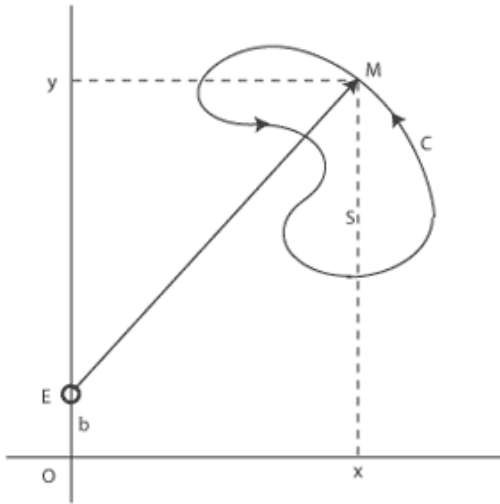


18.022 Recitation Handout
26 November 2014

1. Consider the polygon P whose vertices are listed below, in counterclockwise order. Describe a simple algorithm for approximating the area of P .

x	y		
1.	0.	-0.999301	0.0000100651
0.990436	0.000510364	-0.994893	-0.000198912
0.962169	0.00404386	-0.971584	-0.00262612
0.916455	0.0134308	-0.930411	-0.0101725
0.855307	0.031127	-0.873191	-0.0254117
0.781385	0.059054	-0.802423	-0.0504237
0.697852	0.0984698	-0.721151	-0.0866563
0.608195	0.149879	-0.632792	-0.134824
0.516034	0.212985	-0.540951	-0.194848
0.42493	0.286693	-0.449221	-0.265846
0.338182	0.369151	-0.360994	-0.346165
0.258659	0.457849	-0.279269	-0.433459
0.188645	0.549739	-0.206502	-0.524811
0.129723	0.641405	-0.144474	-0.616889
0.0827009	0.729244	-0.0942056	-0.706119
0.0475787	0.809659	-0.0559169	-0.788884
0.0235696	0.879262	-0.0290287	-0.86172
0.00916064	0.935053	-0.0122151	-0.921505
0.00221855	0.974593	-0.00349795	-0.965635
0.000130899	0.996135	-0.000378337	-0.992164
-0.0000248959	0.998721	0.000000440875	-0.999913
-0.00129456	0.982236	0.000669899	-0.988538
-0.00665282	0.947413	0.00464303	-0.958545
-0.0188134	0.895794	0.0147221	-0.911264
-0.0400542	0.829645	0.0333185	-0.848777
-0.0720676	0.751827	0.0622956	-0.773799
-0.115845	0.665643	0.102843	-0.689529
-0.171601	0.574651	0.15539	-0.599477
-0.238745	0.482473	0.219565	-0.507267
-0.315899	0.392595	0.294196	-0.41644
-0.400957	0.30818	0.377366	-0.330264
-0.491197	0.231899	0.466505	-0.251558
-0.583415	0.165791	0.558525	-0.182543
-0.674106	0.111162	0.649984	-0.124732
-0.759645	0.0685255	0.73727	-0.0788538
-0.836489	0.0375914	0.816797	-0.0448348
-0.901371	0.0172975	0.885207	-0.0218148
-0.951479	0.00589015	0.939547	-0.00821674
-0.984611	0.00104315	0.977439	-0.00185515
		0.997206	-0.0000804643

2. (Fun/Challenge problem) A planimeter is a device used to calculate the area of a two-dimensional region. In this problem, we explore the mathematics behind how the planimeter works. (Thanks to Wikipedia for the figures and the description below).



The pointer M at one end of the planimeter follows the contour C of the surface S to be measured. For the linear planimeter the movement of the “elbow” E is restricted to the y -axis. Connected to the arm ME is the measuring wheel with its axis of rotation parallel to ME . A movement of the arm ME can be decomposed into a movement perpendicular to ME , causing the measuring wheel to rotate, and a movement parallel to ME , causing the measuring wheel to skid, with no contribution to its reading.

Use Green’s theorem to explain why the final reading on the measuring wheel is equal to the area of the surface S .