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, \( \alpha \), of the current patients are treated and discharged.
- A fraction, \( \beta \), of the current patients, unfortunately, die.
- A fraction of the current patients, \( \gamma \), 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 $40 000. 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 $8,000 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 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 \( x_1 \). What if \( x_0 \) is chosen to be the first value of \( x_1 \)?

3. Repeated (1) and (2) to obtain \( x_{k+1} \) from \( x_k \).
Figure 1: Determination of 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