 

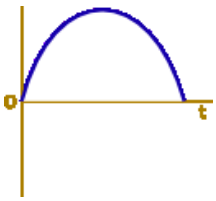
2 

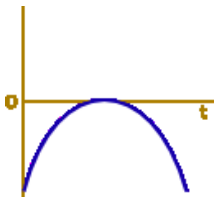
3 

4 

5 

6 

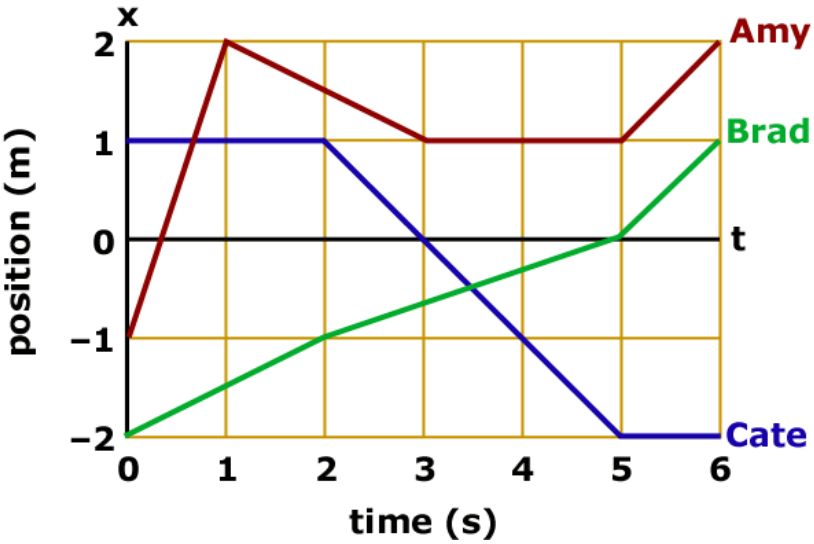
7 

8 

9 None of the graphs

7. A rocket, initially at rest, is fired vertically with an upward acceleration of 10 m/s^2. At an altitude of 0.50 km, the engine of the rocket cuts off. What is the maximum altitude it achieves?
8. A particle confined to motion along the *x* axis moves with constant acceleration from *x* = 2.0 m to *x* = 8.0 m during a 2.5-s time interval. The velocity of the particle at *x* = 8.0 m is 2.8 m/s. What is the acceleration during this time interval?

9. A Cessna aircraft has a liftoff speed of 120 km/h.
    a. What minimum constant acceleration does the aircraft require if it is to be airborne after a takeoff run of 240 m?
    b. How long does it take the aircraft to become airborne?
10. A ball is thrown upward from the ground with an initial speed of 25 m/s; at the same instant, another ball is dropped from a building 15 m high.
    a. After how long will the balls be at the same height?
    b. At what height do they meet?
11. Runner A is initially 4.0 km west of a flagpole and is running with a constant velocity of 6.0 km/h due east. Runner B is initially 3.0 km east of the flagpole and is running with a constant velocity 5.0 km/h due west. How far are the runners from the flagpole when they meet?
12. Three students, Amy, Brad and Cate are walking (or running) in a straight line as represented in the graph below



    a. Which of them have the same displacement at the end of the trip (at 6 s)?
    b. Calculate distance travelled by each of the students.
    c. Which students have the same average speed during the time interval shown (6 s)?
    d. During which 1-second time period(s) are there at least two students with the same speed?