Tutorial Instructions

Lectures 6

1 Write a class

The file `graph.cpp` contains a code skeleton for a rudimentary graphing class. Your task is to implement all of the missing functions. The file `test.cpp` contains a small program that creates a few graphs and prints the values returned by the various functions. Table 1 shows an example of the output you might get after completing the class. Numbers that are very close to but not exactly at their expected values are the result of small numerical errors.

You will have to make some design decisions while writing the class. For example, it is not immediately obvious what to do when the user wants to evaluate y at a point outside of the range defined by the graph. You could return zero, use the closest value or extrapolate somehow. Likewise, you should always make sure that the class knows what to do when graph is empty, contains only one point or other border cases. Such decisions come up frequently in real life, and you must use your best judgment. Compare your results to Table 1 and decide if they make sense.

Table 1: The table shows an example output for the four graphs used in `test.cpp`. Note that the x-axis used by the graph $f(x) = 2x$ is logarithmic, such that the spacing between the points is much smaller at low x. When a value is outside the range defined by the graph, both the cases of returning zero and using a linear extrapolation are considered.

Graph	Empty	(0, 1)	$f(x) = \sin(x)$	$f(x) = 2x$
Defined in	-	-	$[0, 2\pi]$	$[0.001, 10]$
size	0	1	1000	1000
mean	0	1	8.91964e-14	2.1791
stdev	0	0	0.707107	4.14067
integral	0	0	1.99363e-05	99.999
Zero outside range				
f(-0.1)	0	1	0	0
f(pi/2)	0	1	1	3.14159
f(15)	0	1	0	0
Linear extrapolation outside range				
f(-0.1)	0	1	-0.0999993	-0.2
f(pi/2)	0	1	1	3.14159
f(15)	0	1	8.71641	30