Skill 12 (Part 1)
Non Uniform Acceleration

1. On a highway, a car is driven 80. kilometers during the first 1.00 hour of travel, 50. kilometers during the next 0.50 hour, and 40. kilometers in the final 0.50 hour. What is the car's average speed for the entire trip?

   A) 45 km/h   B) 60. km/h

   C) 85 km/h   D) 170 km/h

2. In a 4.0-kilometer race, a runner completes the first kilometer in 5.9 minutes, the second kilometer in 6.2 minutes, the third kilometer in 6.3 minutes, and the final kilometer in 6.0 minutes. The average speed of the runner for the race is approximately

   A) 0.16 km/min   B) 0.33 km/min

   C) 12 km/min   D) 24 km/min

3. A car travels 90. meters due north in 15 seconds. Then the car turns around and travels 40. meters due south in 5.0 seconds. What is the magnitude of the average velocity of the car during this 20.-second interval?
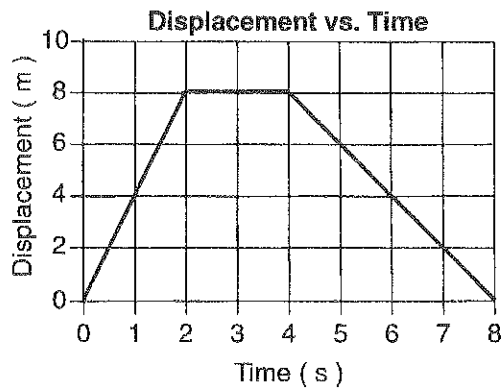
   A) 2.5 m/s   B) 5.0 m/s

   C) 6.5 m/s   D) 7.0 m/s

4. What is the average velocity of a car that travels 30. kilometers due west in 0.50 hour?

   A) 15 km/hr   B) 60. km/hr

   C) 15 km/hr west   D) 60. km/hr west

5. Base your answer to the following question on the graph below, which represents the relationship between the displacement of an object and its time of travel along a straight line.

Displacement vs. Time

What is the average speed of the object during the first 4.0 seconds?

A) 0 m/s   B) 2 m/s   C) 8 m/s   D) 4 m/s

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6. Telly Vision runs 1 km in 5 minutes, walks 2 km in 20 minutes and the jogs 400m to in 2 minutes. What is Telly's average speed?

8. Evan Tually walked 3900 km from New York City to Los Angeles, California in a time period of 100 days. What is Evan's average speed in km/hr?

7. L.E. Vator, the super monkey, starts from rest and climbs up a vine that is 100m tall while pausing to grab bananas. If the climb takes L.E. 10 seconds, what is the average speed of LE?

9. Suppose that you are driving along at a steady 10 m/s for 2 seconds and then you steadily (uniformly) increase to a speed of 30 m/s in 2 seconds. You then hit the brakes and uniformly slow to 20 m/s in 2 seconds.
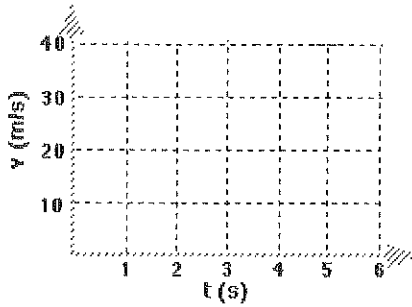
Position vs time.

a) Chart the 6 seconds of motion as described above on the velocity vs time graph provided.

b) What is the distance traveled by the object in the first 2 seconds?

c) What is the acceleration during the first 2 seconds?

d) What is the distance traveled during time 2-4 seconds?

e) What is the acceleration during time 2-4 seconds?

f) What is the distance traveled during the time 4-6 seconds?

g) In the box at right above, draw a sketch of the position (d) vs t that corresponds to the v vs t graph.

10. The vectors below represent the velocity vectors of an object over time. Based on the change in velocity determine the direction and magnitude of the uniform acceleration.

a.

b.

c.

d.
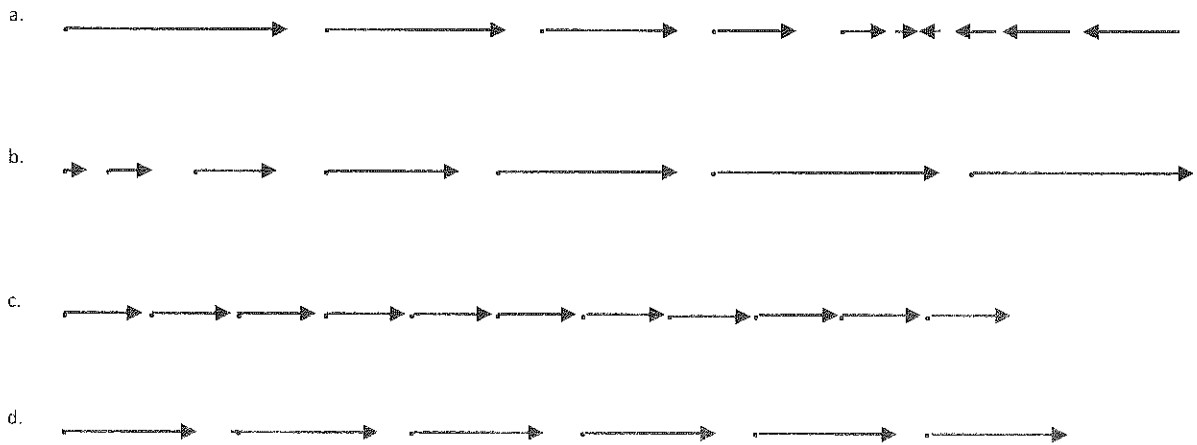
11. State the direction of the acceleration vector for each of the following motions.

a. A ball rolling to the right with an initial velocity slows down to zero and begins speeding up to the left.

b. An object dropped from rest speeds up as it approaches the ground

c. An object travelling with a velocity of 2m/s north has a final velocity of 8 m/s north after 3 seconds

d. A parachutist falling with a downward velocity of 30m/s opens her chute and 5 seconds later has a speed of 15 m/s.

e. A bicyclist traveling east with a velocity of 15m/s coasts to a stop in a distance of 10m.

f. A person jumps with an initial velocity of 5m/s upwards and lands with a velocity of 5m/s downward.

g. A car with a velocity of 5 m/s north, then 5 m/s west, then 5 m/s south, then 5 m/s east, then 5 m/s north.

Kinematics Graphs (slope and area of v vs t)

12. The velocity vs time graphs for two objects are shown below. Use the graphs to describe the motion of the objects as indicated.

(A) (B)
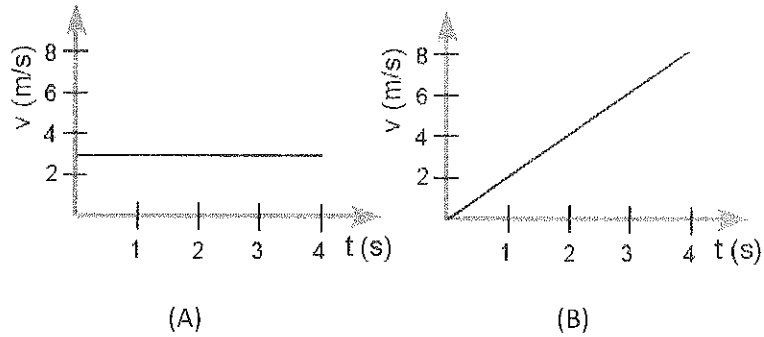
	Object A	Object B
Determine the displacement for the first 3s. Show work!		
Determine the average velocity for the first 3s. Show work.		
Give a written description of the motion.		
Sketch the velocity vectors as a function of time. What does this mean for the acceleration vectors?		

13. The graph below shows the velocity vs time of an object over a 4 second time interval.

Velocity Time Graph

a. Determine the area of each and add together:

A: B:

C: D:

Total

In order to use this method you must first recognize the shape of each component, apply the appropriate equation and then add together all the parts.

The equation for area of a triangle is ½ bh or $\frac{bh}{2}$ which can be rewritten as

$$\text{Area} = \frac{(\Delta x)(\Delta y)}{2}$$

The equation for area of a rectangle is length times width which can be rewritten as

$$\text{Area} = (\Delta x)(\Delta y)$$

b. Using the time and displacement found above construct a distance vs. time graph to correspond with the velocity versus time shown above. Assume starting position is 0m.