

Exercise 104

Total online shopping during the Christmas holidays has increased dramatically during the past 5 years. In 2012 ($t = 0$), total online holiday sales were \$42.3 billion, whereas in 2013 they were \$48.1 billion.

- Find a linear function S that estimates the total online holiday sales in the year t .
- Interpret the slope of the graph of S .
- Use part a. to predict the year when online shopping during Christmas will reach \$60 billion.

Solution

Part (a)

A linear function has the form,

$$S(t) = mt + b$$

Two points on this line are needed to determine m and b . One is initially (at $t = 0$ the value is \$42.3 billion), and the second is a year later (at $t = 1$ the value is \$48.1 billion).

$$42\,300\,000\,000 = m(0) + b$$

$$48\,100\,000\,000 = m(1) + b$$

Solve this system of equations for m and b .

$$b = 42\,300\,000\,000$$

$$m = 5\,800\,000\,000$$

Therefore,

$$S(t) = 5\,800\,000\,000t + 42\,300\,000\,000.$$

Part (b)

The slope is \$5.8 billion dollars per year; this is the annual growth rate of online sales in 2013 with respect to 2012.

Part (c)

To find the time it takes to reach \$60 billion, plug in $S = 60\,000\,000\,000$ and solve the equation for t .

$$S(t) = 5\,800\,000\,000t + 42\,300\,000\,000 = 60\,000\,000\,000$$

$$5\,800\,000\,000t = 17\,700\,000\,000$$

$$t = \frac{177}{58} \approx 3.05 \text{ years}$$