**2**. [6 points] You are an intern at A&B, Alice & Bob Inc. It's the year 2055, and you're headed to Mars to help the newest A&B store, which will open there on January $1^{st}$, 2056.

**a**. [3 points] The daily sales of space suits, in thousands, at the new store $d$ Earth days after it opens can be modeled by the sinusoidal function

$$S(d) = 16 \sin\left(\frac{2\pi}{687} \cdot d\right) + 17.$$

*i.* The function $S(d)$ has a period of one Mars year. Use this information to find the length of a Mars year in units of Earth days.

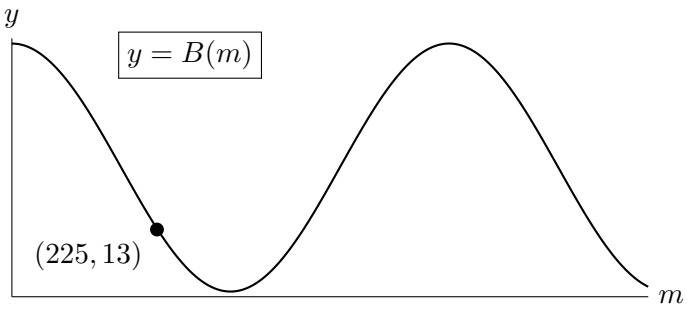
**Answer:** One Mars year is **687** Earth days.

*ii.* According to this model, what are the minimum and maximum daily sales, in thousands, of A&B space suits on Mars?

minimum sales of **1** thousand suits

maximum sales of **33** thousand suits

**b**. [3 points] The daily sales of space boots, in thousands, at the new store $m$ Mars days after it opens can be modeled by a different sinusoidal function $B(m)$, which also has a period of one Mars year, which is 670 Mars days. The graph of $B(m)$ is given below. Note that a maximum occurs at $m = 0$.




The first time that daily sales of space boots equals 13,000 is $m = 225$ Mars days after the store opens, as shown on the graph. Find the next two values of $m$ at which daily sales of space boots will equal 13,000 according to this model. You do not need to simplify your answers.

*Solution:* We know that the period is equal to 670 and $m = 0$ is a maximum. Therefore, using the symmetry of the graph, the next time sales will be 13,000 is

$$670 - 225 = 445.$$

To get the third time when sales are 13,000 we should just add a period to the first solution:

$$225 + 670 = 895.$$

**Answer:** **445** and **895**