

Section 7-1 Systems of linear Equations

Solve two or more equation at a time.

The solution to a system is the ordered pair/s that satisfy all equations.

Example: Which ordered pair satisfies the system

$$x + 2y = 8$$

$$2x - 3y = 2$$

a) (6,1) b) (4,2)

c) (1,0)

Solve by graphing

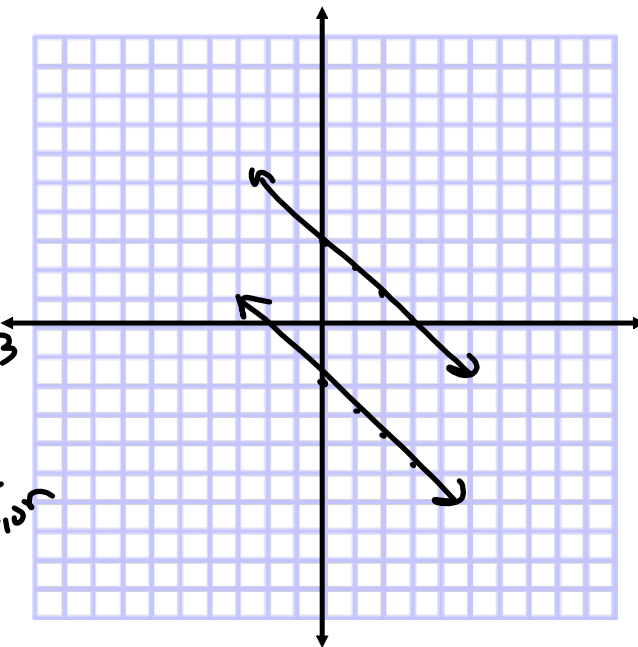
$$\begin{aligned} x + y &= 4 & y &= -x + 4 \\ 2x - y &= -1 \\ \frac{-y}{-1} &= \frac{-2x - 1}{-1} \\ y &= 2x + 1 \end{aligned}$$

$$\begin{aligned} x + y &= 3 & y &= -x + 3 \\ 2x + 2y &= -4 \\ 2y &= -2x - 4 \\ y &= -x - 2 \\ \text{No solution} \end{aligned}$$

$$y = \frac{1}{2}x + 4$$

$$2y = x + 8$$

$$y = \frac{1}{2}x + 4 \quad \text{Infinite Solution}$$



EXAMPLE 5 MODELING - A Landscape Service Application

Tom's Tree and Landscape Service charges a consultation fee of \$200 plus \$50 per hour for labor for landscaping. Lawn Perfect Landscape Service charges a consultation fee of \$300 plus \$25 per hour for labor for landscaping.

- Write a system of equations to represent the cost, C , of the two landscaping services, each with h hours of labor.
- Graph both equations on the same axes and determine the number of hours needed for both services to have the same cost.
- If the Johnsons need 7 hours of landscaping service done at their home, which service is less expensive?

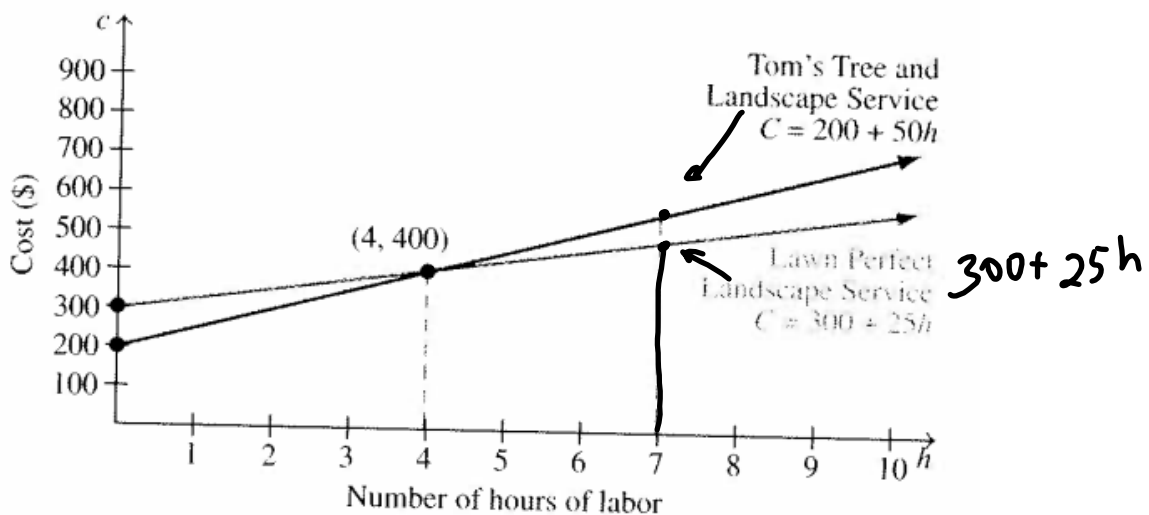
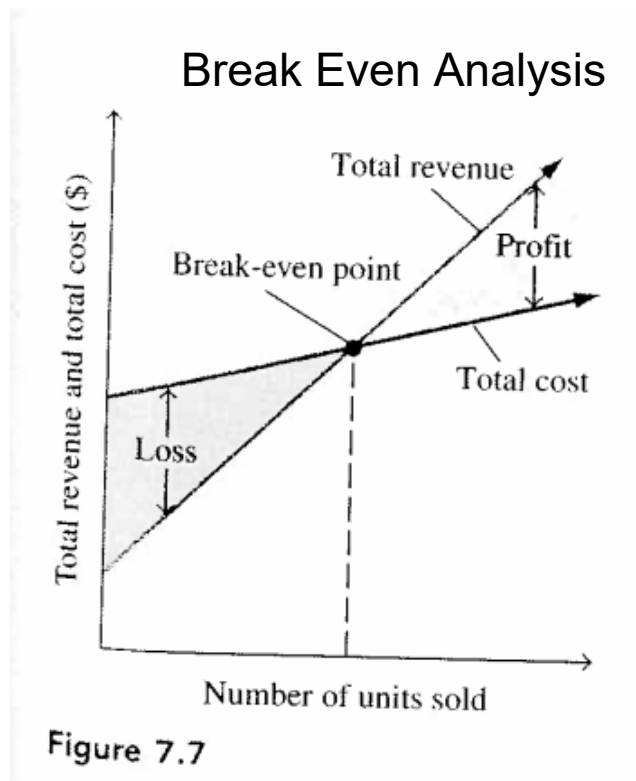


Figure 7.6

Manufacturers use a technique called **break-even analysis** to determine how many units of an item must be sold for the business to 'break even', that is, for its total revenue to equal its total cost.



The linear equation for cost, C, and revenue, R, can both be sketched on the same axes.

Profit, P, is the difference between revenue, R, and C. Thus, $P = R - C$.



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EXAMPLE 6 MODELING - *Profit and Loss in Business*

At a collectibles show, Richard Lane can sell model cars for \$25. The costs for making the cars are a fixed cost of \$150 and a production cost of \$10 apiece.

- a) Write an equation that represents Richard's revenue. Write an equation that represents Richard's cost. $R = 25x$ $C = 150 + 10x$
- b) How many model cars must Richard sell to break even? $(10, 250)$
- c) Write an equation for the profit formula. Use the formula to determine Richard's profit if he sells 14 model cars.
- d) How many model cars must Richard sell to make a profit of \$450?

SOLUTION

$$\begin{aligned} \text{c) } P &= R - C \\ P &= 25x - (150 + 10x) \\ P &= 15x - 150 \\ P &= 15(14) - 150 \\ P &= 210 - 150 = \$60 \end{aligned}$$

$$\begin{aligned} \text{d) } 450 &= 15x - 150 \\ \frac{600}{15} &= \frac{15x}{15} \quad x = 40 \end{aligned}$$

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Exercises 51–55, part of the question involves determining a system of equations that models the situation.

MODELING - Hot-Water Heater Repair Phillip Hoffman's plumber says it will cost Phillip \$250 to repair his water heater. Phillip can purchase a new, more efficient heater for \$700. His current heater costs \$375 per year for energy costs, and the new heater would cost \$225 per year.

- a) Write a system of equations with one equation representing the total cost of repairing the heater plus annual energy costs and the other equation representing the total cost of replacing the heater plus annual energy costs.
- b) Graph both equations (for up to and including 6 years) on the same axes.
- c) Determine the number of years it would take for the total cost of repair to equal the total cost of replacement.