MATH 1311

Section 6.3

Estimating Rates of Change

As seen earlier in the course, we can estimate a rate of change by using the Average Rate of Change formula:

$$AROC = \frac{Change\ in\ y - value}{Change\ in\ x - value}$$

Example:

The data from an airplane gives the distance from Los Angeles at two different time intervals:

Time	1:00 P.M.	1:30 P.M.
Distance from L.A.	360 miles	612 miles

Use this data to calculate the average velocity of the airplane, then estimate its distance from L.A. at the 1:20 pm.

Note: this method will only give estimated values in most cases.

Example:

Water is leaking from a tank. The amount of water remaining in the tank is given in the table as a function of hours.

t = hours	0	3	6	9	12
W = gallons left	860	725	612	515	433

Explain the meaning of dW/dt in terms of this problem. Estimate the value of dW/dt when t = 6 using the time interval [3, 6] and [6,9].

What can you say about how fast water is leaking from the tank based on these figures?

Example:

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Explain the meaning of dW/dt in terms of this problem. Estimate the value of dW/dt when t = 6 using the time interval [3, 6] and [6,9].

Use each of these values of dW/dt to estimate the amount of water in the tank at t = 8.

Rates of Change for Functions given by Formulas

If you are given a formula and wish to determine the rate of change at a specific value, you want to create your own table close to that data point (usually less than 1 unit away to ensure accuracy).

Then, repeat the process that was just performed.

Example:

The amount of cells in a bacteria colony is increasing at a rate given by the formula:

$b(t) = 3500\, e^{2t}$ where t is measured in hours.

Describe in words the meaning of the db/dt for this situation.

Calculate the value for db/dt close to t = 5. *Use t = 5 and t = 5.001 for your calculations.*

Use this value to estimate the number of cells in the colony for after 5 hours and 15 minutes.

The profit that a company makes for producing n-items is given by the formula: $p(n) = 12n^2 – 60n$.

1. Calculate the value of dp/dn for n = 2.5 using values of [2.499, 2.5].
2. Use this to estimate the profit for producing n = 3 items.
3. Calculate the value of dp/dn for n = 2.5 using values of [2.5, 2.501].
4. Use this to estimate the profit for producing n = 3 items.
5. What does this tell you about the value of n = 2.5 in this situation?