Week 3 Class Problems

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1. For many species of fish, the weight W (in g) is a function of the length L (in mm) that can be expressed by

$$W = W(L) = kL^3 \tag{1}$$

where k is a constant. For a particular species of fish $k = 0.02$ and the length of this species is a function of the number of years that the fish has been alive, t, and is given by

$$L = L(t) = 50 - \frac{(t - 20)^2}{10} \tag{2}$$

with no fish living longer than 20 years.

- Determine how the weight of the fish changes with their age (time that they've been alive).
- What are all the possible values of k?
- Plot how the weight of the fish changes through their lifetime.
- Mathematically find the age of the fish for which the weight will exceed 450 g.
- Numerically find the age of the fish for which the weight will exceed 450 g.

2. For fiddler crabs, data gathered by Thompson show that the relationship between the weight C of the claw and the weight of the body W is given by

$$C = 0.11W^{1.54} \tag{3}$$

where W and C are in grams.

- What values can C and W take?
- Plot C for $W \in (0, 20]$.

- Write the function where the weight of the crab body is a function of claw weight.
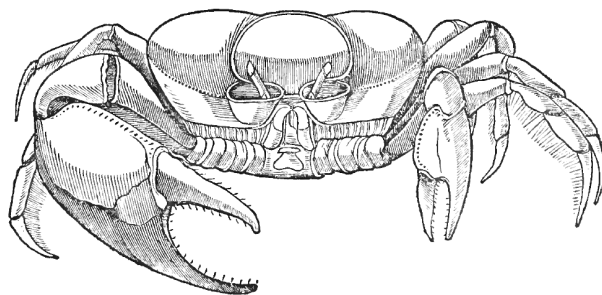- For what values of the claw weight does the crab body weight exceed 6 g?

Figure 1: Fiddler crab, *Ucides cordatus*, from Margrave (1648)

3. The following table give the number of AIDS-related deaths in the New York Prison System.

year	deaths	year	deaths
1981	2	1990	175
1982	4	1991	229
1983	18	1992	208
1984	57	1993	223
1985	99	1994	246
1986	124	1995	256
1987	151	1996	181
1988	158	1997	60
1989	132	1998	39

- Create a scatter plot for the data in the table. Let the x-axis represent the number of years since 1980.
- Determine an appropriate function that can be used to model the data. Why did you choose this function? Estimate the parameter values.
- Using this model(function), determine what year the deaths was a maximum.