

1. [12 points] Jerry Giraffe was a giraffe. He was six feet tall when he was born, and from that moment, he grew at a constant rate of three inches per month until he was twenty feet tall, at which point he stopped growing. He remained twenty feet tall for the rest of his life.

Recall that there are 12 inches in a foot and 12 months in a year.

- a. [3 points] Let m be Jerry's age, in months, and let h be Jerry's height, in feet. Find a formula for h in terms of m that is valid during the time he was growing, that is, from the time Jerry was born until the time he reached his full-grown height of 20 feet.

Solution: Since h has a constant average rate of change, it is a linear function of m . The constant average rate of change is 0.25 feet per month and the initial value is 6 feet. This means a formula for h is given by $h = 6 + 0.25m$.

Answer: During the time that he was growing, $h = \underline{6 + 0.25m \quad \text{or} \quad 6 + \frac{1}{4}m}$

- b. [2 points] How old was Jerry when he stopped growing, i.e. when he reached his full-grown height? *Include units.*

Solution: Recall that $h = 6 + 0.25m$. Setting this to his full-grown height, 20 feet, we find

$$20 = 6 + 0.25m$$

$$14 = 0.25m$$

$$56 = m$$

So Jerry stopped growing when he was 56 months old.

Answer: 56 months old

Let $j(m)$ be Jerry's height in feet when he was m months old. So $h = j(m)$.

Note that $j(m)$ is defined only while Jerry is alive.

- c. [4 points] Jerry Giraffe died at the age of 400 months. What are the domain and range of $j(m)$ in the context of this problem? Use either interval notation or inequalities to give your answers.

Solution: Jerry was alive from the age of 0 to the age of 400 months, so the domain is the interval $[0, 400]$.

The range consists of all the values of Jerry's height during his life. He was born 6 feet tall and grew to a height of 20 feet. The range is thus the interval $[6, 20]$.

Answers: Domain: $[0, 400]$ Range: $[6, 20]$

- d. [3 points] Give a formula for $j(m)$ in terms of m that is valid on its entire domain.

Hint: Use a piecewise-defined function.

Solution: Until Jerry reaches his maximum height at 56 months, the formula for his height is $6 + \frac{1}{4}m$. After he reaches his maximum height at 56 months, he is 20 feet tall until he dies at the age of 400 months.

Therefore, $j(m)$ has the formula $j(m) = \begin{cases} 6 + \frac{1}{4}m & \text{if } 0 \leq m \leq 56 \\ 20 & \text{if } 56 < m \leq 400. \end{cases}$

Answer: $j(m) = \begin{cases} 6 + \frac{1}{4}m & \text{if } 0 \leq m \leq 56 \\ 20 & \text{if } 56 < m \leq 400 \end{cases}$