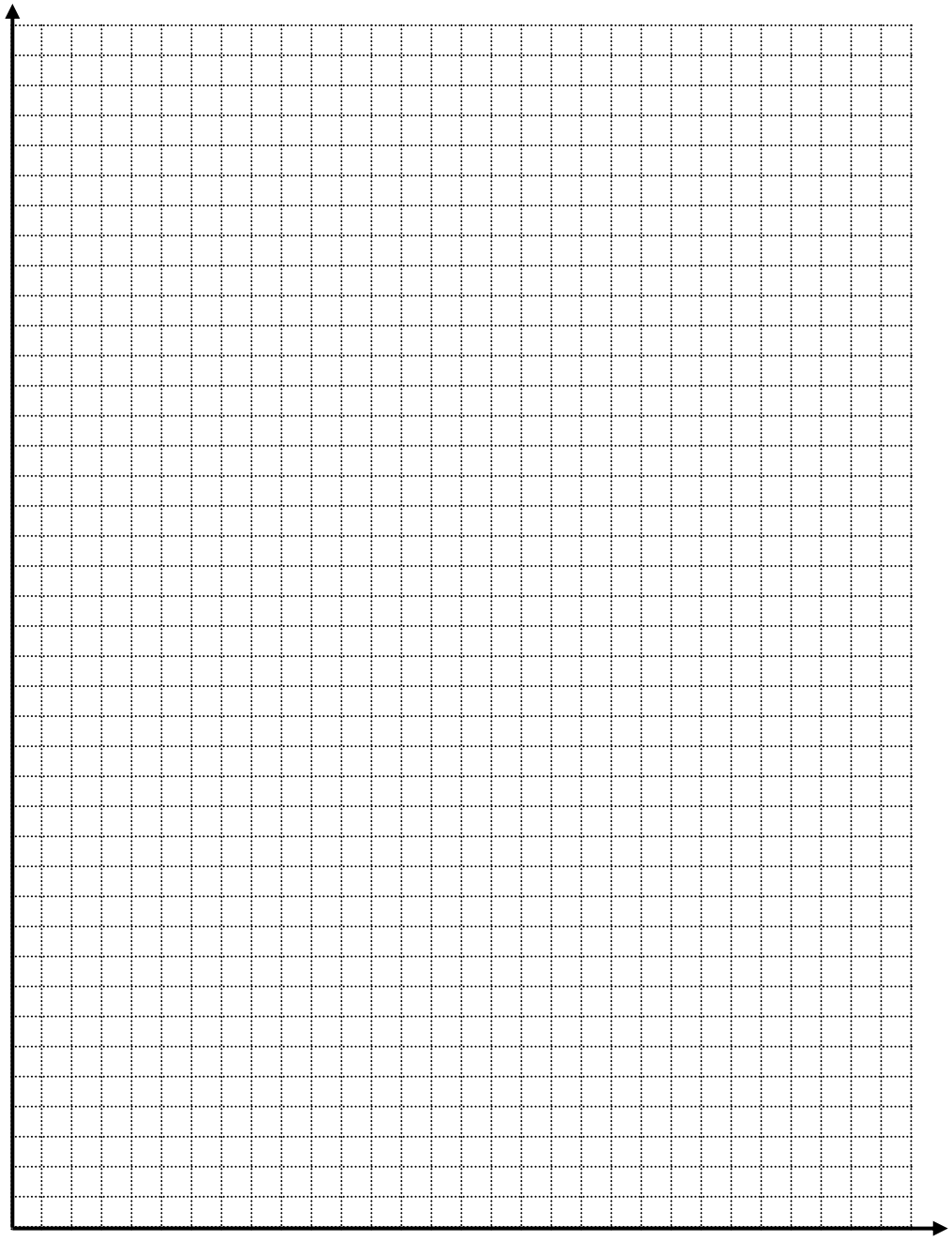
Name_____

Date _____ **Pd** ____

Uniformly Accelerated Motion Model Worksheet 1:

Development of Accelerated Motion Representations

1. The data to the left are for a wheel rolling from rest down an incline. Using the position/time data given in the data table, plot the position vs. time graph.



t (s)	*x* (cm)
0.0	0.0
1.0	5.0
2.0	20.0
3.0	45.0
4.0	80.0
5.0	125.0
6.0	180.0

2. What is the significance of the slope of a position vs. time graph?

3. What is happening to the slope of your position vs. time graph as time goes on?

4. Explain what your answers to questions 2 and 3 tell you about the motion of the wheel.

5. On the position vs. time graph, draw a line which connects the point at $t = 0$ to the point at $t = 6.0$ s.
6. Calculate the slope of this line in the space below. Explain what the slope of this line tells you about the motion of the wheel.

7. On the position vs. time graph, draw a line which connects the point at t = 2.0 s to the point at t = 4.0 s.
8. Calculate the slope of this line in the space below. Explain what the slope of this line tells you about the motion of the wheel.

9. On the position vs. time graph, draw a line tangent to the graph at t = 3.0 s.
10. Calculate the slope of this line in the space below. Explain what the slope of this line tells you about the motion of the wheel.

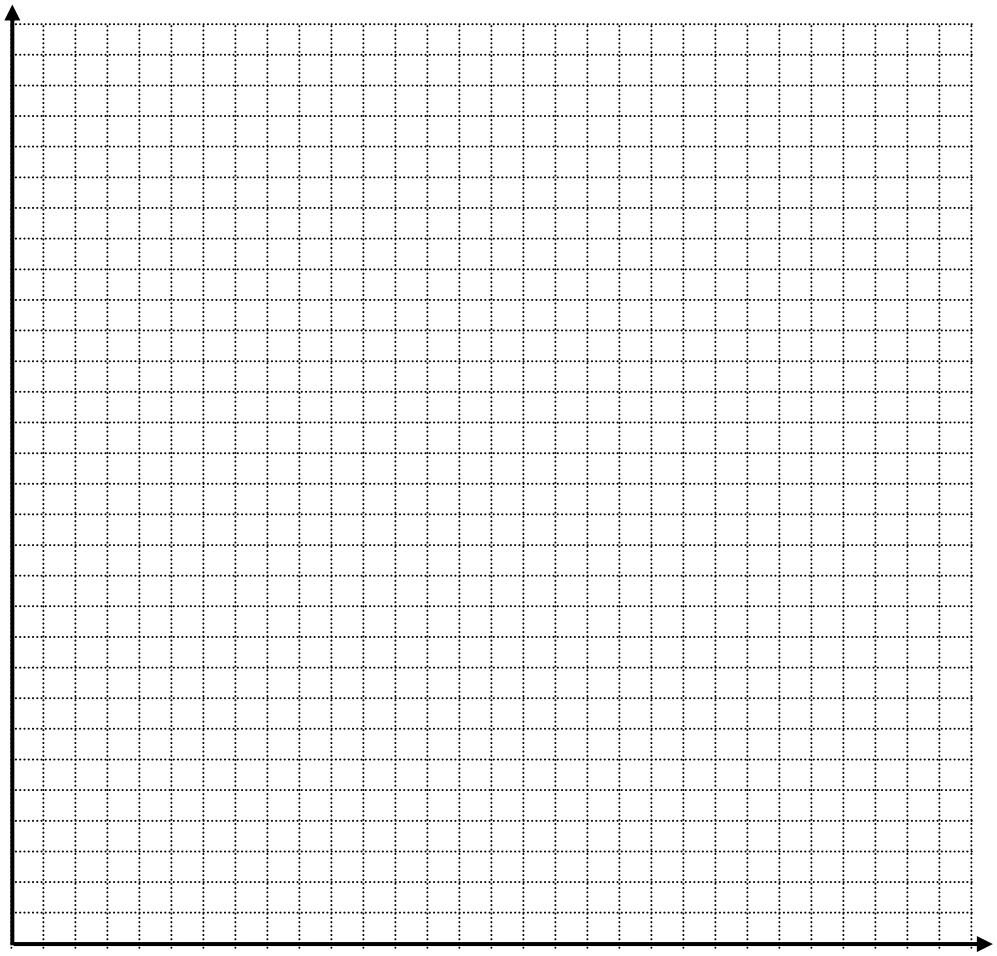
11. Compare the slopes you have calculated in questions 6, 8, and 10. Explain the results of your comparison.

12. Consider an object accelerates uniformly. If you were to calculate the average speed of the object for a given interval of time, would the object ever be traveling with an instantaneous speed equal to that average speed? If so when? Explain!

13. Use the position vs. time data to complete the data table to the right. Using the completed table, plot a velocity vs. time graph on the axes below. Perform a mathematical analysis of the resulting velocity vs. time graph in the space provided, to yield a mathematical model that describes the relationship between velocity and time for this wheel.

t (s)	x (cm)	Δt (s)	Δx (cm)	t_{mid} (s)	$\bar{v}$ (cm/s)
0.0	0.0				
1.0	5.0				
2.0	20.0				
3.0	45.0				
4.0	80.0				
5.0	125.0				
6.0	180.0				

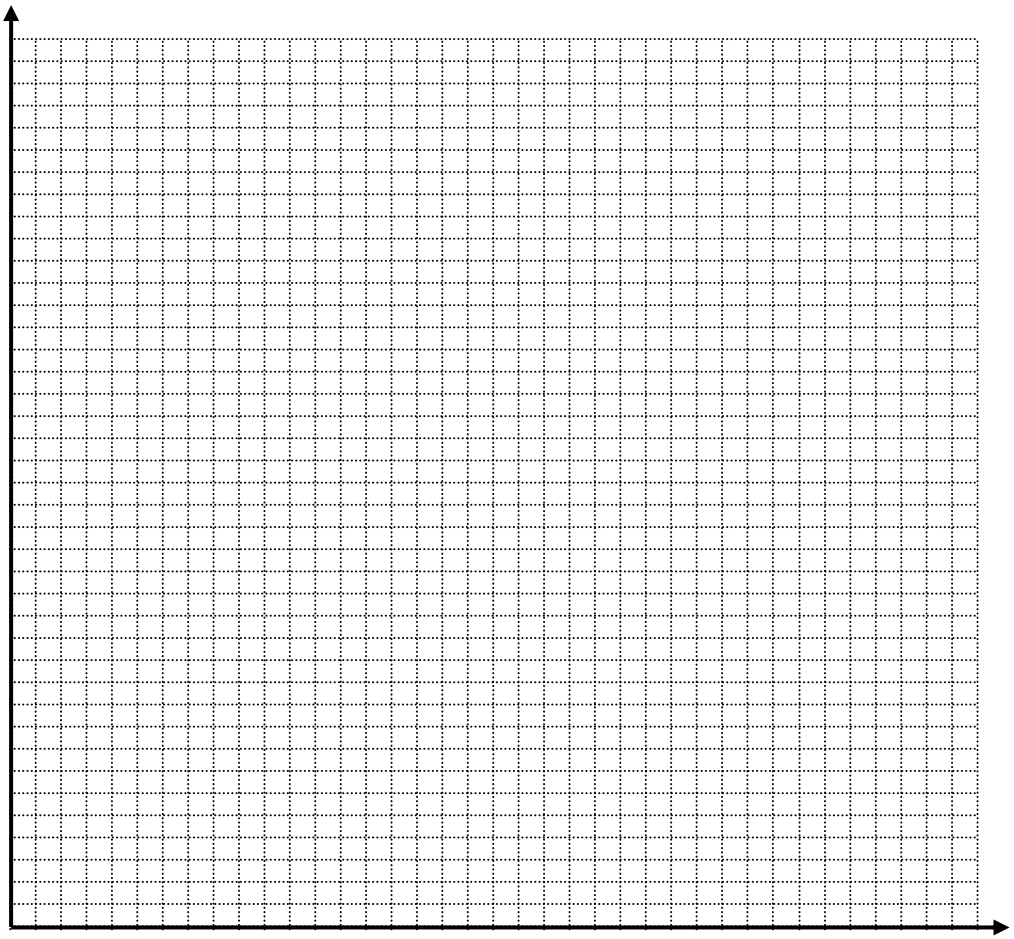
Mathematical Analysis:



14. Based on the shape of your position vs. time graph for these data, it should be clear to you that further manipulation of the data is necessary in order to develop a mathematical model that describes the relationship between position and time. Complete the data table to the right and plot a graph of position vs. time^2. Why were you asked to square time and make this new plot? In the space provided, perform the mathematical analysis of the position vs. time^2 graph to develop the mathematical model that describes the relationship between position and time.

t (s)	x (cm)	t^2 (s^2)
0.0	0.0	
1.0	5.0	
2.0	20.0	
3.0	45.0	
4.0	80.0	
5.0	125.0	
6.0	180.0	

Mathematical Analysis:



15. What is the significance of the slope of your velocity vs. time graph? Explain!

16. Compare the slope of your velocity vs. time graph to the slope of your position vs. time^2 graph. What does this say about the significance of the slope of your position vs. time^2 graph.

17. Write the equation that relates velocity and time for the wheel using the mathematical analysis of your velocity vs. time graph.

18. Write the equation that relates position and time for the wheel using the mathematical analysis of your position vs. time^2 graph.

19. What does the area under a velocity vs. time graph tell you?