Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Members of Group \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Activity on non-constant rates of change

1. *f*, represented by the following table, shows our progress as we drive along an interstate.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *t = hours elapsed since 12:00* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* |
| *y=f(t) mile marker on interstate* | *30* | *40* | *50* | *60* | *70* | *80* | *90* | *100* | *110* |

* 1. Find the average velocity over the following time intervals
     1. [0,3]
     2. [5,6]
     3. [2,8]
  2. Given this data, do the points (intervals) we select change the associated velocity? Explain why or why not.

1. A function *f*, represented by the following table, shows our progress as we drive along an interstate

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *t = hours elapsed since 12:00* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* |
| *y=f(t) mile marker on interstate* | *100* | *100* | *100* | *100* | *100* | *100* | *100* | *200* | *300* |
| *speed at time = t* |  |  |  |  |  |  |  |  |  |

* 1. Given this data, will the points (intervals) we select change the associated velocity? Explain why or why not.
  2. What is the average speed from *t = 0* to *t = 8*
  3. The speed limit is 65 mph. If a police car stops the car at t = 6.5 hours, will the driver receive a ticket?
  4. Why does the average velocity over 8 hours not matter when giving speeding tickets?
  5. Fill in the last row of the table with your best guess of the speed that will register on the speedometer of the car at the given time. What criteria do you use when selecting your best guess of the car’s speed?

1. Given that *f* is represented by the following table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *t (time elapsed in hours)* | *0* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* |
| *y=f(t) money earned* | *10* | *20* | *30* | *40* | *50* | *50* | *50* | *50* | *50* |
| *salary at time = t* |  |  |  |  |  |  |  |  |  |

* 1. What is the average salary from *t = 0* to *t = 8*
  2. If the legal minimum wage is $7.50 per hour, does the average salary meet this requirement?
  3. Does the average salary over 8 hours matter when assessing the minimum wage requirement?
  4. Fill in the last row of the table with your best guess of the wage being earned at time *t*.
  5. What criteria do you use when selecting your best guess of the salary?

1. Given the following table showing the height of a ball as a function of time elapsed:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *t (time elapsed in sec)* | *0.0* | *0.1* | *0.2* | *0.3* |
| *h(t) (height in ft)* | *100* | *98.84* | *97.36* | *95.56* |

1. Find the average velocity over the following time intervals
   1. [0,0.3]
   2. [0,0.2]
   3. [0,0.1]
2. What is the best approximation available for the instantaneous velocity of the ball when *t = 0?*
3. Given that *f(x) = x2,* use Desmos, [<https://www.desmos.com/calculator/gjkd5n0d6w>](https://www.desmos.com/calculator/gjkd5n0d6w) , to first graph *f* and then
   1. For each of the following regions, (i) graph the line between the two endpoints on the graph and (ii) identify the average rate of change for *f* over the interval
      1. [0,2]
      2. [0,1]
      3. [0,0.2]
      4. [0,0.1]
   2. By trying even closer points to *x =* 0, what is our best guess for the instantaneous rate of change of *f* at the point *x = 0*
   3. Use Desmos and the ideas of part a and b to guess the instantaneous rate of change of *f* when:
      1. *x = 1*
      2. *x = 2*
4. Given that *f(x) = 9 – x2,* use Desmos ([<https://www.desmos.com/calculator/gjkd5n0d6w>](https://www.desmos.com/calculator/gjkd5n0d6w) may be helpful but be sure to change the formula being graphed) to first graph *f* and then
   1. For each of the following regions, (i) graph the line between the two endpoints on the graph and (ii) identify the average rate of change for *f* over the interval
      1. [0,2]
      2. [0,1]
      3. [0,0.2]
      4. [0,0.1]
   2. By trying even closer points to *x =* 0, what is our best guess for the instantaneous rate of change of *f* at the point *x = 0*
   3. Use Desmos and the ideas of part a and b to guess the instantaneous rate of change *f* when:
      1. *x = 1*
      2. *x = 2*
5. Describe two situations when mechanical devices allow us to know the instantaneous rate of change and two situations when the average rate of change will need to be used to approximate the instantaneous rate of change.
6. Optional: Given that *f(x)=cos(x)*, use the ideas of the previous problems and whatever technology you prefer to guess the instantaneous rate of change at of *f* at the following points.