

An economist is interested in the variation of the price of a single product. It is observed that a high price for the product in the market attracts more suppliers. However, increasing the quantity of the product supplied tends to drive the price down. Over time, there is an interaction between price and supply. The economist has proposed the following model, where P_n represents the price of the product at year n , and Q_n represents the quantity. Find the equilibrium values for this system.

$$P_{n+1} = P_n - 0.1(Q_n - 500)$$

$$Q_{n+1} = Q_n + 0.2(P_n - 100)$$

- Does the model make sense intuitively? What is the significance of the constants 100 and 500? Explain the significance of the signs of the constants -0.1 and 0.2 .
- Test the initial conditions in the following table and predict the long-term behavior.

	Price	Quantity
Case A	100	500
Case B	200	500
Case C	100	600
Case D	100	400

Racing Shells—If you have been to a rowing regatta, you may have observed that the more oarsmen there are in a boat, the faster the boat travels. Investigate whether there is a mathematical relationship between the speed of a boat and the number of crew members. Consider the following assumptions (partial list) in formulating a model:

- The total force exerted by the crew is constant for a particular crew throughout the race.
- The drag force experienced by the boat as it moves through the water is proportional to the square of the velocity times the wet surface area of the hull.
- Work is defined as force times distance. Power is defined as work per unit time.

Crew	Distance (m)	Race 1 (sec)	Race 2 (sec)	Race 3 (sec)	Race 4 (sec)	Race 5 (sec)	Race 6 (sec)
1	2500	20:53	22:21	22:49	26:52		
2	2500	19:11	19:17	20:02			
4	2500	16:05	16:42	16:43	16:47	16:51	17:25
8	2500	9:19	9:29	9:49	9:51	10:21	10:33

Hint: When additional oarsmen are added to a shell, it is not obvious whether the amount of *force* is proportional to the number in the crew or the amount of *power* is proportional to the number in the crew. Which assumption appears the most reasonable? Which yields a more accurate model?