

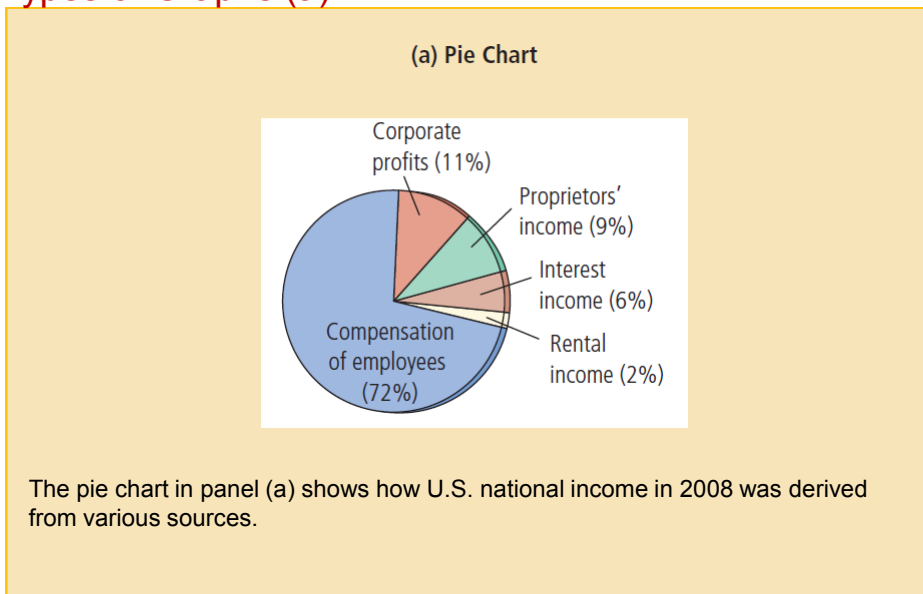
Appendix Graphing: a brief review

- Graphs' purposes:
 - Visually express ideas that might be less clear if described with equations or words
 - Powerful way of finding and interpreting patterns
- Graphs of a single variable
 - ()
 - ()
 - Time-series graph

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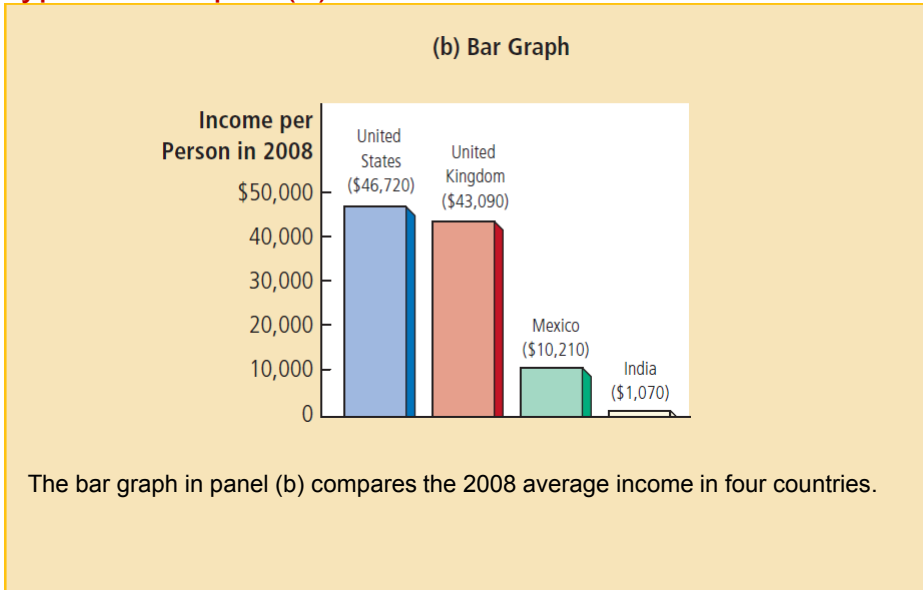
Figure A-1

Types of Graphs (a)



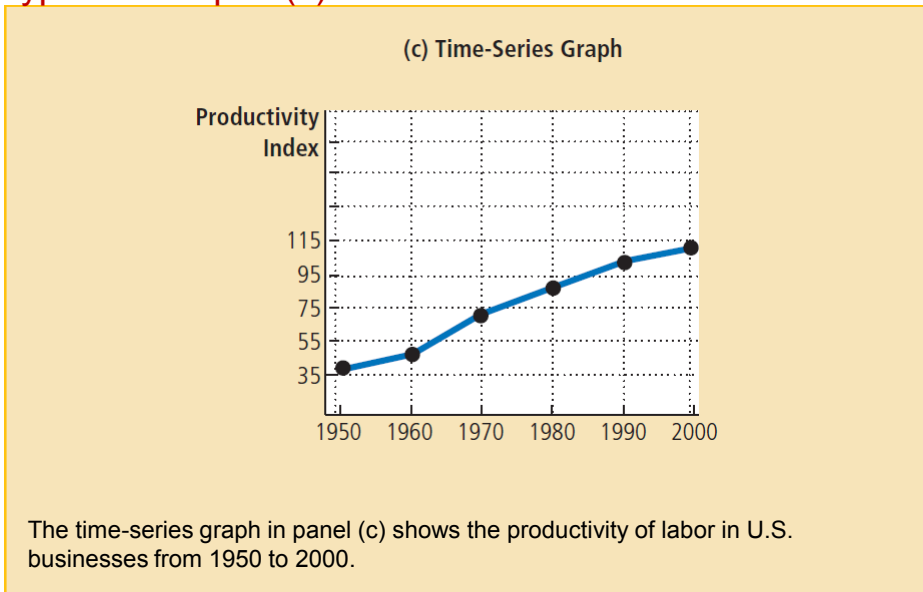
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Figure A-1 Types of Graphs (b)



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Figure A-1 Types of Graphs (c)



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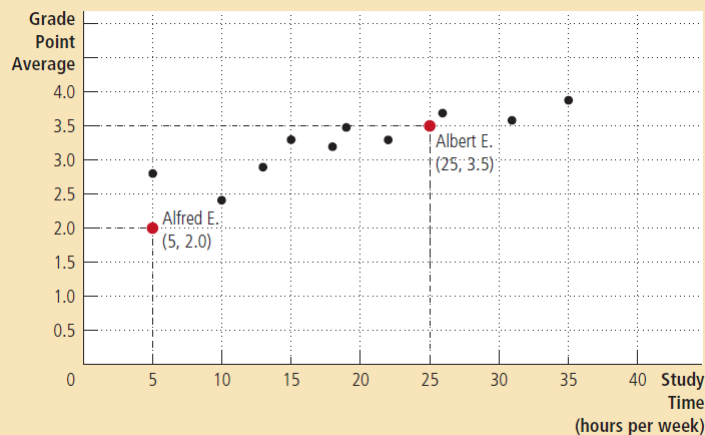
Appendix Graphing: a brief review

- **Graphs of two variables: the coordinate system**
 - Display two variables on a single graph
 - Scatterplot
 - Ordered pairs of points
 - x-coordinate
 - Horizontal location
 - y-coordinate
 - Vertical location

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Figure A-2

Using the Coordinate System



Grade point average is measured on the vertical axis and study time on the horizontal axis. Albert E., Alfred E., and their classmates are represented by various points. We can see from the graph that students who study more tend to get higher grades.

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Appendix Graphing: a brief review

- **Curves in the coordinate system**
- ()
 - Number of novels
 - Price of novels
 - Income
- ()
 - Effect of a good's price
 - On the quantity of the good consumers want to buy
 - For a given income

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Table A-1
Novels Purchased by Emma

Price	For \$20,000 Income:	For \$30,000 Income:	For \$40,000 Income:
\$10	2 novels	5 novels	8 novels
9	6	9	12
8	10	13	16
7	14	17	20
6	18	21	24
5	22	25	28
	Demand curve, D_3	Demand curve, D_1	Demand curve, D_2

This table shows the number of novels Emma buys at various incomes and prices. For any given level of income, the data on price and quantity demanded can be graphed to produce Emma's demand curve for novels, as shown in Figures A-3 and A-4.

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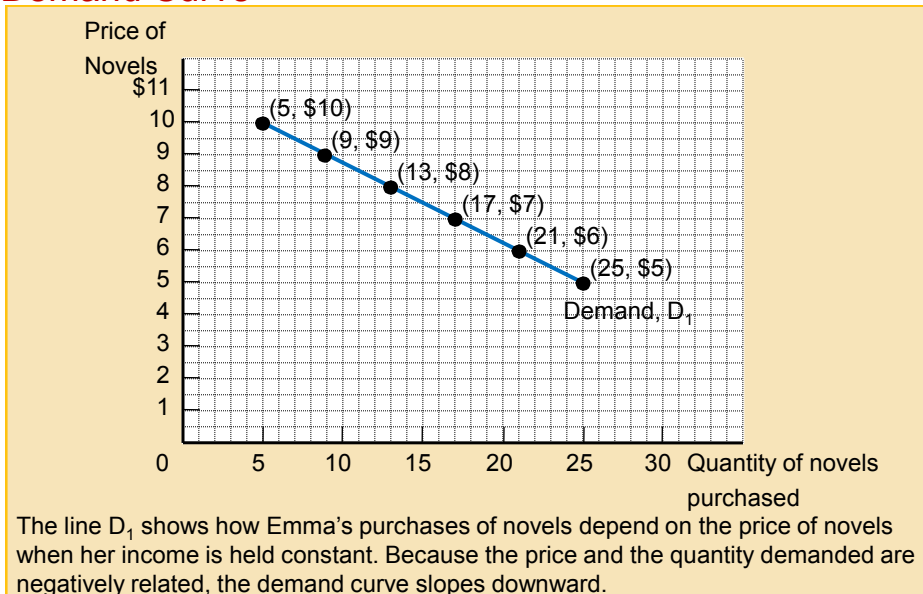
Appendix Graphing: a brief review

- Curves in the coordinate system
- Negatively related variables
 - The two variables move in opposite direction
 - ()
- () related variables
 - The two variables move in the same direction
 - ()
- Movement along a curve
- Shifts in a curve

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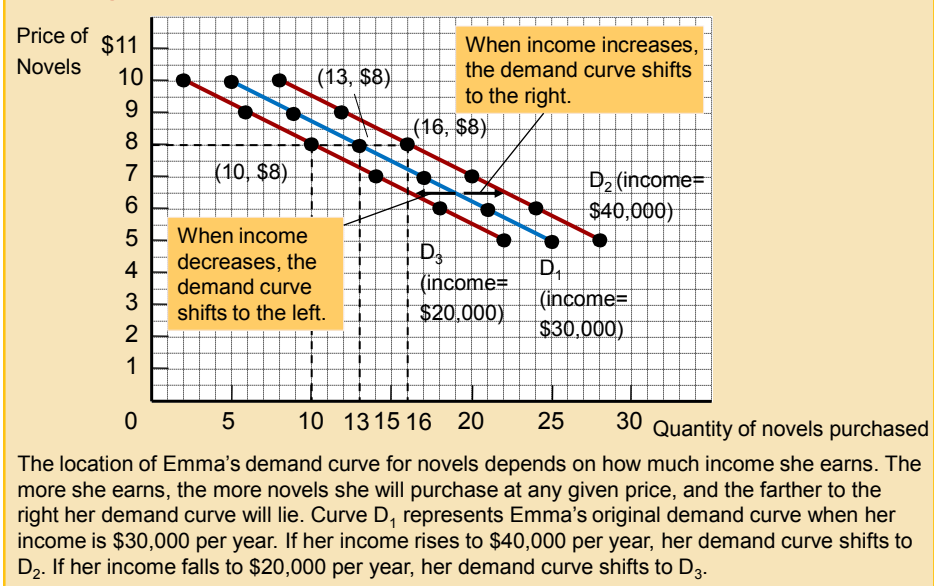
Figure A-3

Demand Curve



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Figure A-4
Shifting Demand Curves



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Appendix **Graphing: a brief review**

- ()
 - Ratio of the vertical distance covered
 - To the horizontal distance covered
 - As we move along the line
 - Δ (delta) = change in a variable
 - The “rise” (change in y) divided by the “run” (change in x).

$$Slope = \frac{\Delta y}{\Delta x}$$

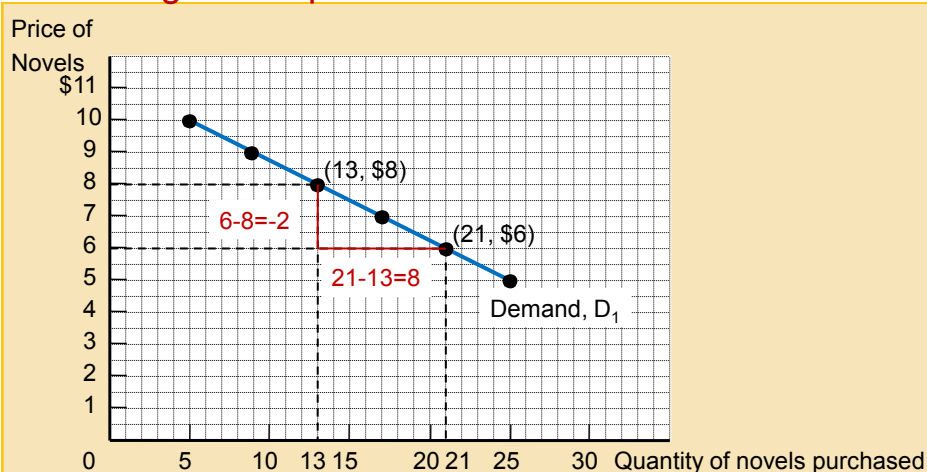
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Appendix Graphing: a brief review

- **Slope**
 - Fairly flat upward-sloping line
 - Slope = small positive number
 - Steep upward-sloping line
 - Slope = large positive number
 - Downward sloping line
 - Slope = negative number
 - Horizontal line
 - Slope = zero
 - Vertical line
 - Infinite slope

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Figure A-5
Calculating the Slope of a Line



To calculate the slope of the demand curve, we can look at the changes in the x- and y-coordinates as we move from the point (21 novels, \$6) to the point (13 novels, \$8). The slope of the line is the ratio of the change in the y-coordinate (-2) to the change in the x-coordinate (+8), which equals $-1/4$.

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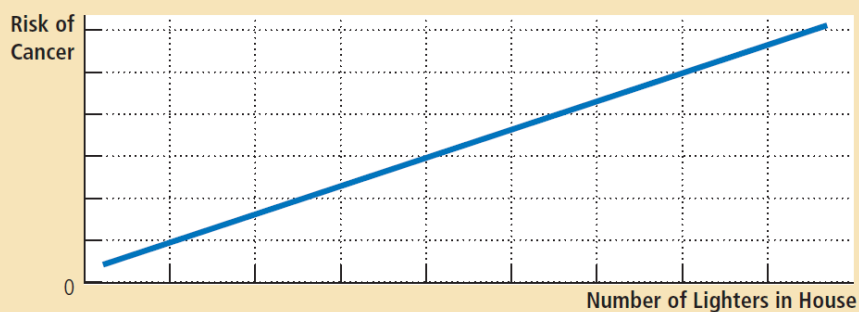
Appendix Graphing: a brief review

- ()
 - One set of events
 - Causes another set of events
 - Omitted variables
 - Lead to a deceptive graph
 - Reverse causality
 - Decide that event A causes event B
 - Facts: event B causes event A

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Figure A-6

Graph with an Omitted Variable

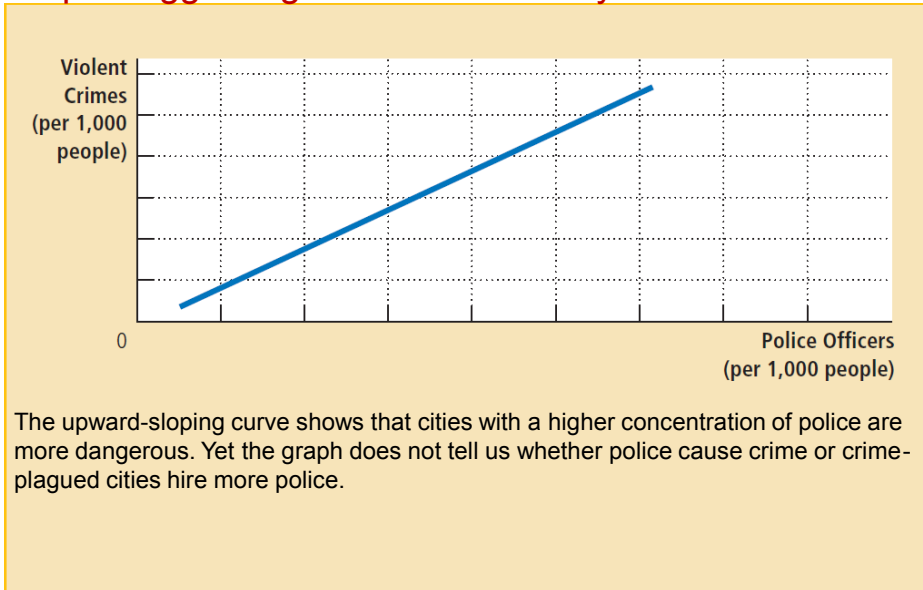


The upward-sloping curve shows that members of households with more cigarette lighters are more likely to develop cancer. Yet we should not conclude that ownership of lighters causes cancer because the graph does not take into account the number of cigarettes smoked.

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Figure A-7

Graph Suggesting Reverse Causality



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