



Part 1 – Discover/Explore Average Value of a Function

Consider the velocity as a function of time for a roller coaster...

1. If you know the velocity at five times, for example 0, 5, 6, 9, 15 m/s, how do you find the average velocity? What do you think the average velocity is for this example?
2. Would this answer seem reasonable for the average velocity for the first 15 seconds if you knew 0 m/s occurred at $t = 0$ sec, $v(1 \text{ sec}) = 5\text{m/s}$, $v(2) = 6$, $v(3) = 9$, and the speed was 15 m/s for the next 12 seconds? Explain.
3. You are on a roller coaster going down a hill and then back up the next. Sketch the graph of what the velocity as a function of time may look like.

Execute program *animate* by typing **animate()** in the HOME screen and pressing **ENTER**.

4. The graph $y(x)$ represents the velocity as a function of time for the interval $0 \leq x \leq 6$. Consider the velocity from $x = 2$ to $x = 5$. What is the average value of the velocity function between $x = 2$ and $x = 5$? How is your answer related to the integral from $x = 2$ to $x = 5$?

Execute program *avecoast* by typing **avecoast()** in the HOME screen and pressing **ENTER**.

5. Now explore the graph of $y(x)$ when x is moved from $x = 2$ to $x = 1$. What is the average value of the function from $x = 1$ to $x = 5$?
6. List all the general observations you made, including the relationship between the integral and the average value of the function.

Turn off the axis to view this picture by pressing **F1** while in the graph screen and selecting **9:Format** and setting axes to off. Display the picture of the graph entitled *coast*.

7. Of the two graphs labeled *a* and *b*, which represents the roller coaster? What observations can be made from the velocity-time graph?

Part 2 – Extension/Homework

For the following problems show your work and circle your solution. Question 1–3 are “non-calculator” problems.

1. If $f(x) = \ln(e^{x^3})$, find the average value of function f on the interval $0 \leq x \leq 4$.
2. What is the mean value of $\frac{1}{x}$ from $x = 1$ to $x = e$?
3. What is the average rate of change of the function $f(x) = |4x - x^2|$ over the interval $-2 < x < 4$?

The following are calculator permitted questions. Show the mathematical set up (which isn't necessarily what you type into your TI-89 graphing calculator).

4. What is the average value the function $f(x) = |4x - x^2|$ over the interval $-2 < x < 4$?
5. If the average value of $y = x^2$ over $[1, b]$ is $\frac{13}{3}$, then what could be the value of b ?

6. Use the Trapezoid Rule to estimate the average value of the velocity over the 10 minute interval.

velocity (mi/min)	7.0	6.8	6.1	5.1	4.2	3.4	3.0	3.1	3.7	4.6	5.6
time (min)	0	1	2	3	4	5	6	7	8	9	10