Vision - Potential

Vision Within Every Instructor - Potential Within Every Student

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Contents

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[1] Preparation for Business Students

(This article consists of the college algebra portions of the Report from the Business and Management workshop held as part of the CRAFTY Curriculum Foundations Project. The workshop included thirty six participants from Business and six mathematicians. The full report, written by Chris Lamoureux—Head, Finance Department, Arizona University, is available in the MAA publication: *Curriculum Foundations Project, Voices of the Partner Disciplines)*

College algebra programs can help prepare students going into business by stressing problem solving using business applications, conceptual understanding, quantitative reasoning, and communication skills. Conceptual understanding can be fostered by motivating the mathematics with the "whys"—not just the "hows." Quantitative reasoning includes becoming familiar and comfortable with the language of mathematics and the application of mathematical reasoning to quantitative problems. It is enhanced through the use of technology, particularly spreadsheets. Communication skills can be developed by having students work in teams and communicate solutions through oral and written reports.

In general, business faculty are less concerned with specific course content than with developing quantitative literacy and analytical ability in students. A measure of the curriculum's success is the students' comfort level when exposed to a new formula in a business class. When in doubt, mathematics faculty should cover *less* material—and treat the material with respect—imparting to students a sense of importance of mathematics as a necessary part in the development of successful business people.

Business decisions are most commonly made under conditions of uncertainty and risk. Inferences must be drawn from data and information that are incomplete, inconclusive, and most likely imprecise. Whenever possible, math courses should attempt to illustrate this ambiguity and provide guidance in dealing with uncertainty and variation.

Business faculty recommend that mathematics curriculums include:

- Realistic business problems (developed in conjunction with business faculty)
- Use of technology (e.g., spreadsheets)

* Supported by the U.S. Military Academy.

- Real (or realistic) data sets
- Problem motivated modeling
- Expressing ideas symbolically
- Sensitivity analysis

Algebra is a basic prerequisite to study business. Students should be able to solve simultaneous equations, understand the concept of function and functional relationships, understand the use of common functions in modeling business concepts, construct and understand graphs, and use abstraction to build simple models.

Students should work on group projects or assignments, and be asked to prepare written reports and oral presentations to communicate the results of their analysis. The ability to work effectively in groups and the ability to explain quantitative concepts and results in plain English are highly valued skills in business.

[2] Indexes

The Consumer Price Index (CPI) is often referenced in social and political discussions as well as in economic discussions. For example, CPI is used in measuring inflation and a central question in the debate over reforming social security is whether future increases in benefits should be tied to changes in wages or to changes in the CPI. Because our economy is consumer based, learning about CPI should be part of every person's education. Since the computations only involve working with fractions and manipulating an elementary equation, CPI, or indexes in general, is a very suitable topic for a Contemporary College Algebra class. The Web and beginning college economics texts serve as resources for both students and instructors. In addition, including two or three classes on CPI provides a nice opportunity to invite an economics or business instructor to speak to the class. This would enhance the connection between business and mathematics at both the student and faculty levels.

How much does a gallon of gas today, cost in 1970 dollars? The first Ford car produced, a 2-person runabout, sold for $850 in 1903. How does this price, expressed in today's dollars, compare with the price of a new Ford coupe today? How can the values of the same economic variable from two different time periods be compared? In order to answer these types of questions, one needs to establish a base price and then make comparisons relative to this base. That is the concept of an *Index*. A price index measures the price level at a given period relative to a chosen base period.

$$\text{Index Number} = \frac{\text{Present Cost}}{\text{Base Year Cost}} \text{ x } 100$$

Example. A first-class postage stamp cost 6 cents in 1970. Using 1970 as the base period, what is today's first-class postage index?

$$\text{First-Class Postage Index} = \frac{0.37}{0.06} \text{ x } 100 = 617$$

Thus it costs 6.17 times as much to buy a first-class postage stamp today as it did in 1970. Because the index number for the base period is always 100 (Why?), the index of 617 indicates a 517 percent increase in the cost of a first-class postage stamp since 1970. Note that

percent change = price index number - 100

The CPI represents the change in price of a representative set (i.e., a "market basket") of goods and services commonly purchased by households (e.g., food, soap, paper towels, energy, automobiles, haircuts, etc.). The base period, say 1967, is denoted by writing "(1967=100)."

Knowing the sequence of yearly CPI numbers enables one to compare prices in different periods by manipulating the previous Index Number equation. For example, what

is $1,000 today worth in 1980 dollars? (The reader should fill in the explanations for the following list of manipulations.)

Index 1980 = $\frac{\text{Cost 1980}}{\text{Base Year Cost}}$ x 100

Cost 1980=(Index 1980)(Base Yr. Cost)/100

Cost 2005=(Index 2005)(Base Yr. Cost)/100

$\frac{\text{Cost 1980}}{\text{Cost 2005}} = \frac{\text{Index 1980}}{\text{Index 2005}}$

Cost 1980 = Cost 2005 x $\frac{\text{Index 1980}}{\text{Index 2005}}$

Thus if the 1980 Index is 450 and the 2005 Index is 900, $1,000 in 2005 would have been worth $500 in 1980.

Given the following list of CPI numbers (1982-84 = 100), determine how much $1 in 1913 would be worth today. Also explain what might have caused the index numbers to decrease from 1925 through 1933. (The 2005 number is an estimate.) The complete list from 1913 is available at www.CPI.org.

Year	Annual Average
1913	9.9
1925	17.5
1929	17.1
1933	13.0
1934	13.4
1935	13.4
1970	38.8
1980	82.4
1990	130.7
2005	195.3

There are many indexes. The Gross Domestic Product (GDP) measures changes in the total output of our national economy. Samples of more specialized indexes include Consumer Confidence Index, Import Price Index, NASA New Start Index, and Produce Price Index.

[3] Problems of the Week

Miami Dade College

The following problems were selected from the "Problem of the Week" program run by the mathematics department at Miami Dade College.

1. Three different numbers are chosen such that when each of the numbers is added to the average of the other two, the results are 65, 69, and 76, respectively. Find the average of the original three numbers.

2. Suppose all the vehicles traveling on a certain interstate highway have either 18 wheels on five axles or four wheels on two axles. In a five-minute period, 224 wheels on 88 axles passed by an observation station. How many vehicles passed by the observation station during that period?

3. The area of the top of a box is 30 sq. in. and the area of the front is 12 sq. in. If the surface area of the box is 164 sq. in., what is the volume of the box?

4. Two ladders, one of which is twice as long as the other, rest on the floor and reach the same vertical height on a wall. The shorter ladder makes an angle of 60 degrees with the floor. Determine the sine of the angle that the longest ladder makes with the floor.

5. In the base 10 number system, the number 526 means $5\cdot10^2+2\cdot10+6$. In the land of Nottenfingers, the numbers are written in base B. Jones purchases a TV set there for 440 monetary units (abbreviated m.u.). He gives the sales person a 1000 m.u. bill and receives 340 m.u. in change. What is B? (There is no sales tax in the land of Nottenfingers.)

[4] Capacity versus Wing Span

The March issue of Continental Airlines inflight magazine contained the following table listing the different types of airplanes in their fleet, the capacity of each, and the wingspan of each.

Plane	Capacity	Wing Span
777-200 ER	283	199' 11"
767-400 ER	235	170' 4"
767-200 ER	174	156' 1"
727-200	183	124' 10"
737-300	124	112' 7"
ERJ-145	50	65' 9"

Plot the data of Capacity vs. Wing Span and then fit a curve to your scatter plot.

What does your model predict for the length of the wing span for a plane that holds 75 passengers?

Interpret the meaning of the y-intercept of your model.

Interpret the meaning of the slope of your model.

How do you explain the strange behavior of the middle two points in the scatter plot?

An interesting quote:

> "In theory, there is no difference between theory and practice. In practice, there is."
>
> Yogi Berra

[5] Notices

1. Laurette Foster, Dorothy Hunter, and Don Small will present a minicourse on Contemporary College Algebra at this summer's *Mathfest* in Albuquerque, New Mexico, August 4-6, 2005.

2. Past issues of the *Vision - Potential* Newsletter are available on our website: www.ContemporaryCollegeAlgebra.org.

3. Deadline for contributions to the September Newsletter is Thursday, September 1, 2005. Opinion articles, suggestions for writing assignments, small group in-class activities, small group out-of-class projects, Queries, announcements, etc. are welcomed.

4. To subscribe to this Newsletter, write to Don Small, Department of Mathematics, U.S. Military Academy, West Point, NY 10996 or contact him via e-mail at don-small@usma.edu.