

7. [15 points] Word of Chuck and Samsa's heroics soon spread far and wide. Residents of Chickenville realized that the giant cockroaches were actually very amiable creatures, and began to keep them as pets. In Chickenville t months after February 1,
- The total number of chickens is $P(t)$.
 - The total number of pet cockroaches is $C(t)$.
 - The total number of wild cockroaches is $W(t)$.

Assume that all of these functions are **increasing**, and assume all cockroaches are either wild or pets. Write mathematical expressions for the following quantities, **including relevant units**.

- a. [3 points] The fraction of cockroaches that are kept as pets t months after February 1.

Solution:

$$\frac{C(t)}{C(t) + W(t)}$$

- b. [3 points] The average rate of change for the total number of cockroaches between April 1 and June 1.

Solution:

$$\frac{C(4) + W(4) - C(2) - W(2)}{2}$$

- c. [3 points] The number of months it takes for the number of pet cockroaches to increase from 62 to 130.

Solution:

$$C^{-1}(130) - C^{-1}(62)$$

- d. [3 points] The number of **years** it takes, after February 1, for the number of wild cockroaches to increase to 205.

Solution:

$$\frac{W^{-1}(205)}{12}$$

- e. [3 points] Write a practical interpretation of the quantity $P(C^{-1}(327))$.

Solution: It is the number of chickens there are in Chickenville when there are 327 pet cockroaches.