

Using and Creating Internet Math Resources: Putting the Mathematics Archives to Work

A Minicourse Presented at the 22nd Annual Conference of
The American Mathematical Association of Two-Year Colleges

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Program Description:

Using the Mathematics Archives as a starting point, participants will travel the World Wide Web in search of interactive mathematics courses, tutorials and other resources that they can use. Participants will then organize and construct a series of web pages using HTML to create an online math tutorial. Intended for a general audience; no previous HTML experience required. (1-5pm, Thursday, November 14, 1996. Cerritos Community College.)

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[Math Archives Home Page](#)



The Mathematics Archives Home Page is shown in a reduced form on the left of this page. The home page is the starting point for your investigation of the myriad of resources available to you at the click of a mouse. From the home page you may connect to any of the major sections of the archives. These sections are:

- [Topics in Mathematics](#)
- [Software](#)
- [Teaching Materials](#)
- [Other Math Archives Features](#)
- [Other Links](#)
- [Search the Math Archives](#)
- [What's New on the Math Archives](#)
- [Math Archives Information](#)

As you proceed through this presentation, you may chose at any time to connect directly to the Mathematics Archives. You can do so by clicking on the facsimile of the home page shown on the left in each succeeding page in this presentation. If you do, you can return to this series of pages by using the **BACK** selection in your browser or by selecting this page in the history list (under GO in the Netscape menu bar).

Each page in this presentation has three choices in the lower area of the page. The **Back** selection here will take you to the previous page in this presentation. The **Presentation Table of Contents** selection will return you to the first page in this presentation. The **Next** selection will advance you to the next page in the presentation. Also on each of the subsequent pages in this presentation will have an enlarged portion of the home page. If you click on this graphic, you will be transferred to the related page on the Mathematics Archives.

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The Topics in Mathematics Page



Topics in Mathematics NEW

Teaching materials, software, WWW links organized by Mathematical Topics. Searchable database.

The words *Topics in Mathematics* can be seen on the representation of the Mathematics Archives home page shown to the left and above. The phrase is in blue, underlined text (your browser could possibly look different). This indicates that the phrase is **hypertext**. When a hypertext link is selected (usually by clicking the mouse on it) a related page would be loaded into the browser's viewing window. In this case, the user would be connecting to a *new* feature on the Archives.

The *Topics* page provides the user with the opportunity to search an expanding database of links to Internet sites of interest to mathematics professionals. The links are found by entering keyword(s) and are categorized as to level of mathematical background expected of the user. There is also an alphabetical listing of links which the user may scan.

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The Software Page



Software

Public domain and shareware software, links to other software sites.

The Mathematics Archives hosts a large collection of public domain software and shareware of interest to mathematics professionals and to students. The software is arranged by platform (Mac, PC, etc.) as well as application (calculus, linear algebra, etc.). With each piece of software, a description can be read before choosing to download the file. While commercial software is not available for download, most are described and many have been reviewed by independent individuals.

As is standard with the Mathematics Archives, the *Software* page provides the user with the opportunity to search for usable software by subject area, keyword, publisher, etc.

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The Teaching Materials Page



Teaching Materials

Calculus Resources On-line, Emerging Scholars Program, Graphing Calculators, JAVA and Other Interactive WWW Pages, K-12 Teaching Materials, Lessons, Tutorials and Lecture Notes, Visual Calculus, etc.

Included in this area of the Mathematics Archives, are the pages forming the Calculus Resources On-line. This is an extensive compilation of initiatives, projects, and programs related to the teaching of calculus. Also listed here is a collection of calculus problems developed as part of the Emerging Scholars program. Links to all sorts of mathematics education resources of interest to K-12 teachers as well as post-secondary educators are found from this page. If you are looking for lesson plans, check out this page!

One of the new and exciting features located at the Mathematics Archives is the collection called *Visual Calculus*. The Visual Calculus pages are devoted to showing instructors (or students) how a particular calculus concept can be demonstrated on selected computer software. Detailed instructions with screen snapshots are given to illustrate the effective use of technology in mathematics instruction. Teachers wanting to use computer software in their classes but who are new to the technology will find these pages invaluable.

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The Other Math Archives Features Page



Other Math Archives Features

Electronic Proceedings of the CTM and the ICTCM, POPMathematics, Project NEXT, UTK Mathematical Life Sciences Archives, etc.

Several collections of papers, abstracts of papers or projects, and problem sets are housed at the Mathematics Archives. Included are 31 NSF/ILI projects presented at an ILI Poster Session, 25 papers presented at the Fifth Conference on the Teaching of Mathematics, and the contributed papers of the 1994, 1995, and 1996 International Conferences on Technology in Collegiate Mathematics.

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The Other Links Page



Other Links

Links to other mathematics related sites and sites of interest to students and teachers of mathematics.

Sure there are generic search engines on the net. However, the Mathematics Archives provides an exhaustive set of links to **mathematics-related** Internet sites. These sites have been examined for applicability and categorized and described by fellow mathematics professionals. These links have been classified for you and arranged in a logical organization. In addition, the entire archives contents is searchable by keyword(s).

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The Search the Math Archives Page



Search the Math Archives

Full text searching of all pages and documents on the Math Archives.

One of the most valuable features of the Mathematics Archives is the ability to search all the web pages and all the documents in the collection. For the mathematics professional, this represents an advancement over searching at one of the generic Internet search locations. The documents as well as the web pages that describe them are related to mathematics, classified as to applicability, and located in one place. The extensive collection of links to mathematics sites on the Internet are also part of the searchable database.

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The What's New on the Math Archives Page



What's New on the Math Archives

A listing of the current month's and previous months' additions to the Math Archives.

Check this page often! Each time a new resource is added or a new link is cataloged, an entry is made on this page. As you can see by examining this page and the pages for previous months, new entries are frequent.

As always, remember that the entire Mathematics Archives is searchable by keyword.

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The Math Archives Information Page



Math Archives Information

Goals, financial support, personnel, information on submitting materials to the Math Archives, etc.

The Mathematics Archives is supported by the National Science Foundation, the state of Tennessee Science Alliance, and the Departments of Mathematics at Calvin College and the University of Tennessee, Knoxville. The Directors of the Archives, Earl Fife and Larry Husch, are assisted by a team of several moderators responsible for specific information types as well as mathematics professionals like yourself. You can help by submitting materials for inclusion or notifying the Archives staff of an online resource not already cataloged.

During a recent month, **317,516 files** were transmitted by the Mathematics Archives. This represented **4,388,567,532 bytes** of information sent to **80 countries**.

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Examples of Effective Use of the Internet in Teaching Mathematics

The following examples are given to illustrate a particular technique in presenting mathematics via the World Wide Web. This list should not be construed as a definitive list but is given simply to provide the math professional with an idea of the types of things happening on the World Wide Web. Authors are noted when possible. For more information on a particular page, please visit that page and check for the author's e-mail address.

Use of inline graphics (gif files) to represent mathematics symbols

[Abstract Algebra Online: Integers](#). John A. Beachy.

Use of a clickable imagemap for user input

[Analysis Webnotes: The Lower Riemann Sum](#). John Lindsay Orr.

Discussion Forum.

[Analysis Webnotes: Discussion Questions](#). John Lindsay Orr.

Delivery of Maple V worksheets.

[Calculus I with Maple V](#). Dr. Joe A. Marlin & Dr. Hok Kim
with Labs & Projects by Dr. Ernest Burniston.

Delivery of Maple V, Mathematica, MathCad, Theorist worksheets.

[Calculus Modules Online](#). PWS Publishing.

Homework Hints.

Colgate: [Math 213 Home Page](#).

Lecture Notes.

[Examples of self-similar tilings](#). David J. Wright.

Online Course.

[Statistics 438: Graphical Data Analysis](#). Jeff Banfield.

Syllabus.

[Introductory Numerical Analysis](#). James Carr.

Delivery of Motion Pictures (mpeg files).

[The Interactive Physics Problem Set](#). U.C. Berkley.

Frames.

[Interactive Real Analysis](#). Bert G. Wachsmuth.

Delivery of Quicktime Movies.

[Central Limit Theorem](#). Berrie Zielman.

Online Expression Evaluator (perl script).

[On-Line Calculator](#). David Sumner.

Automatically Generated Computer-graded Smart Exercises for Instruction via the Web.

[Online Exercises](#). Wlodzimierz Bryc and Stephan Pelikan.

Delivery of Mpeg Animations.

[Graphics for the calculus classroom](#). Douglas N. Arnold.

Java Tutorial.

[The Vector Cross Product](#). David McNamara, Alan Middleton, and Eric Schiff.

Java Applet.

[Graphing Cubic Polynomials](#). Jim Carlson.

Java Applet.

[The Geometry Applet](#). David Joyce.

Technology Instructions.

[Visual Calculus](#). Larry Husch.

Biography.

[The Alan Turing Page](#). Andrew Hodges.

Reference.

[Favorite Mathematical Constants](#). Steven Finch.

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HTML Practice for Mathematics Professionals

During this presentation we will practice using HTML by re-creating some mathematics-related web pages. These pages will be handed out in hardcopy during the workshop. Participants will enter the html code into a word processor during the session.

The Handouts

- [Demand](#)
- [Demand: Symbolic Analysis](#)
- [Demand: Numerical Analysis](#)
- [Demand: Numerical Analysis, TI-83 Procedure](#)
- [Demand: Graphical Analysis](#)
- [Demand: Verbal Analysis](#)

After the conference, the handouts listed above will be available on-line and the descriptions will become active hypertext links.

HTML Tags Used in the Handouts:

Tag Type	Tag	Modifier
Structure	HTML	
	HEAD	
	TITLE	
	BODY	BGCOLOR, TEXT, LINK, VLINK, ALINK
Headings	H2, H3	ALIGN
Links	A	NAME, HREF
Lists	OL	
	UL	
	LI	
Tables	TABLE	CELLSPACING, CELLPADDING, BORDER, BGCOLOR
	TR	ALIGN, VALIGN
	TH	ROWSPAN, COLSPAN
	CAPTION	
	TD	ALIGN, VALIGN
Forms	FORM	
	INPUT	TYPE, NAME, SIZE, VALUE
	TEXTAREA	NAME, ROWS, COLS
Character Formatting	B	
	I	
	SUB	
	SUP	
	FONT	SIZE
Paragraphs	P	
	BLOCKQUOTE	
Images	IMG	SRC, ALT, HEIGHT, WIDTH, NOBORDER, ALIGN
Other	HR	SIZE, WIDTH, NOSHADE
	&	NBSP, COPY
	<!-- -->	#ECHO LAST MODIFIED

Many other HTML tags in addition to the tags actually inbedded within the handouts will be discussed. For more detailed information on HTML, versions of HTML, HTML editors, and HTML tutorials, check the [HTML section on Yahoo](#).

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Demand

- The change in revenue as price is increased -

Will a publisher increase revenue by increasing the suggested retail price of the next book published? How does revenue change as the price is increased? What happens to the consumer demand for the book if the price is increased? Is there a best price for the book? How many books should the publisher have order from the printer? Is there a price so high that no one would buy the book? Would a decrease in the price of the book stimulate sales so that more revenue might be expected?

The following series of pages may help you consider the fundamental question of how revenue changes as price increases.

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Demand

- Symbolic Analysis -

Situation:

From past experience, a publisher knows that a particular type of book will sell 14,000 copies at a price of \$20 each. Market research further indicates that for every one-dollar increase in price, sales will fall by 400 copies. The publisher asks for your advice in deciding the suggested retail price of the next book published.¹

Symbolic Analysis:

In this situation, the number of books sold will change if the publisher decides to change the suggested retail price of the book. Since the number of books sold depends on the number of times the publisher decides to increase the price, one may use the **variable x to represent the number of increases**.

The suggested retail price may then be thought of as the usual price (\$20) plus the amount that the publisher decides to increase the price of the book. Since the increases come in \$1 dollar increments, the **total increase may be written as $1x$** (\$1 per increase times the number of increases). Of course, $1x$ is usually written as just x . Therefore, the **suggested retail price can be written as $20 + x$** .

The number of books expected to be sold may be thought of as the usual number (14,000) less the number not sold as a result of raising the asking price of the book. The number not sold will be 400 for each increase in price. Therefore, the number not sold may be written $400x$. The **expected number of books sold may be represented by $14000 - 400x$** .

The revenue from book sales is calculated by multiplying the number of books sold by the price charged for each book. In previous times this could be determined by multiplying 14000 books by \$20 per book for a total revenue of \$280,000. If the publisher changes the suggested retail price of the book, the **total revenue will be the number of books expected to be sold times suggested retail price**. Using the analysis above this would be **written as $(14000 - 400x)(20 + x)$** .

Conclusion:

A function useful in determining the anticipated revenue could be represented by:

$$f(x) = (14000 - 400x)(20 + x)$$

Further analysis of this situation may be accomplished by [graphing the function](#) listed above or by [examining projected sales data](#).

[1](#) Problems of this type may be found in Mathematical Analysis, 3rd. Ed. By Arya and Lardner, published by [Prentice Hall](#), 1989, page 93.

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Demand

- Numerical Analysis -

Situation:

From past experience, a publisher knows that a particular type of book will sell 14,000 copies at a price of \$20 each. Market research further indicates that for every one-dollar increase in price, sales will fall by 400 copies. The publisher asks for your advice in deciding the suggested retail price of the next book published.¹

Numerical Analysis:

From a [symbolic analysis](#) of the situation, a function used to model this situation is given by $f(x) = (14000 - 400x)(20 + x)$, where x represents the number of increases and $f(x)$ is the anticipated revenue. A table of data may be constructed by substituting values for x into the expression and calculating values for $f(x)$.

Revenue Data

Increases (x)	Books Sold (14000-400x)	Price of Book (20+x)	Revenue (14000-400x)(20+x)
0	14,000	\$20	\$280,000
1	13,600	\$21	\$285,600
2	13,200	\$22	\$290,400
3	12,800	\$23	\$294,400
4	12,400	\$24	\$297,600
5	12,000	\$25	\$300,000
6	11,600	\$26	\$301,600
7	11,200	\$27	\$302,400
8	10,800	\$28	\$302,400
9	10,400	\$29	\$301,600
10	10,000	\$30	\$300,000
11	9,600	\$31	\$297,600
12	9,200	\$32	\$294,400
13	8,800	\$33	\$290,400
14	8,400	\$34	\$285,000
15	8,000	\$35	\$280,000
16	7,600	\$36	\$273,600
17	7,200	\$37	\$266,400
18	6,800	\$38	\$258,400
19	6,400	\$39	\$249,600
20	6,000	\$40	\$240,000

As can be seen from the table above, the revenue without increasing the suggested retail price of the book would be expected to be \$280,000. For the first few times the price is increased the revenue also increases. The revenue reaches a maximum value of \$302,400 for seven and eight increases.

Further analysis of this situation may be accomplished by [graphing the function](#) listed above or by a [symbolic analysis](#). The numerical analysis may be [modeled effectively on the TI-83 graphics calculator](#).

1 Problems of this type may be found in Mathematical Analysis, 3rd. Ed. By Arya and Lardner, published by Prentice Hall, 1989, page 93.

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Demand

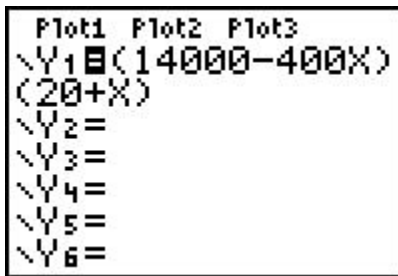
- Numerical Analysis -
- TI-83 Procedure -

Situation:

From past experience, a publisher knows that a particular type of book will sell 14,000 copies at a price of \$20 each. Market research further indicates that for every one-dollar increase in price, sales will fall by 400 copies. The publisher asks for your advice in deciding the suggested retail price of the next book published.¹

Calculator Procedure:

1. Press the **Y=** key and enter the function into **Y1=** as $(14000-400x)(20+x)$. Your screen should look like this:



2. Press the **2nd TblSet** keys and enter 0 for **TblStart** and 1 for **deltaTbl**.



3. Now press **2nd TABLE** to see the table.

X	Y ₁	Y ₂
0	280000	
1	285600	
2	290400	
3	294400	
4	297600	
5	300000	
6	301600	
X=0		

In the graphic shown here, **X** represents the number of \$1 increases in the price of the book. **Y₁** represents the total revenue from book sales.

To stop the animation (for Netscape 2.0 and above), click the stop button in the browser menu bar or tap the **Esc**-key on the keyboard.

Reload the page to start the animation again.

Notice that the revenue (Y1) increases from \$280,000 to \$302,400 at seven increases and also at eight increases. After eight increases, the revenue begins to decrease.

Further analysis of this situation may be accomplished by [graphing the function](#) listed above, or by a [symbolic analysis](#). The numerical analysis may be [modeled without the calculator](#).

1 Problems of this type may be found in [Mathematical Analysis](#), 3rd. Ed. By Arya and Lardner, published by [Prentice Hall](#), 1989, page 93.

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Demand

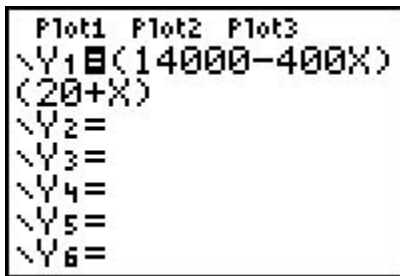
- Graphical Analysis -
- TI-83 Procedure -

Situation:

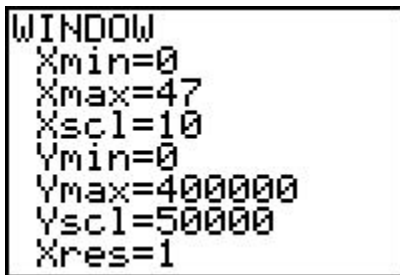
From past experience, a publisher knows that a particular type of book will sell 14,000 copies at a price of \$20 each. Market research further indicates that for every one-dollar increase in price, sales will fall by 400 copies. The publisher asks for your advice in deciding the suggested retail price of the next book published.¹

Calculator Procedure:

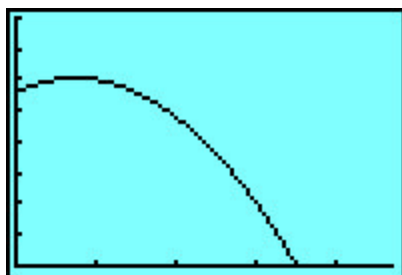
1. Press the **Y=** key and enter the function into **Y1=** as $(14000-400x)(20+x)$. Your screen should look like this:



2. Press the **WINDOW** key and enter the values below. This will ensure a freindly window for this graph.

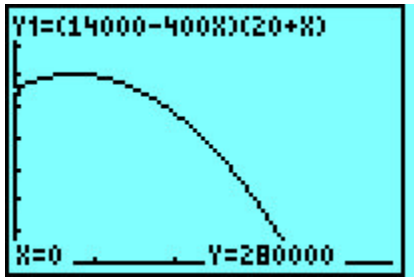


3. Now press **GRAPH** to see the graph.



In the graphic shown here, the x-axis represents the number of increases and the y-axis represents the total revenue from sales.

4. Now press the **TRACE** key. The display will change so that the function, the value of x (number of increases) and y (revenue) are shown.



To stop the animation (for Netscape 2.0 and above), click the stop button in the browser menu bar or tap the **Esc**-key on the keyboard.

Reload the page to start the animation again.

Notice that the revenue (Y) increases from \$280,000 to \$302,400 at seven increases and also at eight increases. After eight increases, the revenue begins to decrease.

Further analysis of this situation may be accomplished by a [symbolic analysis](#), or by a [numerical analysis](#).

¹ Problems of this type may be found in [Mathematical Analysis](#), 3rd. Ed. By Arya and Lardner, published by [Prentice Hall](#), 1989, page 93.

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Demand - Verbal Analysis -

Situation:

From past experience, a publisher knows that a particular type of book will sell 14,000 copies at a price of \$20 each. Market research further indicates that for every one-dollar increase in price, sales will fall by 400 copies. The publisher asks for your advice in deciding the suggested retail price of the next book published.¹

What do you think?

Name:

Your e-mail address:

1. From the symbolic analysis, which of the following expressions describes the number of books sold?
 - a. x
 - b. $20+x$
 - c. $400x$
 - d. $14000-400x$

2. Which type(s) of analysis did you prefer?
 Symbolic Numerical Numerical, with TI-83 Graphical

3. Why did you prefer that type of analysis?

4. What would you recommend to the publisher?

Send

Clear Information

[1](#) Problems of this type may be found in [Mathematical Analysis](#), 3rd. Ed. By Arya and Lardner, published by [Prentice Hall](#), 1989, page 93.

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Minicourse Questions and Comments

Do you have an unresolved question from this workshop? Or perhaps you have thought of question after the session was over. If so, please ask it in the space provided below. I will give it some thought and e-mail you back. Comments and suggestions for improving the workshop are also appreciated. You can also use your regular mailer to send comments to [John St.Clair <jstclair@mscc.cc.tn.us>](mailto:jstclair@mscc.cc.tn.us).

Name:

E-mail address:

Question:

Comment:

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