A helping hand in economics

Brush up on the math skills you need to succeed!

Math Skills for Economics

A mathematician, an accountant and an economist apply for the same job.

The interviewer calls in the mathematician and asks "What do two plus two equal?" The mathematician replies "Four." The interviewer asks "Four, exactly?" The mathematician looks at the interviewer incredulously and says "Yes, four, exactly."

Then the interviewer calls in the accountant and asks the same question "What do two plus two equal?" The accountant says "On average, four - give or take ten percent, but on average, four."

Then the interviewer calls in the economist and poses the same question "What do two plus two equal?" The economist gets up, locks the door, closes the shade, sits down next to the interviewer and says "What do you want it to equal?"

Angela Barnaby @ CCC

Math for Economics

Overview: Economic Measurement Concepts

- Tables, Charts and Graphs
  - Illustrate economic relationships
  - Numerous examples in almost every chapter of an economics text
- Ratios and Percentages
  - Often used by economists to express the relationship of one numerical value to another
- Real and Nominal Values
  - Often economic figures are calculated in actual dollars or adjusted dollar amounts (important to understand distinction)
- Index Numbers
  - An extension of the previous concept
  - Economic figures which take into consideration changes in price levels (i.e. inflation) so that different years' values can be compared

Tables, charts and Graphs

- Format presents data in a meaningful, manageable form
- Example 1 – student income data

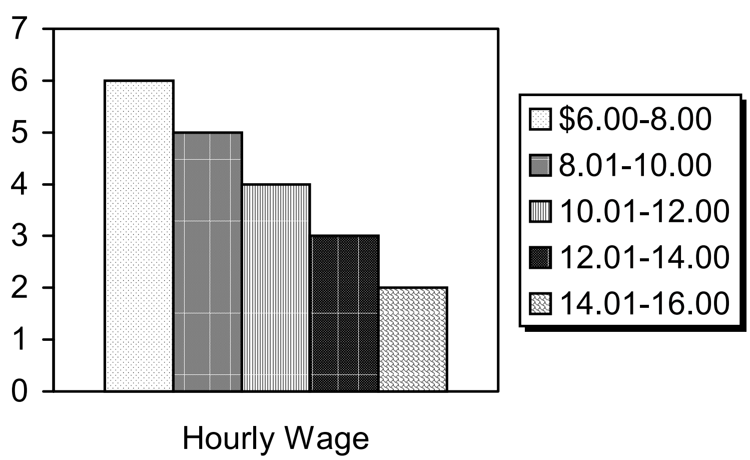
  - **Raw Data:**

    $6.00, 8.00, 10.00, 13.00, 7.00, 9.50, 12.00, 15.00, 6.00, 9.00, 11.00, 14.00, 6.00, 9.00, 11.50, 14.00, 8.00, 10.00, 12.00, 16.00

  - **Table Form**:

Hourly Wage	Number of Students in Category
$6.00-8.00	6
8.01-10.00	5
10.01-12.00	4
12.01-14.00	3
14.01-16.00	2

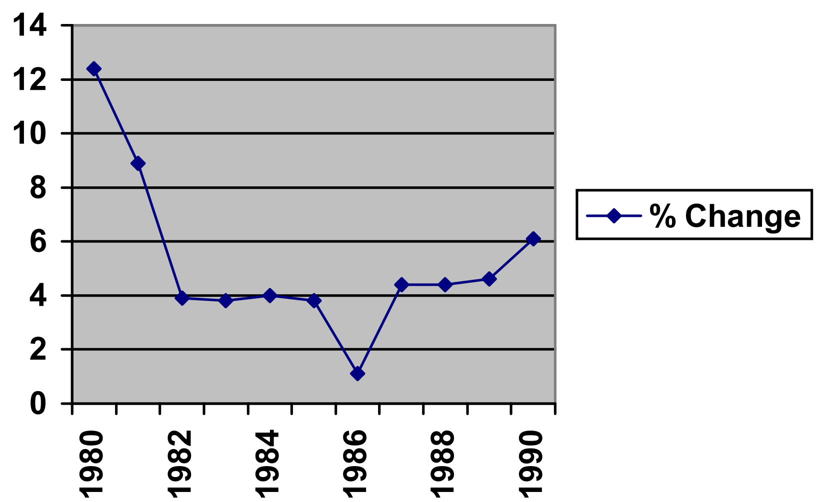
  - **Bar Graph & Line Graph**



  - Notes:
    - The left side of the graph is the *vertical axis*
    - The bottom is called the *horizontal axis*
    - Conclusions:

- **Time Series Data**: Percentage Change in Consumer Prices (i.e. Inflation)
  - Economists are often concerned with behavior over a period of time

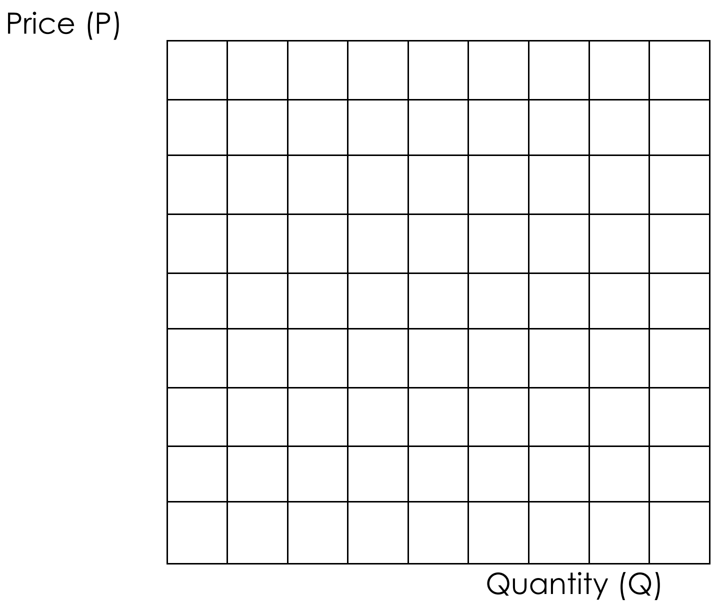
Year	Percent Change in Consumer Prices
1980	12.4
1981	8.9
1982	3.9
1983	3.8
1984	4.0
1985	3.8
1986	1.1
1987	4.4
1988	4.4
1989	4.6
1990	6.1



- Notes:
  - Horizontal axis shows the time
  - Vertical axis indicates variation over time
  - Conclusions

- Example 3: **The Supply Curve**

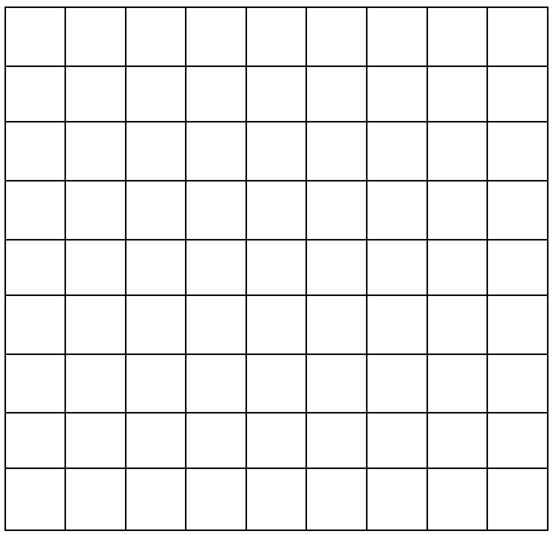
Price	Quantity Supplied
$6	120
9	170
12	200
15	220
18	250
21	300



- Notes:
  - Economic logic often suggests that two variables are linked in a specific way
  - Other things being constant (ceteris paribus) as price goes up, the quantity supplied increases and visa versa
  - This illustrates an increasing function, **directly related variables** or a positive relationship
  - From centuries of actual observations of the relationship of prices and the quantity supplied at those prices, economists have come up with a theoretical relationship between price and quantity supplied
    - General relationship between price and quantity supplied:
      (see above)

- Example 4: **The Demand Curve**

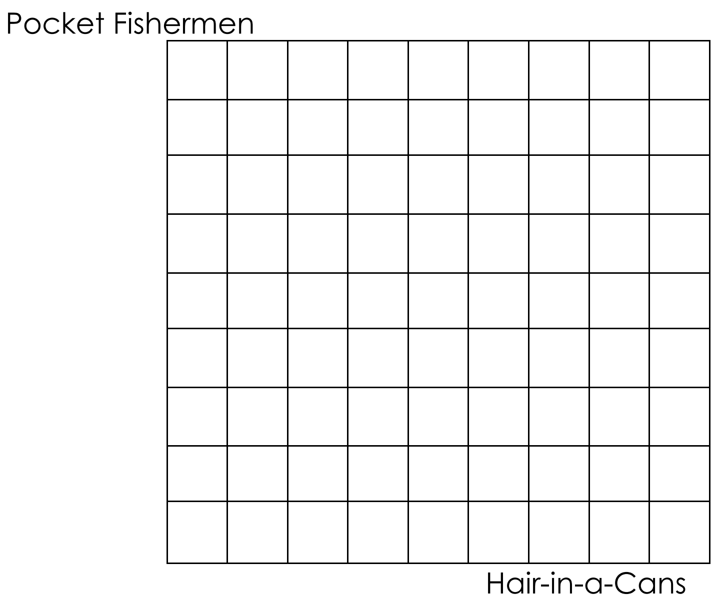
Price	Initial Quantity Demanded	New Quantity Demanded
$6	270	320
9	230	280
12	200	250
15	170	220
18	130	180
21	90	140



- Notes:
  - Other things being constant (ceteris paribus) as price goes up, the quantity demanded decreases and visa versa
  - This illustrates a decreasing function, **inversely related variables** or a negative relationship
  - Assume demand for the Pocket fisherman is increased (e.g. Superbowl ad, etc.) let's see what happens…
    - General relationship between price and quantity demanded:

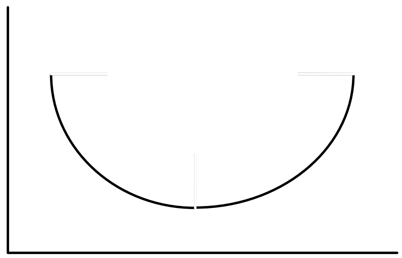
- ❑ Example 5: **The Production Possibilities Curve**

Ronco	
Pocket Fisherman	Hair-in-a-Can
0	32
2	28
4	24
6	14
8	0

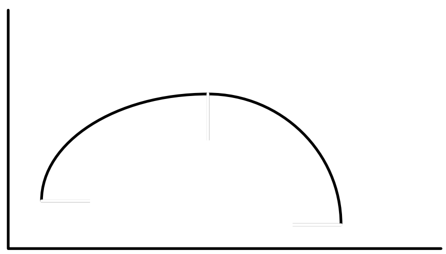


- ❑ Notes:
  - ❑ Other things being constant (ceteris paribus) as price goes up, the quantity demanded decreases and visa versa
  - ❑ This illustrates a decreasing function, inversely related variables or a negative relationship
    - ❑ General relationship between possible combinations of output (2 goods):

- Example 6: **Complex Relationships**
  - Variables: Age of drivers (x) and number of accidents (y)



    - Initially it is an inverse relationship, then it levels off and becomes a direct relationship
  - Variables: Speed (x) and gas mileage (y)



  - Initially it is a direct relationship, then it levels off and becomes an inverse relationship

Ratios and Percentages

- **Ratios** show the relationship of one numerical value to another numerical value
  - "5 to 1" *or* 5:1 *or* $\frac{5}{1}$
- Calculated by expressing two numbers as a fraction and then reducing the fraction to lowest terms
  - Example: Assume the average American family earns $30,000 and spends $24,000; also assume that they can do two things save the money or spend it (no taxes, etc.)

    Savings would be $6,000

    The proportion between these two activities would be:

$$\frac{\text{Spending}}{\text{Savings}} = \frac{24{,}000}{6{,}000} = \frac{4}{1}$$

- So consumption to savings ratio is 4:1
- In this case we know that Americans spend four times as much as they save four times as much as they save…or on the average, for every one dollar Americans save, they spend four dollars
- Example: Calculate and interpret the ratio of spending to income.

- **Percentages** convert ratios into a base of 100.
  - To convert a ratio to a percent divide the numerator (fraction's top) by the denominator (fraction's bottom) and multiply the result by 100.
- Example: What percentage of its income does the average American family consume?

- Example: What percentage of its income does the average American family save?

- **Percentages** can also show how much a number has changed
- Example 1: What percent of the number $10,000 is the number $2,000?
  - Formula: Percent = $\frac{\text{Part}}{\text{Whole}}$

- Example 2: If you wage rate is $5.00 and you get a raise so that you make $7.50, what is the percentage increase in your salary?
  - Formula: divide the difference between your old and new salary by the old rate.

- Example 3: If the price of a house went down from $200,000 to $150,000, what was the percentage decrease?

Nominal and Real Values

- Most measurements in economics have both nominal and real values

- Example 1: Assume you earn $100 per week (no taxes, savings, etc.); this amounts to $5,200 per year that you spend on goods.

  Assume you receive the same salary of $5,200 next year.

  If prices go up 10%, then you will not be able to buy as much this second year; in fact it will buy 10% less.

  Your nominal income is the same $5,200, but your real income declined by 10%. So your real income is

  5,200 – 520 = $4680.

- Your **nominal income** is your income measured in dollars for this year.

- Your **real income** is the buying power of your nominal income.

- In economics, a nominal value adjusted for price changes is called a **real value**.

Index Numbers

- Used by economists to show relative changes in factors such as consumer prices or the gross national product (how much an economy produces in a year).

- These measurements set up a base period and measure the changes from the base year to the present.

- The base period is given an index number of 100 or 100%, the other numbers are expressed as percentages of the base year

- Examples: Consumer Price Index (ave. price level of a basket of goods)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CPI*	82.4	90.9	96.5	99.6	103.9	107.6	109.6	113.6	118.3	124.0	130.7
*Assume a base period of 1992-1994											

  - In 1990 the CPI is 82.4; so in 1990 prices were 82.4% of prices in the base period (i.e. prices were lower)

  - In 2000 the CPI is 130.7; so in 2000 prices were 130.7% of prices in the base period (i.e. prices were higher)