RATES OF CHANGE

Objective: Students will learn what rate of change is moving from a basic concept into its concept in calculus. They will demonstrate knowledge by participating in the group project and rated an average of 8 overall by their peers and their self (self & group evaluation are on a different document on blackboard).

Assessment: Students will each complete different parts of the group project and will evaluate themselves as well as their peers and must be rated an average of an 8 on a 1-10 scale evaluation.

Standard: **2.01** Explore and interpret the concept of the derivative graphically, numerically, analytically and verbally.

1. Interpret derivative as an instantaneous rate of change

Much of the differential calculus is motivated by ideas involving rates of change. When we talk

about an average rate of change, we are expressing the amount one quantity changes over an

interval for each single unit change in another quantity. For example, if a car travels 90 miles in

two hours, it would be averaging 45 miles per hour, indicating that we expect the distance it has

traveled to change by 45 miles for every one hour the time changes.

1. Express each of the following as an average rate of change:

a. The airfare from Wilkes Barre to San Francisco rose $120 in the last three months.

b. In five trading days the stock price dropped three dollars.

c. At Penn State, enrollment has increased 8% in the last four years.

d. John expects to lose nine pounds in six weeks with his new exercise program and diet.

Rates of change and graphs:

2. Suppose the following table represents temperature values on a typical June day in Scranton.

Plot the data on the axes indicated, using a scale from 7 to 18 on the horizontal axis and from

40 to 90 on the vertical axis (you can let the origin represent the point (7, 40)). Express the

times on a 24 hour basis (1 p.m. is 13, 2 p.m. is 14, etc.). Use these points to sketch the

graph of the temperature as a function of time on this interval.

Time Temperature

|  |  |
| --- | --- |
| 7 a.m.  | 49 |
| 8 a.m.  | 58 |
| 9 a.m.  | 66 |
| 10 a.m.  | 72 |
| 11 a.m.  | 76 |
| 12 noon  | 79 |
| 1 p.m.  | 80 |
| 2 p.m.  | 80 |
| 3 p.m.  | 78 |
| 4 p.m.  | 74 |
| 5 p.m.  | 69 |
| 6 p.m.  | 62 |

 3. Have each member of your group calculate the average rate of change of the temperature

over a different time period (for example, one might do the period from 9 a.m to 1 p.m.).

4. Now draw the line segment between the corresponding points on your graph and find its

slope. What do you observe?Just as the slope of the segment between two points gave the average rate of change of the

temperature over the interval, so too the slope of the tangent line to the curve at a point will tell us

the rate at which the temperature is changing at that particular moment, the instantaneous rate

of change.

5. Have each person in your group draw a line that seems to be tangent to your graph at the

point corresponding to 10 a.m. Pick another point on this tangent line, estimate its

coordinates, and use these to find the slope of the tangent line. How fast does this indicate

the temperature is changing at 10 a.m.?

6. Compare with one another the results each of you found in the last question. Why would we

not expect them all to be the same? Are they significantly different? Is this what you would

anticipate?

Baildon, John. *Collaborative Projects in Calculus I* [word document]. Retrieved from: <http://archives.math.utk.edu/ICTCM/VOL12/P001/paper.pdf>