

Chapter 1 Homework Problems

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Section 1.3

- Entomologists have discovered that there is a linear relationship between the number of chirps of crickets of a certain species and the air temperature. When the temperature is $70^{\circ}F$, the cricket chirp at the rate of 120 times per minute, and the crickets chirp at the rate of 160 times per minute when the temperature is $80^{\circ}F$.
 - Find a equation that gives the chirping rate as a function of the air temperature.
 - Use this equation to determine the chirping rate when the temperature is $102^{\circ}F$.
 - Do the x and y intercepts make sense? explain.
- The radius bone extends from the wrist to the elbow. A person whose radius bone is 24cm long is 172cm tall, while another person with a radius bone of 26cm is 175cm tall.
 - Write a linear equation showing how the height, y , corresponds to the length, x , of a person's radius bone.
 - How tall is a person whose radius bone measures 20cm?
 - Do the x and y intercepts of this equation make sense? explain.
- The blue-book value of a Chevy truck was \$20,000 when it was 3 years old and \$12,600 when it was 8 years old. Assuming the value changes in a linear fashion, find the equation that gives the linear depreciation of the truck as a function of its age.
- An automobile purchased for use by the manager of a firm at a price of \$14,000 is to be depreciated using the straight-line method over five years. What will the book value of the automobile be at the end of five years if the automobile has a scrap value of \$1,000 at the end of 10 years?
- A new machine that costs \$50,000 has a useful life of nine years and a scrap value of \$500.
 - Using a straight-line depreciation, find the equation for the value V in terms of x where x is in years.
 - What is the slope and its significance?
- Bob has a tractor that was worth \$85,000 three years after he purchased it and eight years later is worth \$36,000. Assume that the value of the tractor depreciates linearly.
 - Find a linear equation that gives the value of the tractor x years after it was bought.
 - How much did the tractor cost when it was new?
 - What is the rate of depreciation?
- In 1980 a certain rare coin was worth \$185 and it was worth \$220 in 1994. Assume that the value of the coin increases linearly as a function of time since 1980. Find a linear equation that gives the value of the coin as a function of time.
- Jason bought a four year old RV for \$40,000. Eight years later he sold it for \$15,000. Assume that the value of the RV depreciates linearly.
 - Find linear equation that gives the value of the RV where x is the age of the RV.
 - How much did the RV cost when it was new?
 - What is the rate of depreciation?
- Executive Auto Rental charges a fixed daily rate and a mileage charge. One customer rents a car for one day and drives it 125 miles. His bill is \$35.75. Another customer rents a car for one day and drives it 265 miles. Her bill is \$51.15. Write the linear equation that gives the cost as a function of the miles driven.

Section 1.4

- If possible, find the point of intersection of these lines.
 - $7x - y = 32$
 $2x + 3y = 19$
 - $3x - 4y = 22$
 $2x + 5y = 7$
 - $2x - 3y = -27$
 $5x - 7.5y = 4$
 - $y - 1.5x = -4$
 $x + 3y + 3 = 0$
 - $y - 2x = -4$
 $x + 3y + 3 = 0$
- Find the break even point for the firm with a cost function of $C(x) = 15x + 12000$ and revenue function $R(x) = 21x$.
- Bob's Scantron Store sells scantrons for \$0.25 each. The store purchases them for \$0.15 each. If the store breaks even when 6500 scantrons are sold each month,
 - What is the revenue function?
 - what is the cost function? (Assume it is linear.)
 - What is the profit function?
- Dave sells widgets at his widget stand. He buys the widgets for \$5 each. When he sells 30 in a month, then his profit is \$290. When he sells 20 widgets in a month, then his cost for that month is \$500. Find Dave's monthly cost function and revenue function.

14. Nathan operates a geography tutoring stand. His monthly rent for the stand is \$45 and he has to pay A&M \$0.75 for each question that he answers.
- What should Nathan charge to answer each question if he wants to make a profit of \$15 when answering 40 questions?
 - How many questions does he have to answer so that he will break even?
15. Phill sells cds at his music stand and has a monthly rent of \$600. When he buys 60 cds then his cost for that month is \$1680. He will break even when he sells 40 cds in a month. Find Phill's monthly cost, revenue, and profit functions.
16. Mark's Lemonade Stands, which has a stand in front of all of the Walmarts in Houston, has a cost function of $C(x) = 240x + 2405$ and a revenue function of $R(x) = 500x$. The cost and revenue functions have units of dollars where x is measured in thousand of cups sold.
- Find the profit function.
 - How many cups of lemonade must be produced in order to break even? (be careful of the units)
 - What will the revenue be at this level of production?
17. Rita's Bike Shop has noticed that when the bikes are priced at \$159 only 10 bikes are sold and 40 bikes are sold when the price is \$99 (based on past result of the sales on ten-speed bikes). Assuming that this information is linear, find the demand equation.
18. If an ipod costs \$400, 2000 sell. If the price increases to \$500, then 1500 sell. The producer is willing to provide 700 ipods if the price is \$580 and are willing to provide 1300 ipods when the is \$940. Assume supply and demand are linear.
- Find the supply equation.
 - Find the demand equation.
 - Find the equilibrium point.
19. Find the equilibrium quantity and the equilibrium price for the supply and demand equations. x is measured in thousand of items and price is measured in dollars.
- Demand: $26700x + 329y - 315182 = 0$
 Supply: $1100x - 47y + 12690 = 0$
20. An on-line tennis site has found that when a certain type of racket is priced at \$120 then 8 thousand rackets are demanded and for a price of \$230 then 3 thousand rackets are demanded. The supply equation is $x - 40p + 3568 = 0$. p is the price of the rackets in dollars and x is the number of rackets.
- Assuming the demand function is linear, find the demand equation.
 - Find the equilibrium quantity.
 - Find the equilibrium price.
21. Markers Are Us has, with much studying, found that when the price is \$16 then 8 thousand markers are demanded and for a price of \$31 then 3 thousand markers are demanded. The supply equation is $2x - p + 10 = 0$. p is the price of the markers in dollars and x is the number of markers in thousands.
- Assuming the demand function is linear, find the demand equation.
 - Find the equilibrium quantity.
 - Find the equilibrium price.
22. The supplier of Krispy Kritters cereal will not market Krispy Kritters if the price per box is \$1.50 or less. If the price is \$3.00 per box, they will make 600 boxes available per week.
- Find the supply function. Let x be the number of boxes supplied.
 - The weekly demand function for Krispy Kritters cereal is given by $x + 200p = 600$. What is the equilibrium quantity for Krispy Kritters cereal?

Section 1.5

23. True or False: The least square regression line will go through at least one point of the data.
24. The table gives the average completion times (in minutes) to complete baseball games in recent years. Let time start with zero in 1982.

Year	1982	1984	1986	1988	1990
time	154	155	164	165	168

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- Compute the least squares (linear) regression line for this data.
 - Predict the average completion time of a game in the year 1986.
 - In what year would the average completion time be 3 hours?
25. Raw material used in the production of a synthetic fiber is stored in a place which has no humidity control. Measurements of the relative humidity in the storage place and the moisture content of a sample of the raw material (both in percentages) on 12 days yield the following results:

Humidity(x)	46	53	37	42	34	29
Moisture content (y)	12	14	11	13	10	8

Humidity(x)	60	44	41	48	33	40
Moisture content (y)	17	12	10	15	9	13

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- (a) Determine the equation of the least-squares line for this data.
- (b) Estimate the moisture content when the relative humidity is 38 percent.
- (c) Estimate the relative humidity when the moisture content is 16 percent.
- (d) Estimate the moisture content when the relative humidity is 41 percent.
26. The following data are representative of information in *Energy Policy*, March 1983. The data represents carbon dioxide (CO₂) emissions from coal-fired boilers (in units of 1000 tons) over a period of years between 1965 and 1977. For this problem let the time start with zero in 1965.(i.e. 1965 is zero, 1970 is five,...)

Year(x)	0	5	8	9	10	11	12
CO ₂ emission (y)	910	680	520	450	370	380	340

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- (a) Determine the equation of the least-squares line for this data.
- (b) Predict the carbon dioxide emissions in the year 1972.
- (c) In what year would we expect to have carbon dioxide emissions of 200?
- (d) Predict the carbon dioxide emissions in the year 1975.
- (e) Predict the carbon dioxide emissions in the year 1985.
27. The movie Shrek opened in the UK in the summer of 2001. The movie's weekend gross (in millions of pounds) for the first five weekends is given in the following table. Data obtained from us.imdb.com

Weekend	1	2	3	4	5
weekend gross	4.686	3.251	2.804	1.901	.932

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- (a) Determine the equation of the least-squares line for this data.
- (b) Estimate the weekend gross for the 6th weekend.
- (c) Estimate the weekend gross for the 2nd weekend.

28. Now lets talk about Shrek in the US. The number of screens that this movie was shown on was given in the following table.

week number	3	4	5	6	7
number of screens	3661	3715	3317	3007	2704

week number	8	9	10	11	12
number of screens	2107	1767	1551	1439	1010

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- (a) Determine the equation of the least-squares line for this data.
- (b) On how many screens was this movie shown in the first week?
- (c) In what week was this movie shown on 700 screens?
29. The following set of data is the winning height in the pole vault competition at the Olympics. **For this problem, let time start in 1920, i.e. $x = 0$ means 1920.**

Year	1920	1924	1928	1932	1936
Height in feet	13.42	12.96	13.77	14.15	14.27

Round your numbers to four decimal places and use the regression equation to answer the other parts.

- (a) Compute the least squares regression line for this data.
- (b) Predict the winning height in the year 1932?
- (c) In what year would the winning height be 15ft if this competition was held every year?