

5.2 Reducing Balance Loans

Problems Worksheet

$$\left(1 + \frac{i}{n}\right)^n - 1$$

Step Up In
Mathematics Applications
Unit 3 and 4

CALCULATOR FREE

- Deduce a recursion equation for the balance of the loan or savings account for each scenario below.
 - A \$10 000 loan with weekly interest of 0.06% and weekly repayments of \$260.
 - An investment account that grows from \$8700 at 0.89% each month with an additional \$300 deposited each month.
 - A loan at 12% pa, compounded monthly, for \$20 000. Each month, a \$450 repayment is required.
 - A savings account has \$700 added to it each month. The account accrues interest at 6% pa, compounded monthly. The account started empty.
- The changes of a loan balance due to regular interest and repayment schedules is shown in the table below.

Week	Opening Balance	Interest	Payment	Closing Balance
1	10000.00	250.00	800.00	9450.00
2	9450.00	236.25	800.00	8886.25
3	8886.25	222.16	800.00	8308.41
4	8308.41	207.71	800.00	A
5	7716.12	B	800.00	7109.02

- Calculate the interest rate applied each week.
- Hence, deduce a recursion equation for the loan balance each week.
- Calculate the values for **A** and **B** to the nearest cent.

4. Jodie takes out a \$675 000 loan with a 5.58% pa interest rate. She chooses to make monthly payments, which is also the compounding period of the interest.
- Calculate the value of the monthly repayments if the loan is “interest only” (i.e. Jodie only pays off the interest each month such that the loan balance does not reduce over time).
 - Calculate the time until the loan is repaid if Jodie pays \$500 above the interest only amount each month.
 - Calculate how much the monthly repayment needs to be for Jodie to pay off the loan within 25 years.
 - Hence, deduce a recursion rule to show Jodie’s loan balance at the end of the n th month and find the balance of the loan after 16 months using the rule.
 - Calculate the amount of interest paid over the lifetime of the loan.
5. A used car salesman works out a deal with Jennifer that if she can put down a \$1500 deposit, she can purchase a \$22 000 car with the remaining covered by a personal loan. The loan has a rate of 4.80 % pa, compounded weekly. Jennifer will pay \$180 each week.
- Deduce a recursive formula for the balance of the loan at the end of each week.
 - Calculate the amount Jennifer owes after 6 months.

- c. Calculate the time it takes Jennifer to repay the entire loan and the value of her last payment.
- d. Calculate the total amount Jennifer spent buying the car.
- e. Jennifer also had an option decrease her weekly repayments by \$20, and have a lower interest rate of 4.70% pa. Should she have taken this option? Justify your choice.
6. Susana and Mohammad owe approximately \$320,000 on their 25-year term loan. They initially owed \$480,000. The interest of the loan is compounded monthly and Susana and Mohammad have made regular \$3,500 monthly repayments.
- a. Determine the nominal interest rate of the loan.
- b. Hence, deduce the recursion equation for the balance of the loan at the end of each month.
- c. Approximate how many years Susana and Mohammed have been paying off the loan.

7. Cooper gets a \$26 000 personal loan for a car. He was offered a special interest rate of 2.50% pa for the first year, which then increases to 3.25%. He makes regular repayments of \$180 each month. The interest compounds monthly.
- a. Deduce a recursion equation for the balance of the loan throughout the first year.
- b. Hence, fill in the missing entries in the table below.

Month	Closing Balance
10	24 728.95
11	
12	

- c. Determine the amount left on the loan at the end of the second year.
- d. Determine how much more Cooper has paid for the car overall because of the increased interest rate after the first 12 months compared to if the special interest rate was maintained for the life of the loan.