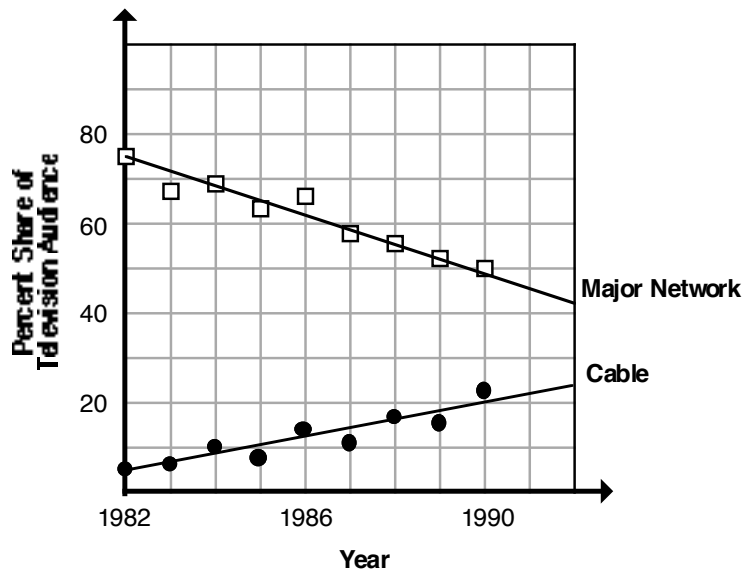


3 Linear Equations and Inequalities

How many different television stations do you watch in a typical day or week? With the spread of local cable systems, American television watchers now have access to dozens of different special-focus stations – from music videos and sports to news, cartoons, and home shopping. As a result, the audience for shows on the major networks has declined rather steadily. The following graph shows the trend from 1982.



Think About This Situation

The graph shows trends in American television viewing habits for a period of 8 years from 1982 to 1990.

- What significant patterns do you see in the data?
- Would you expect the trends in the data from 1982 to 1990 to continue until the year 2000? Explain your reasoning.
- How would you go about finding linear models for these data on TV audience share?
- To make a report on future prospects of cable and major network television audiences, what kinds of questions would you be able to answer using the linear models?

INVESTIGATION 3.1: Using Tables and Graphs

There are several kinds of questions that naturally occur in thinking about the television audience trends. For example, people planning to invest in a television business might wonder:

- When might the cable audience share reach 30 percent?
- When might the cable and network audience shares be equal?
- How long will the network audience share remain above 50 percent?

Trends in network and cable television audience shares can be modeled by the following linear equations:

$$\text{Major Networks: } Y_1 = 75 - 2.5X$$

$$\text{Cable: } Y_2 = 5 + 2.5X$$

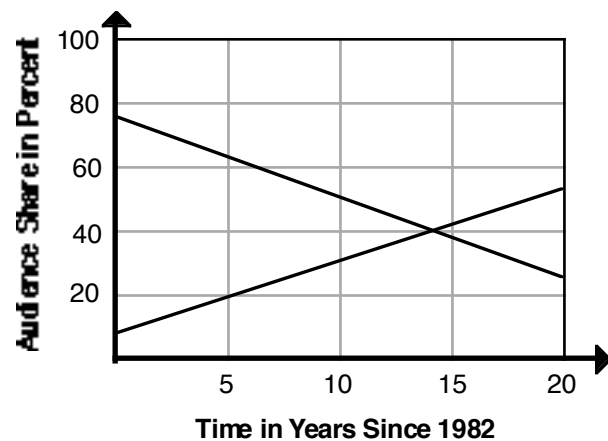
(where x stands for years since 1982 and y stands for percent audience share). Using symbolic models, the prediction questions can be written as algebraic equations and inequalities like these:

- $30 = 5 + 2.5X$
- $5 + 2.5X = 75 - 2.5X$
- $75 - 2.5X \geq 50$

The problem is finding values of X (times) when various audience share conditions hold.

One way to solve the equations or inequality is to make tables and graphs of (*time, share*) data for the two models and look for key points in each.

X	Y1	Y2
0	75	5
1	72.5	7.5
2	70	10
3	67.5	12.5
4	65	15
5	62.5	17.5
6	60	20
7	57.5	22.5
8	55	25
9	52.5	27.5
10	50	30
11	47.5	32.5
12	45	35
13	42.5	37.5
14	40	40
15	37.5	42.5
16	35	45
17	32.5	47.5
18	30	50
19	27.5	52.5
20	25	55



1. Estimate solutions for each of the following linear equations and inequalities. In each case, explain what the solutions tell about prospects for network and cable television audience shares, and explain how solutions can be found using the table and graph.
 - (a). $30 = 5 + 2.5X$
 - (b). $50 = 75 - 2.5X$
 - (c). $5 + 2.5X = 75 - 2.5X$
 - (d). $75 - 2.5X \geq 50$
 - (e). $5 + 2.5X \leq 75 - 2.5X$

2. Write and solve equations and inequalities matching each of the following questions about network and cable television audience shares. In each case, explain how you can use tables and graphs of the linear models to find solutions.
 - (a). When will the major network audience share decline to 30 percent?
 - (b). When will the cable audience share reach 40 percent?
 - (c). When will the major network audience share be below 50 percent?
 - (d). When will the major network audience share be less than the cable audience share?

When you are asked to solve an equation or inequality, it is always a good idea to check the solution you come up with.

3. If someone told you that the solution to $45 = 75 - 2.5X$ is $X = 10$, would you believe them? How could you check their suggestion, without using either the table or the graph?

4. If someone told you that the solution to $5 + 2.5X \leq 30$ is $X \leq 11$, how could you check their suggestion:
 - (a). In the table?
 - (b). On the graph?
 - (c). Without using either table or graph?

Checkpoint

Many important questions about linear models lead to solution of equations and inequalities like $40 = 75 - 2.5x$ or $5 + 2.5x \geq 50$.

- (a). What does it mean to solve an equation or inequality?
- (b). How do you check a solution?
- (c). How can tables and graphs of linear models be used to find solutions of equations and inequalities?

Be prepared to share your group's responses with the class.