AP Physics Prep **Name: ______________________________ Date: _____________**
Homework for Day 1, Session 1

Part 1: Basic Operations of Calculus

1. In chemistry, the rate of reaction (r) is defined as the rate at which concentration (c) changes. Both the rate and the concentration are functions of time (t). Which of the following statements are true? There may be more than one correct answer.
   a) $\frac{dr}{dt} = c$ b) $\frac{dc}{dt} = r$ c) $c' = r$ d) $r' = c$
   e) Concentration is the indefinite integral of the rate of reaction.
   f) Rate of reaction is the slope of the tangent to the graph of c vs t.

2. In electrical engineering, charge is the area under the curve of current vs. time, and therefore charge is the ________________________________ of current.

3. A pipe is releasing water. You know the volumetric flow rate (Q) as a function of time (t). In order to calculate the volume of water released (V), you must graph Q vs. t and calculate the area under the curve. In other words ________ is the definite integral of ________ .

4. A long, thin steel bar is heated at one end and cooled at the other. With your extensive knowledge of thermodymanics, you can calculate the rate at which temperature (T) changes as you change the position (x) of a thermometer which is in contact with the bar.
   a. The aforementioned rate is the __________________ of temperature.
   b. If you wanted to find temperature as a function of position, you would have to take the ________________________________ .

5. Explain the difference between a secant line and a tangent line.

6. Explain the difference between an average change and an instantaneous change. Which one is the slope of a secant line? Which one is the slope of a tangent line? Which one is the same as a derivative?

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Part 2: Limits

Find the following limits.

7) $\lim_{x \to 4}(3x-4) =$	8) $\lim_{x \to -2}\frac{x-5}{4x+3} =$
9) $\lim_{x \to 1/2}(4x-1)^{50} =$	10) $\lim_{s \to 4}\frac{6s-1}{2s-9} =$
11) $\lim_{x \to 1/2}\frac{2x^2+5x-3}{6x^2-7x+2} =$	12) $\lim_{x \to 2}\frac{x^2-x-2}{(x-2)^2} =$
13) $\lim_{x \to -2}\frac{x^3+8}{x^4-16} =$ (hint: look up "sum of cubes")	14) $\lim_{x \to 2}\frac{(1/x)-(1/2)}{x-2} =$
15) $\lim_{x \to 1}\left(\frac{x^2}{x-1}-\frac{1}{x-1}\right) =$	16) $\lim_{x \to -8}\frac{16x^{2/3}}{4-x^{4/3}} =$

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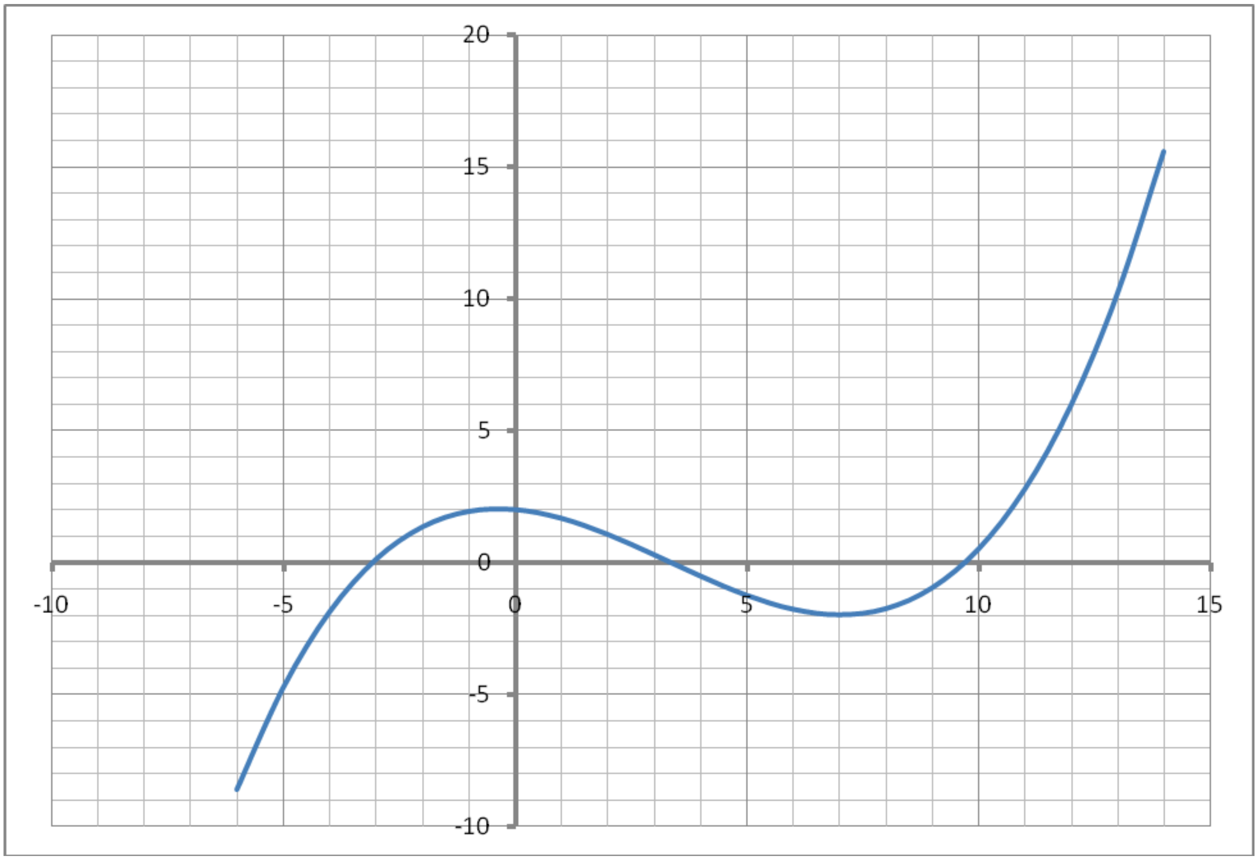
Part 3: Derivatives and Tangents

Use the graph below the answer the questions on this page.



17) On the graph above, draw tangents at x = -5, x = 3, and x = 10

18) Use the tangents you drew to calculate the derivative of this function at x = -5.

19) At what point or points is the derivative 0?

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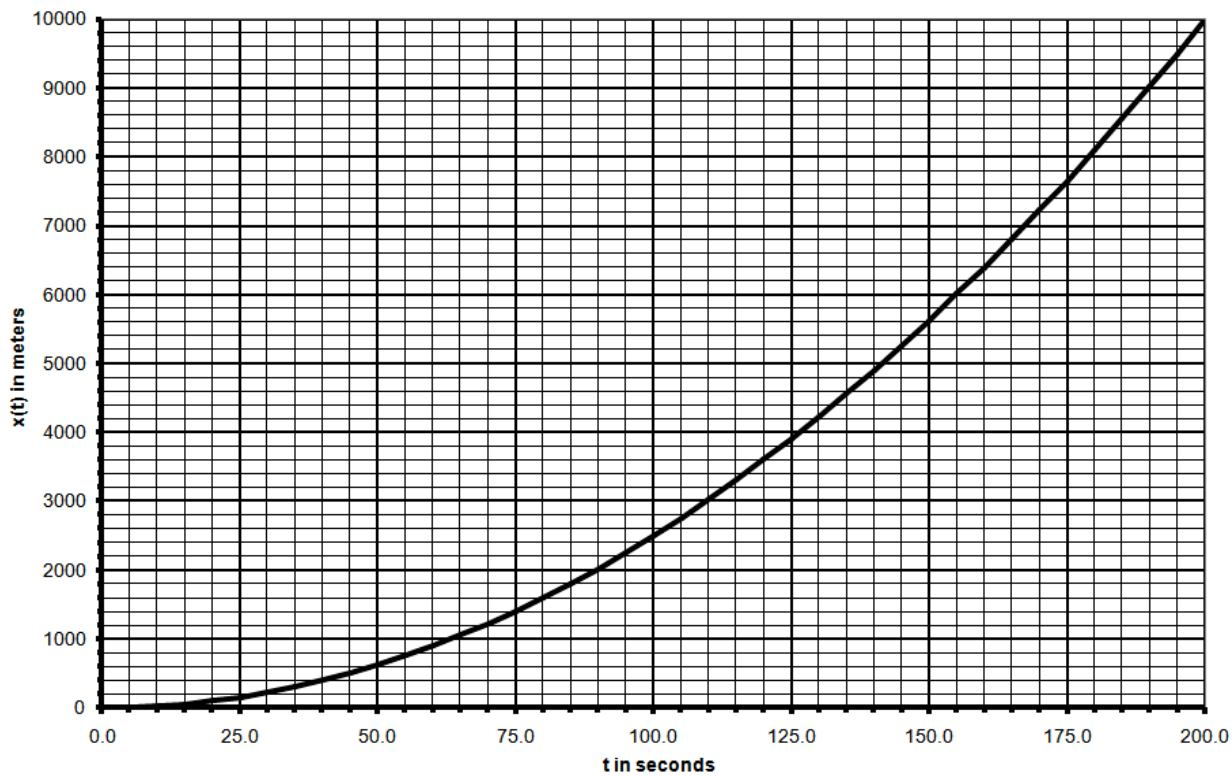
Objective: On any position vs. time graph, the instantaneous velocity at a given time is equal to the slope of a tangent. In this worksheet, you will practice calculating the instantaneous velocity by using tangent lines. <u>Use the graph below to answer all of the remaining homework questions</u>.



20. Draw tangents to the position vs. time graph at 0 sec, 50 sec, 100 sec, and 175 sec.
21. For each of the tangents drawn in part 20, locate two points along the tangent.

Tangent at time point	Point 1		Point 2	
	Time (sec)	Position (m)	Time (sec)	Position (m)
0 sec				
50 sec				
100 sec				
175 sec				

22. Use the points from part 21 to calculate the slope of the tangents drawn in part 1. Show your work for the 50 second time points in the space below.

Time Point	Slope (m/sec)
0 sec	
50 sec	
100 sec	
175 sec	

23. The slopes calculated in part 22 are equal to the instantaneous velocity. Use the results from part 22 to make a graph of instantaneous velocity vs. time in the grid below.

24. On the graph in problem 23, draw a single, straight line which gets as close to your data points as possible (a line of best fit).