Precalculus - an open access textbook

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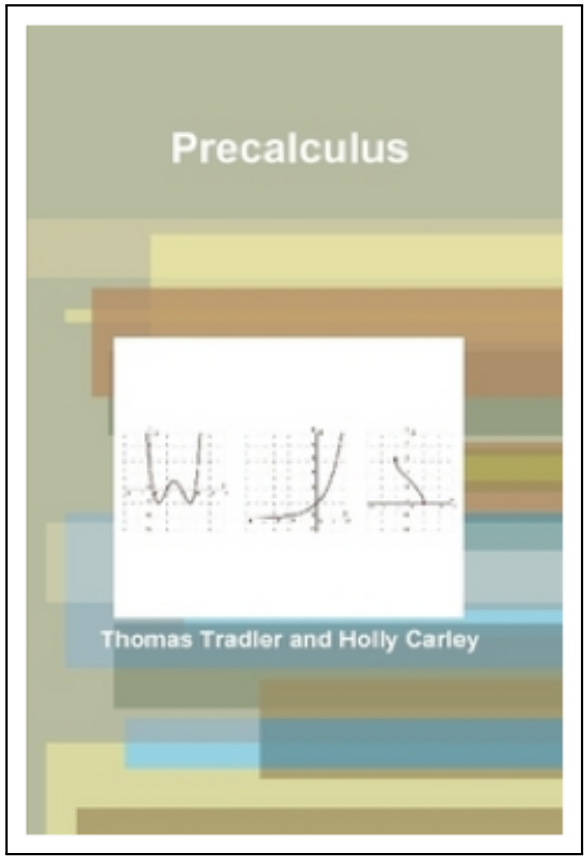
- "Precalculus" is an open access textbook
- written by T. Tradler and H. Carley
- adopted as official textbook for MAT 1375 in Fall 2013



- Citytech Math Department: $\sim$ 50 different courses offered, $\sim$ 270 course sections, $\sim$ 45 full time faculty
- Main calculus sequence:

MAT 0630/0650	$\sim$ 50 sections	Remedial math
MAT 1175	$\sim$ 45 sections	
MAT 1275	$\sim$ 40 sections	
MAT 1375	$\sim$ 30 sections	Precalculus
MAT 1475	$\sim$ 20 sections	Calculus 1
MAT 1575	$\sim$ 10 sections	Calculus 2
MAT 2675	$\sim$ 2 sections	Calculus 3

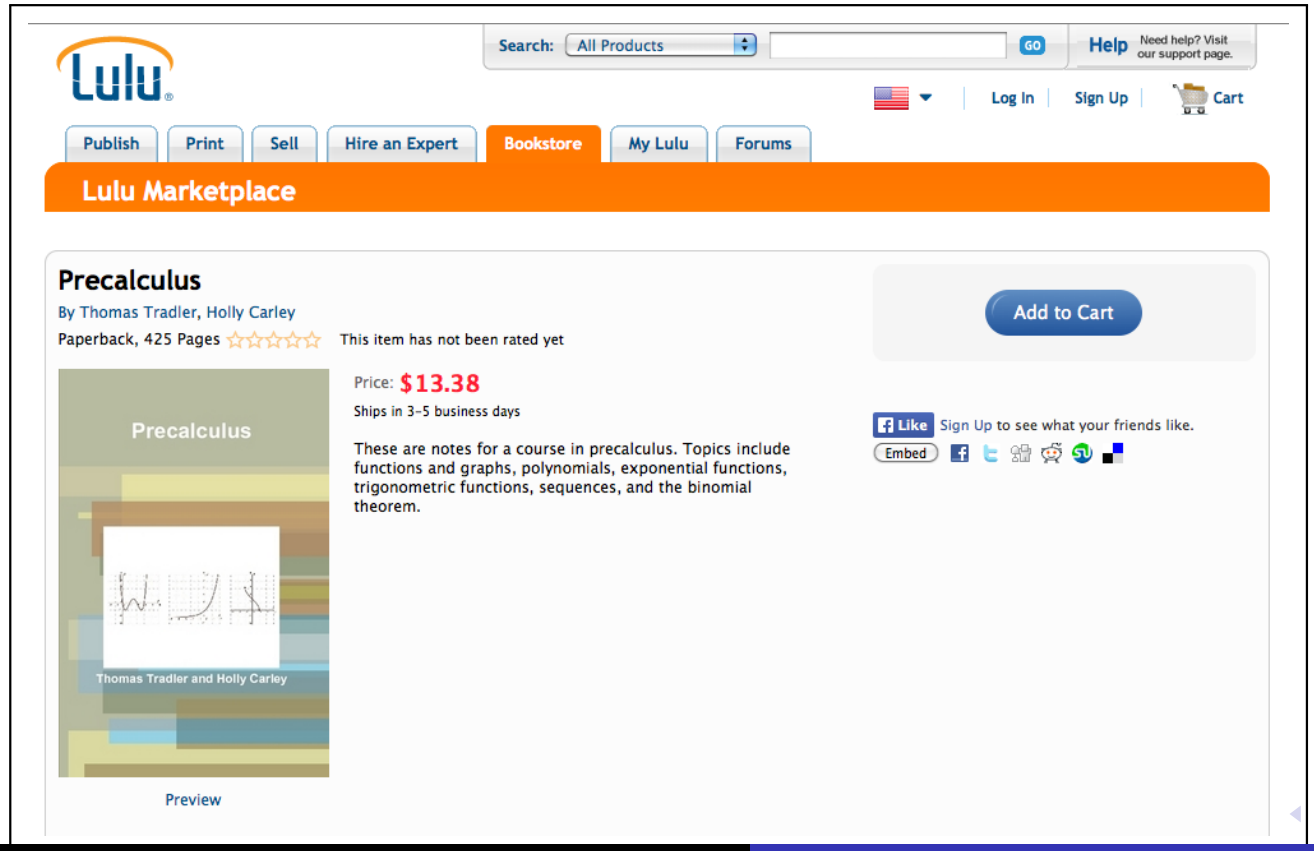
- Total: $\sim$ 270 sections, $\sim$ 165 sections in MAT 0650-1375
- My experience: teaching Precalculus at Citytech since 2003, at Baruch in 2001

- Discussions on open textbooks: 1990s and before, discussions in the department, Dean of Arts and Sciences, ...
- Early discussions in department to develop calculus textbook
- Problems with old textbook: not customized to our needs, course topics had to fit given exercises, change of editions, price, availability to students, etc.
- 2009-2011: serious contemplation to write Precalculus textbook, and started gathering ideas for such a project
- 2010-2011: Curriculum changes to MAT 1375

- 2011-2012: I started writeup while teaching several sections of the course
  - Prof. Carley started revisions, additions and proof reading
- 2012-2013: book was tested as experiment by (at least) 8 full time faculty members
  - correction of mistakes and typos
  - suggestions by students and faculty were implemented
- Fall 2013: full adoption as official textbook for MAT 1375
- Spring 2014: new edition, more corrections and additions as requested by faculty and students

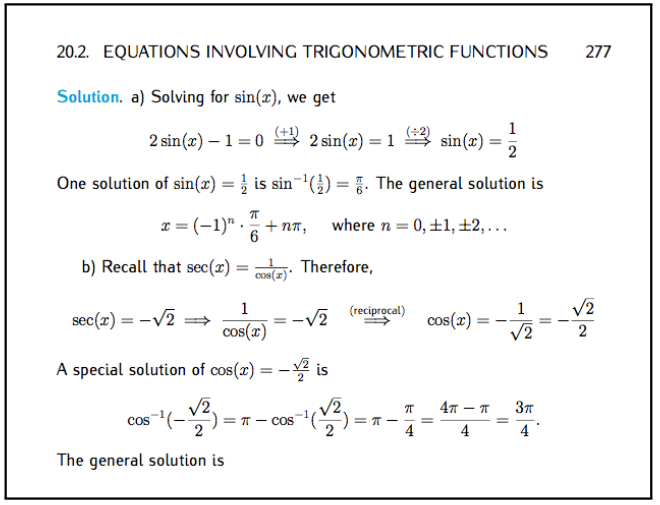
Online access

- Link to the textbook via mathematics website or directly:
  www.citytech.cuny.edu/academics/deptsites/mathematics
  websupport1.citytech.cuny.edu/faculty/ttradler/precalculus.html
- printed version on www.lulu.com



Software used

- LaTeX
  - open source software
  - standard for math papers
  - easily implement special characters: $\sqrt{3}, \frac{3}{4}, 10^{n+3}, \int_a^b f(x)dx$
- TI-Smartview software generates calculator pictures
  - complete emulator for Texas Instrument graphing calculator



20.2. EQUATIONS INVOLVING TRIGONOMETRIC FUNCTIONS 277

Solution. a) Solving for $\sin(x)$, we get

$$2\sin(x) - 1 = 0 \overset{(+1)}{\Longrightarrow} 2\sin(x) = 1 \overset{(\div 2)}{\Longrightarrow} \sin(x) = \frac{1}{2}$$

One solution of $\sin(x) = \frac{1}{2}$ is $\sin^{-1}(\frac{1}{2}) = \frac{\pi}{6}$. The general solution is

$$x = (-1)^n \cdot \frac{\pi}{6} + n\pi, \quad \text{where } n = 0, \pm 1, \pm 2, \ldots$$

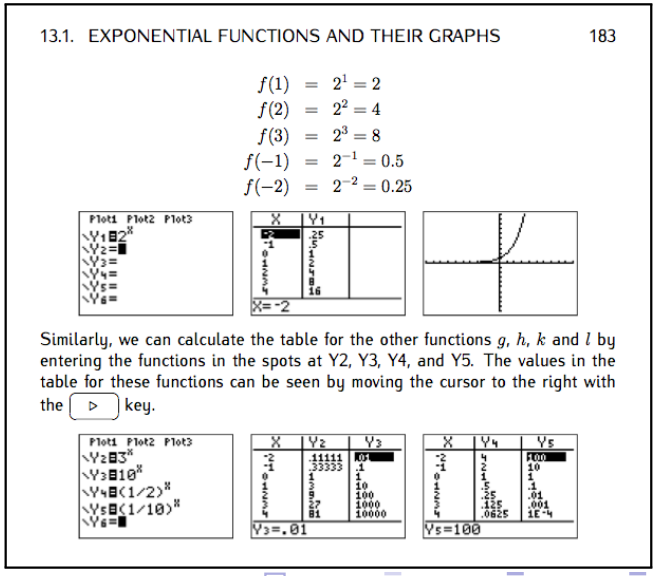
b) Recall that $\sec(x) = \frac{1}{\cos(x)}$. Therefore,

$$\sec(x) = -\sqrt{2} \Longrightarrow \frac{1}{\cos(x)} = -\sqrt{2} \overset{\text{(reciprocal)}}{\Longrightarrow} \cos(x) = -\frac{1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$$

A special solution of $\cos(x) = -\frac{\sqrt{2}}{2}$ is

$$\cos^{-1}(-\frac{\sqrt{2}}{2}) = \pi - \cos^{-1}(\frac{\sqrt{2}}{2}) = \pi - \frac{\pi}{4} = \frac{4\pi - \pi}{4} = \frac{3\pi}{4}.$$

The general solution is



13.1. EXPONENTIAL FUNCTIONS AND THEIR GRAPHS 183

$$\begin{aligned} f(1) &= 2^1 = 2 \\ f(2) &= 2^2 = 4 \\ f(3) &= 2^3 = 8 \\ f(-1) &= 2^{-1} = 0.5 \\ f(-2) &= 2^{-2} = 0.25 \end{aligned}$$

Similarly, we can calculate the table for the other functions g, h, k and l by entering the functions in the spots at Y2, Y3, Y4, and Y5. The values in the table for these functions can be seen by moving the cursor to the right with the ▷ key.

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- Copyright registered with U.S. copyright office
- no ISBN (yet...)

- Objective for Precalculus textbook:

Create a course tool that works for Citytech!

- Current status: continuous adaptation to specific needs and requests by students and faculty
- Possible future developments:
  - allow modification, make source code available online, fully open source
  - allow wider distribution via amazon, etc.
  - alternative: publish via traditional publisher
  - develop other courses in the Calculus sequence 0650-1375

- Develop WeBWork homework system along side course texts for MAT 0650-MAT 1375
- WeBWork is an open source online homework system
- WeBWork has a large library of homework problems for all kinds of topics; (relatively) easy to develop additional homework problems
- WeBWork is supported by the MAA (Mathematical Association of America) and NSF and already in use in many universities

Thank you!