EXAMPLE 5 Calculating Acid Mixtures

How much pure acid must be added to 50 mL of a 35% acid solution to produce a mixture that is 75% acid? (See Figure 2.58.)

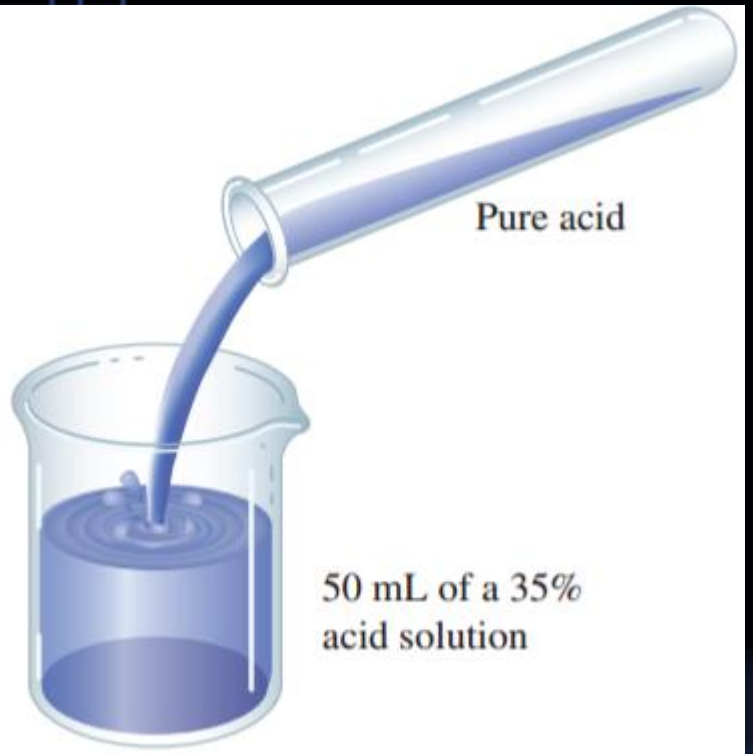


FIGURE 2.58 Mixing solutions.

$$\frac{\text{mL of pure acid}}{\text{mL of mixture}} = \text{concentration of acid}$$

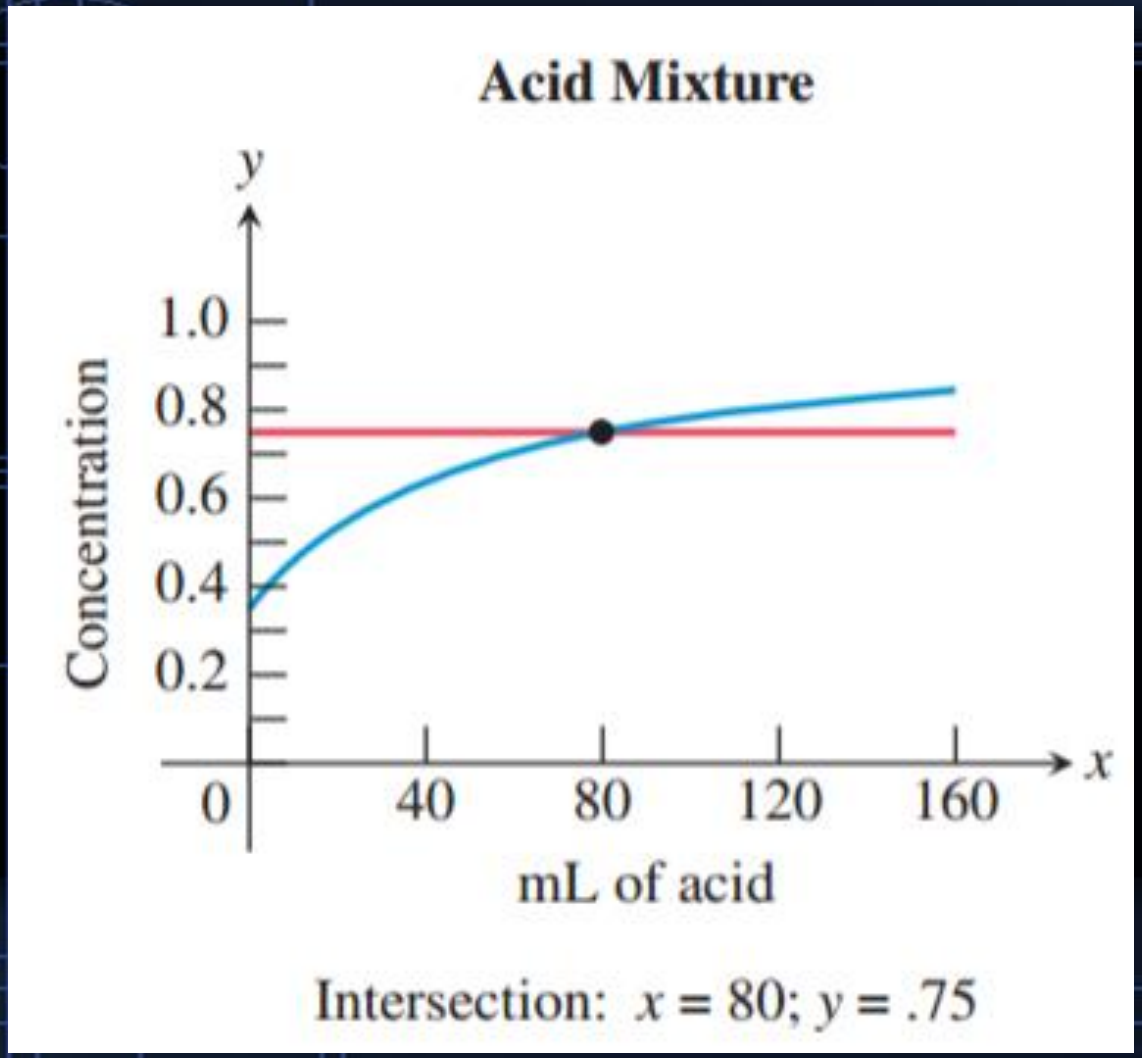
0.35×50 or 17.5 = mL of pure acid in 35% solution

x = mL of acid added

$x + 17.5$ = mL of pure acid in resulting mixture

$x + 50$ = mL of the resulting mixture

$$\frac{x + 17.5}{x + 50} = 0.75$$

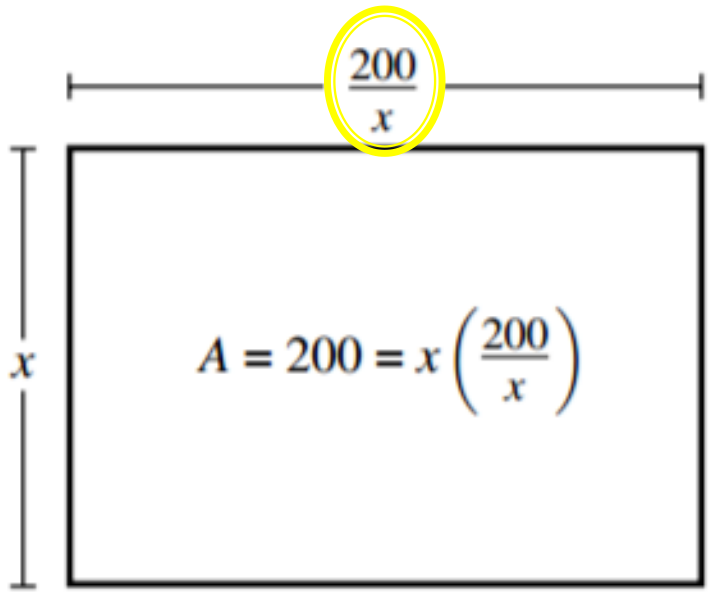

Acid Mixture
y
1.0
0.8
0.6
0.4
0.2
Concentration
0
40
80
120
160
x
mL of acid
Intersection: x = 80; y = .75

EXAMPLE 6 Finding a Minimum Perimeter

Find the dimensions of the rectangle with minimum perimeter if its area is 200 square meters. Find this least perimeter.

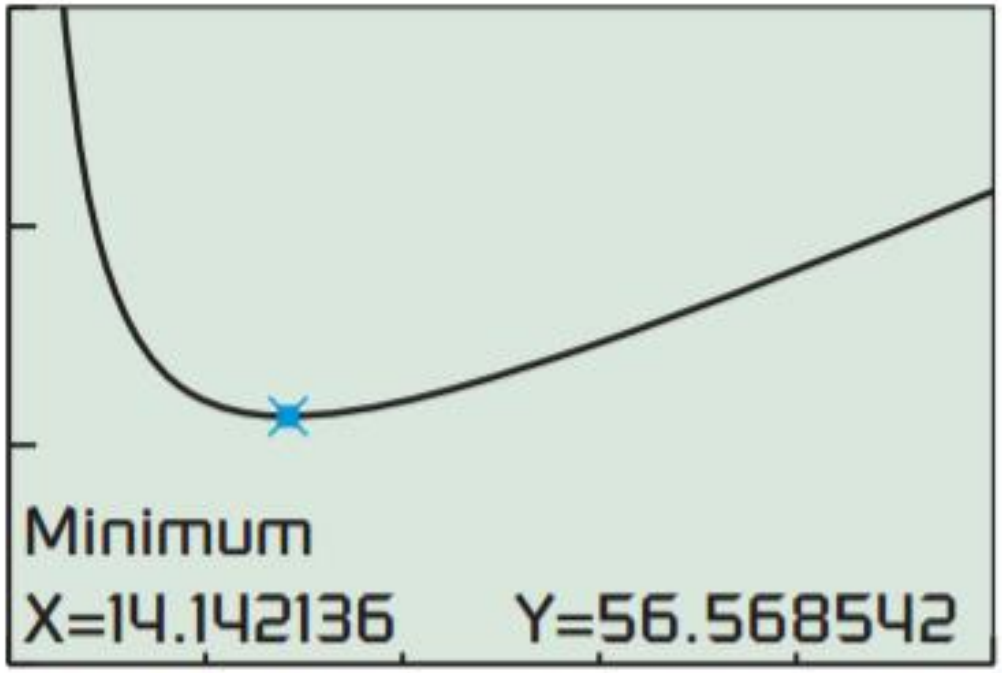
SOLUTION

Model



$$\text{Perimeter} = 2 \times \text{length} + 2 \times \text{width}$$

$$P(x) = 2x + 2\left(\frac{200}{x}\right) = 2x + \frac{400}{x}$$



[0, 50] by [0, 150]

FIGURE 2.61 A graph of $P(x) = 2x + 400/x$. (Example 6)

EXAMPLE 7 Designing a Juice Can

Stewart Cannery will package tomato juice in 2-liter cylindrical cans. Find the radius and height of the cans if the cans have a surface area of 1000 cm^2. (See Figure 2.62.)

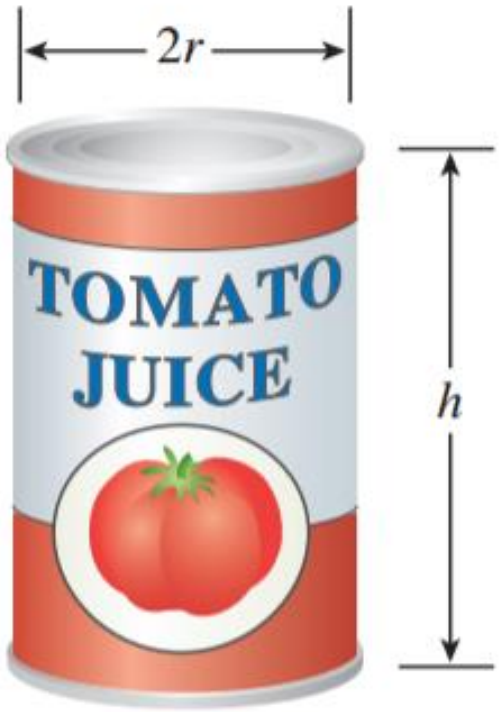


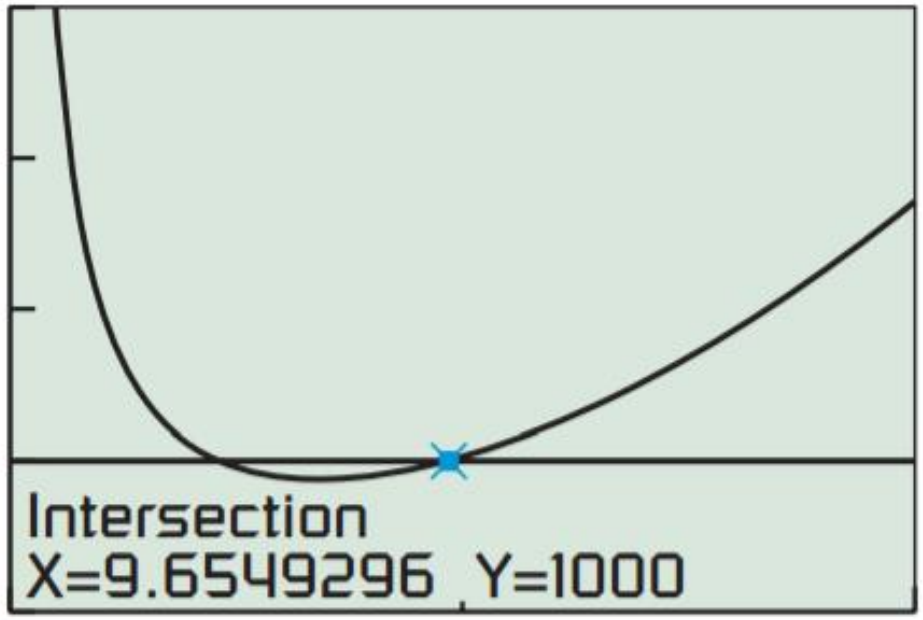
FIGURE 2.62 A tomato juice can. (Example 7)

$$V = \pi r^2 h = 2000 \quad \text{and} \quad S = 2\pi r^2 + 2\pi r h = 1000.$$

$$h = \frac{2000}{\pi r^2}$$

$$2\pi r^2 + 2\pi r\left(\frac{2000}{\pi r^2}\right) = 1000$$

$$2\pi r^2 + \frac{4000}{r} = 1000$$



[0, 20] by [0, 4000]

FIGURE 2.63 (Example 7)

Interpret

With a surface area of 1000 cm^2, the cans either have a radius of 4.62 cm and a height of 29.83 cm or have a radius of 9.65 cm and a height of 6.83 cm.