Mr. Klansek

Name: ______________________

Date: __________ Block: _______

# Ch 2 Test preview

You should

→ have the following memorized:

$$\Delta x = x_f - x_i \qquad v_{ave} = \frac{\Delta x}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t}$$

$$\Delta x = \frac{1}{2}\left(v_i + v_f\right)\Delta t; \quad \Delta x = v_i \Delta t + \frac{1}{2} a (\Delta t)^2; \quad v_f^2 = v_i^2 + 2a\Delta x$$

where: $\Delta$ = change; $x$ = position; $t$ = time; $v$=velocity; and $a$ = acceleration

→ be able to rearrange the equations to solve for any of the variables.

→ be able to find the relevant information in word and logic problems, and determine what equation(s) to use and in what form.

→ understand **frame of reference** and be able to solve problems accounting for it.

→ understand the difference between vectors & scalars (speed v. velocity, distance v. displacement)

→ be able to interpret and draw graphs of position vs. time; velocity vs. time, and acceleration v time.

→ understand the implications of free-fall

→ Solve the following types of problems:

**Average velocity and displacement**

**Average acceleration**

**Velocity and displacement with constant acceleration**

**Final velocity after any displacement**

**Falling object**

Examples:

1. A cheetah is known to be the fastest mammal on Earth, at least for short runs. Cheetahs have been observed running a distance of $5.50 \times 10^2$ m with an average speed of $1.00 \times 10^2$ km/h.
    a. How long would it take a cheetah to cover this distance at this speed?
    b. Suppose the average speed of the cheetah were just 85.0 km/h. What distance would the cheetah cover during the same time interval calculated in (a)?

2. A pronghorn antelope has been observed to run with a top speed of 97 km/h. Suppose an antelope runs 1.5 km with an average speed of 85 km/h, and then runs 0.80 km with an average speed of 67 km/h.
    a. How long will it take the antelope to run the entire 2.3 km?
    b. What is the antelope's average speed during this time?

3. The black mamba is one of the world's most poisonous snakes, and with a maximum speed of 18.0 km/h, it is also the fastest. Suppose a mamba waiting in a hide-out sees prey and begins slithering toward it with a velocity of
+18.0 km/h. After 2.50 s, the mamba realizes that its prey can move faster than it can. The snake then turns around and slowly returns to its hide-out in 12.0 s. Calculate
    a. the mamba's average velocity during its return to the hideout.
    b. the mamba's average velocity for the complete trip.
    c. the mamba's average speed for the complete trip.

4. In the Netherlands, there is an annual ice-skating race called the "Tour of the Eleven Towns." The total distance of the course is $2.00 \times 10^2$ km, and the record time for covering it is 5 h, 40 min, 37 s.
    a. Calculate the average speed of the record race.
    b. If the first half of the distance is covered by a skater moving with a speed of $1.05v$, where $v$ is the average speed found in (a), how long will it take to skate the first half? Express your answer in hours and minutes.

5. In 1992, Maurizio Damilano, of Italy, walked 29 752 m in 2.00 h.
    a. Calculate Damilano's average speed in m/s.
    b. Suppose Damilano slows down to 3.00 m/s at the midpoint in his journey, but then picks up the pace and accelerates to the speed calculated in (a). It takes Damilano 30.0 s to accelerate. Find the magnitude of the average acceleration during this time interval.

6. South African frogs are capable of jumping as far as 10.0 m in one hop. Suppose one of these frogs makes exactly 15 of these jumps in a time interval of 60.0 s.
   c. What is the frog's average velocity?
   d. If the frog lands with a velocity equal to its average velocity and comes to a full stop 0.25 s later, what is the frog's average acceleration?

7. In a 1986 bicycle race, Fred Markham rode his bicycle a distance of $2.00 \times 10^2$ m with an average speed of 105.4 km/h. Markham and the bicycle started the race with a certain initial speed.
   a. Find the time it took Markham to cover $2.00 \times 10^2$ m.
   b. Suppose a car moves from rest under constant acceleration. What is the magnitude of the car's acceleration if the car is to finish the race at exactly the same time Markham finishes the race?

8. In 1994, a human-powered submarine was designed in Boca Raton, Florida. It achieved a maximum speed of 3.06 m/s. Suppose this submarine starts from rest and accelerates at 0.800 m/s$^2$ until it reaches maximum speed. The submarine then travels at constant speed for another 5.00 s. Calculate the total distance traveled by the submarine.

9. Peter Rosendahl rode his unicycle a distance of $1.00 \times 10^2$ m in 12.11 s. If Rosendahl started at rest, what was the magnitude of his acceleration?

10. Suppose that Peter Rosendahl began riding the unicycle with a speed of 3.00 m/s and traveled a distance of $1.00 \times 10^2$ m in 12.11 s. What would the magnitude of Rosendahl's acceleration be in this case?

11. In 1976, Kitty Hambleton of the United States drove a rocket-engine car to a maximum speed of 965 km/h. Suppose Kitty started at rest and underwent a constant acceleration with a magnitude of 4.0 m/s$^2$. What distance would she have had to travel in order to reach the maximum speed?

12. With a cruising speed of $2.30 \times 10^3$ km/h, the French supersonic passenger jet Concorde is the fastest commercial airplane. Suppose the landing speed of the Concorde is 20.0 percent of the

cruising speed. If the plane accelerates at $-5.80\ m/s^2$, how far does it travel between the time it lands and the time it comes to a complete stop?

13. The distance record for someone riding a motorcycle on its rear wheel without stopping is more than 320 km. Suppose the rider in this unusual situation travels with an initial speed of 8.0 m/s before speeding up. The rider then travels 40.0 m at a constant acceleration of $2.00\ m/s^2$. What is the rider's speed after the acceleration?

14. The lightest car in the world was built in London and had a mass of less than 10 kg. Its maximum speed was 25.0 km/h. Suppose the driver of this vehicle applies the brakes while the car is moving at its maximum speed. The car stops after traveling 16.0 m. Calculate the car's acceleration.

15. The Sears Tower in Chicago is 443 m tall. Suppose a book is dropped from the top of the building. What would be the book's velocity at a point 221 m above the ground? Neglect air resistance.

16. The tallest roller coaster in the world is the Desperado in Nevada. It has a lift height of 64 m. If an archer shoots an arrow straight up in the air and the arrow passes the top of the roller coaster 3.0 s after the arrow is shot, what is the initial speed of the arrow?

17. A man named Bungkas climbed a palm tree in 1970 and built himself a nest there. In 1994 he was still up there, and he had not left the tree for 24 years. Suppose Bungkas asks a villager for a newspaper, which is thrown to him straight up with an initial speed of 12.0 m/s. When Bungkas catches the newspaper from his nest, the newspaper's velocity is 3.0 m/s, directed upward. From this information, find the height at which the nest was built. Assume that the newspaper is thrown from a height of 1.50 m above the ground.