

Exercise 51

The Federal Helium Reserve held about 16 billion cubic feet of helium in 2010 and is being depleted by about 2.1 billion cubic feet each year.

- Give a linear equation for the remaining federal helium reserves, \mathbf{R} , in terms of t , the number of years since 2010.
- In 2015, what will the helium reserves be?
- If the rate of depletion doesn't change, in what year will the Federal Helium Reserve be depleted?

Solution

Because the rate at which the reserve is being depleted each year is constant, a linear function can be used to model the amount left. Let t be the number of years after 2010, and let R be the amount of helium left in the reserve. The amount present at $t = 0$ is 16 billion cubic feet, or $16 \times 10^9 \text{ ft}^3$. The rate that it increases each year is -2.1×10^9 cubic feet per year.

$$R(t) = (-2.1 \times 10^9)t + (16 \times 10^9)$$

Plug in $t = 5$ to determine the amount of helium in reserve in 2015.

$$R(5) = -2.1 \times 10^9(5) + 16 \times 10^9 = (-10.5 + 16) \times 10^9 = 5.5 \times 10^9 \text{ ft}^3 \quad (5.5 \text{ billion cubic feet})$$

Set $R = 0$ and solve the equation for t to determine when the reserve will be depleted.

$$0 = (-2.1 \times 10^9)t + (16 \times 10^9)$$

$$2.1 \times 10^9 t = 16 \times 10^9$$

$$t = \frac{16 \times 10^9}{2.1 \times 10^9} = \frac{160}{21} \approx 7.62$$

Therefore, in 7.62 years, or a little after the middle of 2017, the reserve will be depleted.