

1. A data plan for a smartphone charges 99 cents per day for data usage up to 20 megabytes and 7 cents for each additional megabyte or part of a megabyte.
- (a) Use brace notation to write a formula for the daily cost, C , of the data plan as a function of the number of megabytes, m , used.

Solution:

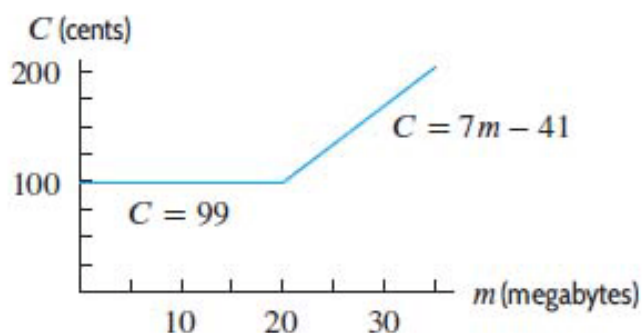
$$C = f(m) = \begin{cases} 99 & \text{for } 0 \leq m \leq 20 \\ 99 + 7(m - 20) & \text{for } m > 20, \end{cases}$$

Or, after simplifying:

$$C = f(t) = \begin{cases} 99 & \text{for } 0 \leq m \leq 20 \\ 7m - 41 & \text{for } m > 20. \end{cases}$$

- (b) Graph the function.

Answer:



- (c) State the domain and range of the function.

Solution:

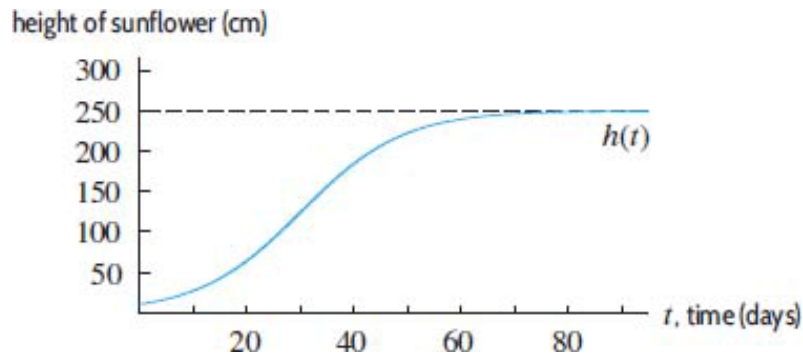
Because negative data usage makes no sense, the domain is $m \geq 0$ megabytes.

From the graph, we see that the range is $C \geq 99$ cents.

2. A sunflower plant is measured everyday t , for $t \geq 0$. The logistic function can model the height, $h(t)$ centimeters, of the plant,

$$h(t) = \frac{250}{1 + 24(0.9)^t}$$

This function is graphed in the figure below



The height of sunflower as a function of time

(a) What is the *domain* of the function in this model?

Solution: Measurements can be made at any time after $t = 0$. The graph starts on the vertical axis and extends to the right, so the domain of the function is $t \geq 0$. If we consider that the sunflower dies on some day, T , then the domain is $0 \leq t \leq T$, in days.

(b) What is the *range* of the function?

Solution: To find the range, notice that the graph is increasing, and that its smallest value occurs at $t = 0$. Evaluating at $t = 0$, yields

$$h(0) = \frac{250}{1 + 24(0.9)^0} = \frac{250}{25} = 10 \text{ cm.}$$

This means that the plant was 10 cm high when it was first measured on day $t = 0$; At t increases, the plant grows, and $h(t)$ increases. The values of $h(t)$ approach, but never reach 250. This suggests that the range is $10 \leq h \leq 250$ cm.

(c) What does this (b) tell you about the height of the sunflower? (Explain using complete sentences!)

Answer: This information tells us that sunflowers typically grow to a height of about 250 cm.