1. Imagine an automobile slowing down steadily (uniformly) as it moves forward approaching a stop sign. After a complete stop, it accelerates uniformly back up to its original velocity.
   a. Sketch a velocity vs time graph describing its motion.
   b. Sketch an acceleration vs time graph describing the same motion. *Try not to contradict #2.*
   c. Remember that there must be a one-to-one correspondence between events on one graph and events on the other. Label some such events clearly on each graph.

2. A car is driven uphill for 3.0 seconds at constant velocity. Suddenly something breaks. The car coasts uphill for another 2.0 seconds, and then coasts back down with uniform acceleration.
   a. If uphill velocities and accelerations are positive, then velocities and accelerations in the *downhill* direction must be _____tive. (See page 17c.)
   b. Sketch the car's velocity vs time graph and the car's acceleration vs time graph. (Use #2a & 4a.)
   c. Label the major events on each graph, as in 3c. Using the words “sudden” and “gradual”, explain what causes any changes in acceleration.

3. Imagine driving on a highway. To pass a slower vehicle, you accelerate from 20.0 m/sec to 32.0 m/sec. It takes 3.00 seconds, and your car travels 95.0 meters during the process.
   a. Your initial speed was ________ _____. Your change in speed was _____ ___.
   b. The car's speed-time graph may be linear, concave up, or concave down. Sketch all three.
   c. Calculate the average acceleration of the car. Show how you do it. (Use RS II.)
   d. Calculate the average speed of the car. Again, please show how you do it.
   e. How far would the car have travelled during the 3.00 seconds if its acceleration had been uniform? Again, show how you get your answer and *check units.* (Use #2 on RS II.)
   f. Compare 3e with the given distance. Then decide which of the three graphs in 3b best describes the motion and explain your decision.

4. A bicycle is pedaled at a steady speed over a measured distance "D_p". Let "T_p" represent the amount of pedaling time. The brakes are applied suddenly and the bicycle skids to a stop. Let "D_s" represent the skidding distance. (Those three quantities are easy to measure.)
   a. Show how the pedaling speed can be calculated from those measured quantities.
   b. Show how the braking acceleration can be calculated from the same given quantities.
   c. Show that the units balance in equation 4b.
   d. As an extra-credit activity, make those measurements with a partner, and use them to determine a bicycle’s maximum braking acceleration.

5. On page 16 you created an equation describing the displacement vs time graph for an object moving with uniform acceleraton along a straight path. On that same page you also used your falling-body data to make a data table and a graph of **displacement vs.time squared.**
   * a. Was its shape a surprise, or was it expected? *Please explain, using #2 on page 16.*
   * b. You also found a numerical value for the slope of this new graph. Was that slope a surprise, or was it expected? (It is not necessary to convert units here, but you *must* explain what number you expected, and why, and you *must* give the value obtained from the graph.)

6. Suppose we *throw* an object downward, so its initial speed is *not* zero:
   a. Sketch a speed-time graph which describes its freely-falling motion.
   b Is its area triangular? "____, because neither the initial nor the final _______ is zero."
   c. Can the initial displacement be zero in this case? ____ (If not, please explain.)
   d. Create an equation to describe the object’s displacement-time graph, as on page 16. *Remember that this equation can have only two variables.* __ = _____________
   e. In that equation the variables "__" and "__" represent ________ and ________, respectively.
   f. Define the two constants in the equation: __ = _______________ , __ = _____________
   g. Does equation 6d contradict 6c? ____ -If so, please *explain* why that error hasn't been corrected.
   h. Describe (with sketches) how the shape of the displacement vs time-squared graph in this case will differ from the one with zero initial velocity. *Explain how you obtain those results.*

1. If an object’s velocity is constant then its displacement-time graph _______ be a straight line.
   If the velocity is *not* constant, then the displacement-time graph _______ be a straight line.
   (must be, can’t be)

2. A displacement-time graph shaped like a “V” describes a speed that changed _________ly.
   (suddenly, gradually) Can a real object move in that way? ____ (See page 17c)

3. A certain moving object has a non-linear displacement-time graph.
   We find that its graph of displacement vs *time squared* is a straight line through the origin.
   After 3.6 seconds of travelling the object is 40 meters from its starting point.
   a. The object's average speed is ____ ____. The slope of the linear graph is ____ _____.
   b. Create an equation describing the displacement-time graph as you did on pages 16, 17, & 28.
   c. Use 3b to calculate the object's acceleration. Show how you do it.

4. Imagine that you are standing on a road and that a car with an improved speedometer is backing up toward you. (This speedometer can give negative readings.) The car's initial displacement is positive because it is in front of you and you are at the origin. Its initial speed is *negative*, because it is backing up. The car is gradually slowing down because the driver sees you standing there and is applying his brakes.
   a. Sketch and label three possible speed-time graphs, showing what happens if the braking effort is steady, increasing, or decreasing. Label them clearly so I'll know which is which.
   b. Sketch the corresponding displacement-time graphs.
   c. “Speed” is the _______ of a __________ vs _____ graph. Label a point of high-speed motion and a point of slow motion on each D-t graph to show that you remember that definition.

5. A car is driven at a steady 80 mph for two seconds. The brake pedal is held down firmly with steady effort for the next two seconds, but that does not completely stop the car. The brake is then released, and the accelerator pedal is pressed to the floor for the final two seconds.
   a. Sketch the car's speed-time graph. (See page 24.)
   b. Sketch the car's displacement-time graph. (Use page 29.)
   c. Label the 2- and 4-second points on the t-axis of each graph.
   d. The speed-time graph shows that the speed just after 2 seconds ____ equal to the speed just before that time. (is, isn’t) -Is it possible for those speeds to be unequal? ___ (See page 17c)
   e. The slope of the displacement-time graph at a point just after the 2-second mark _____ equal to the slope at a point just before that mark. (is, isn’t)
   f. Does 5e contradict 5d? ___ If so, explain why you decided not to correct that silly mistake.

* 6. Suppose you are sitting blindfolded in an automobile. Whenever the car accelerates forward you feel something pushing you. Name the object that does the pushing and describe the direction of the push. Then describe exactly when the push begins to act and when it stops acting.

7. Sketch a curved displacement-time graph that begins at the origin with a positive slope and which levels off gradually. Then sketch the corresponding speed-time graph. Label the two graphs so I'll know which is which.

8. Sketch a curved displacement-time graph with a positive but finite initial value and a negative but finite initial slope. Make it level off gradually, approaching the horizontal axis. Then sketch and label the corresponding speed-time graph.

9. Sketch a curved displacement-time graph in the first and second quadrants that is identical to its corresponding speed-time graph. (Such a shape is very unusual.)