O: Level 5: Quantitative Kinematic Graphs 5: Story Graphs Name _____

[Pick one of two questions]

Question 1:
A car follows the following motion:

- Initial position = 0.
- A car is stopped at a red light. The light turns green at time t = 0.
- For the first 5 seconds, it accelerates at a rate of 4 m/s^2.
- For the next 15 seconds, it travels at a constant velocity.
- The car sees a red light ahead. It begins to slow down at a rate of -4 m/s^2. It slows until it is at rest.

On a separate sheet of paper, create three kinematic graphs that illustrate the motion of this car: a position-time graph, a velocity-time graph, and an acceleration time graph. Each of your graphs *must* be quantitatively correct for full credit. You need to determine an appropriate scale for the graphs yourself.

Question 2:
A car follows the following motion:

- Initial position = 0.
- A car is traveling at an initial speed of 20 m/s. It continues at this speed for a time of 4 seconds.
- Suddenly, a deer jumps out in front of the car. The car comes to an extremely short stop in only 2 seconds. The driver, fortunately, does not strike the deer. ☺
- The driver does not move the car for four seconds while the deer passes.
- The driver is now totally shaken. Driving extremely slowly and carefully, the driver takes 10 full seconds to accelerate back to a speed of 20 m/s.
- She continues at this speed for another 6 seconds.

On a separate sheet of paper, create three kinematic graphs that illustrate the motion of this car: a position-time graph, a velocity-time graph, and an acceleration time graph. Each of your graphs *must* be quantitatively correct for full credit. You need to determine an appropriate scale for the graphs yourself.

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Answers:
question 1
stage 1 displacement = 50 meters [final position = 50 meters] [upward parabola]
stage 2 displacement = 300 meters [final position = 350 meters] [straight line slope = 20]
stage 3 displacement = 50 meters [final position = 400 meters] [downward parabola]

stage 1 velocity = sloped upward to 20
stage 2 velocity = constant at 20
stage 3 velocity = downward at 20

stage 1 acceleration = + 4m/s^2
stage 2 acceleration = 0
stage 3 acceleration = -4 m/s^2

stage 1 time = 0 – 5 s
stage 2 time = 5 – 25 s
stage 3 time = 25 – 30 s

question 2:
[this method is how I should *teach* them to solve these problems: find all of the variables, and know the shape of the graph in that section!]
stage 1 : constant velocity
displacement = 80 meters,
time interval = 4seconds
velocity = 20 m/s
acceleration = 0
initial position = 0 meters
final position = 80 meters
initial time = 0 s
final time = 4 s

stage 2: negative acceleration
time = 2 s
acceleration = - 10 m/s2
final velocity = 0
initial velocity = 20 m/s
displacement = 20 meters
initial position = 80 meters
final position = 100 meters
initial time = 4 s
final time = 6 s

stage 3: stopped
time = 4 seconds
displacement = 0

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acceleration = 0
final velocity = 0
initial velocity = 0
initial time = 6 s
final time = 10 s
initial position = 100 meters
final position = 100 meters

stage 4: positive acceleration
time = 10 s
acceleration = 2 m/s/s
initial velocity = 0
final velocity = 20 m/s
displacement = 100 meters
initial time = 10 s
final time = 20 s
initial position = 100 meters
final position = 200 meters

stage 5: constant velocity
time = 6 s
acceleration = 0
velocity = 20 m/s
displacement = 120 meters
initial position = 200 meters
final position = 320 meters
initial time = 20 s
final time = 26 s

time must be up to 26 in intervals of 2 [13 intervals]
position must be up to 320 in intervals of 20 [16 intervals]
velocity is much simpler, because it only stops at to or zero
acceleration is from – 10 to 10 in intervals of 2