

MST, Question 5.

Consider the problem of modelling patient flow in a department of geriatric medicine. Each day the following activities occur:

- A number of new patients are admitted to the department for acute care.
- A fraction, α , of the current patients are treated and discharged.
- A fraction, β , of the current patients, unfortunately, die.
- A fraction of the current patients, γ , are transferred to another section.

(a) Write down a **word** equation that defines this problem. [2]

(b) Write down, formally, the difference equation that describes the above scenario. Define **all** variables and explain your terms.

MST, Question 6.

Steven decides to purchase a car for \$40 00. He has savings of \$17 000 and has the choice of two payment schemes.

- He can put down a deposit of \$17 000 and take out a five-year loan (amortization scheme) from the bank with interest at 7.5% p.a. compounded quarterly.
- He can put down a deposit of \$15 000 and make weekly payments of \$105 for five years to the dealer. At the end of five years he makes a final payment of \$3500

(a) Which option should Steven choose (justify your answer)? How much money does he save? [5]

Steven decides to purchase a car for \$40 000.

SCHEME 1. He can put down a deposit of \$17 000 and take out a five-year loan (amortization scheme) from the bank with interest at 7.5% p.a. compounded quarterly.

SCHEME 2. He can put down a deposit of \$15 000 and make weekly payments of \$105 for five years to the dealer. At the end of five years he makes a final payment of \$3500

Which option should Steven choose (justify your answer)? How much money does he save?

[5]

MST, Question 6 (b)

Steven opts to pay the dealer directly rather than take a loan out from the bank. He decides to invest the remaining \$2 000 of his savings in a five-year term deposit account with his bank. If interest is compounded annually what is the minimum interest rate that is required for his decision to make sense?

[2]

Assignment 4.

2. A retailer receives an invoice for \$8000 for a shipment of furniture, with terms 3/10, $n/40$. (If you are unfamiliar with this notation read question 6 in chapter 3.6.1).

- (a) What is the highest simple interest rate at which he can afford to borrow money in order to take advantage of the cash discount?
- (b) If the retailer can borrow money at a simple interest rate of 21%, find his profit resulting from the cash discount when he pays the invoice on the 10th day.

2. A retailer receives an invoice for \$8000 for a shipment of furniture, with terms 3/10, $n/40$.

(a) What is the highest simple interest rate at which he can afford to borrow money in order to take advantage of the cash discount?

2. A retailer receives an invoice for \$8000 for a shipment of furniture, with terms 3/10, $n/40$.

(b) If the retailer can borrow money at a simple interest rate of 21%, find his profit resulting from the cash discount when he pays the invoice on the 10th day.

Chapter 4, cobwebbing

$$x_{n+1} = f(x_n)$$

1. Draw a vertical segment along $x = x_0$ until we intersect the curve $y = f(x)$, intersecting at P . This gives us the value $x_1 = f(x_0)$.
2. Draw a horizontal segment from P to $y = x$. The abscissa of this point of intersection is x_1 . Wh
3. Repeated (1) and (2) to obtain x_t from x_t .

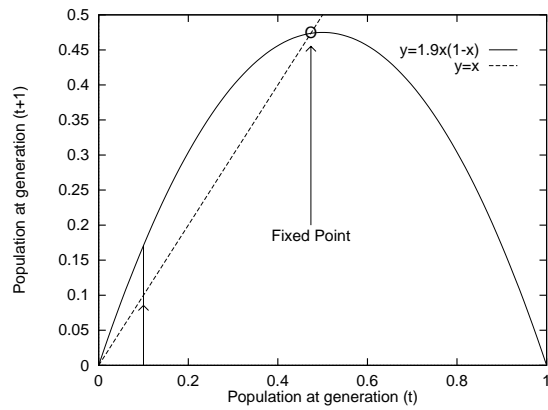
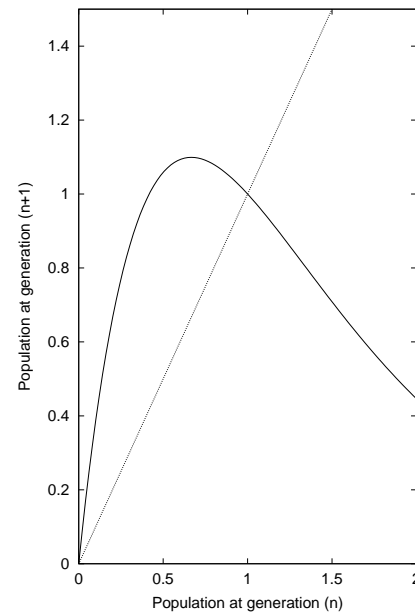
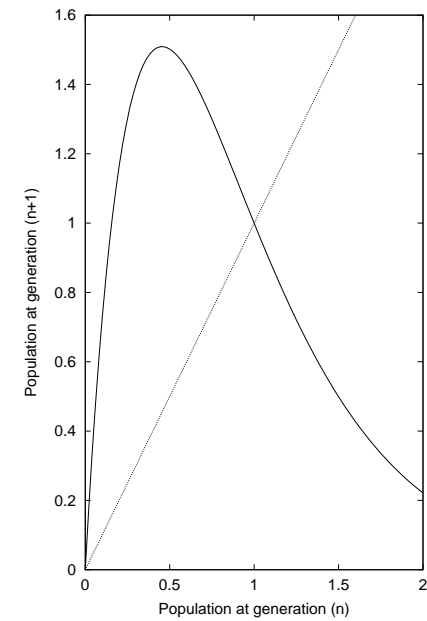


Figure 1: Determination of population dynamics using cobwebbing.

Determine the population dynamics using cobwebbing.



Determine the population dynamics using cobwebbing.



Chapter 7, Example 7.6.

Verify that

$$p = \frac{k}{r} + \left[p_0 - \frac{k}{r} \right] e^{rt}$$

is the solution of the differential equation

$$\frac{dp}{dt} = rp - k, \quad p(0) = p_0.$$

Chapter 7.8, question 1.

The function $y = f(x)$ is drawn in figure 2. Roughly sketch the function $f'(x)$

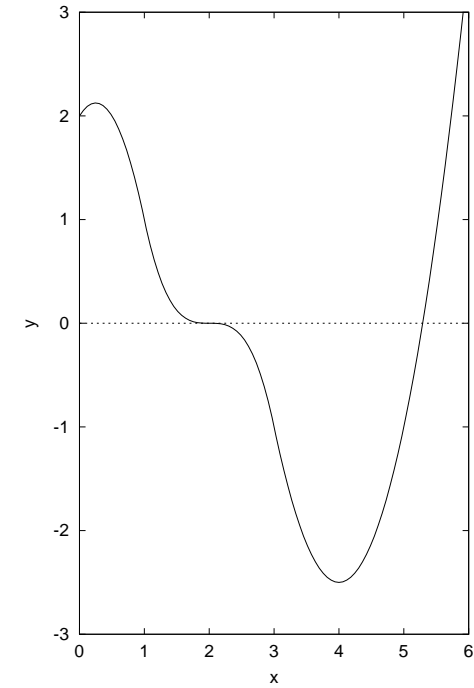


Figure 2: Figure for question 7.8.1