

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Lesson Plan - Balance Outstanding

The quantity of work is for two 45- minutes' lessons- one on Balance Outstanding after a certain periods of time by using the Power point presentation, and the second lesson is for consolidation by working on the worksheet.

Pre-knowledge

- Substitution into a formula
- Solving algebraic equations
- Converting percentages to decimals and decimals to percentages

Aims

- To learn the terminology in Mathematics of Finance connected to balance outstanding in savings and annuities
- To use correctly the two formulae for balance outstanding
- Logical and critical thinking- what kind of transactions will benefit them.

Resources

- Power Point
- Worksheet

Activities

- By following the Power Point presentation, the learners need to learn the basic formulae and do the examples together.
- In groups or individually they must solve the application problems in the worksheet.

Worksheet

The worksheet is divided into three sections:

Section A- easy questions for the lower ability pupils

Section B- middle level of difficulty questions

Section C- advanced (difficult) questions for the gifted and talented pupils.

Note: The learners are encouraged to use a calculator only once in their solution in Mathematics of Finance. Only the final answer should be rounded off.

Power point Example

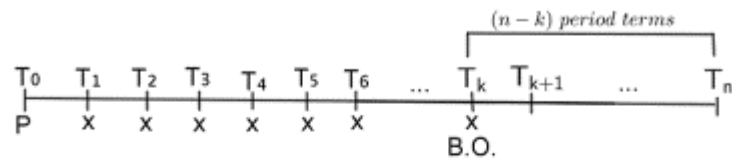
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Many people borrow money to buy a car or a home, but do not pay off the loan for its entire term. Rather, they pay off the loan early by making a lump sum final payment. This payment is called the **balance outstanding** or the **unpaid balance**.

Assume a loan of P pounds from a bank is to be repaid by means of equal, end of month instalments of x rand per month for n months. The interest rate is compounded monthly.

To calculate the balance outstanding (B.O.) after the k -th payment is made, we have two options:

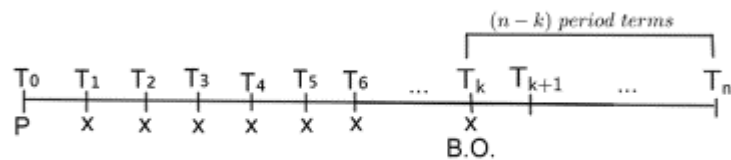


Method 1:

The balance outstanding is the same as the present value for the last $(n-k)$ months of the time of the loan.

$$\text{Then } B.O. = x \cdot \frac{1 - (1+i)^{-(n-k)}}{i}.$$

Note: This method can only be used if all monthly payments are equal.



Method 2:

If all monthly payments are not equal, ie the final payment is smaller than the regular monthly payments.

Then balance outstanding is the difference of the future value of the loan for k months and the future value of the payments at the end of the k -th month:

$$B.O. = F_{\text{loan}} - F_{\text{payments}}$$

$$B.O. = P(1+i)^k - x \cdot \frac{(1+i)^k - 1}{i}$$

EXAMPLE 1

Ross takes a loan of £18 000 from a bank to buy a car. The agreement is that he will repay the loan by means of equal monthly instalments at the end of each month for 5 years. The interest charged by the bank is 8.6% per annum, compounded monthly.

- (a) How much is the monthly payment?
- (b) At the end of the third year Ross receives a bonus and he decided to repay the balance outstanding of the loan as a lump sum. How much is his final lump sum payment?

Solution

$$(a) \quad P = x, \frac{[1-(1+i)^{-n}]}{i} \quad n = 5 \times 12 = 60$$

$$x = \frac{P \cdot i}{1-(1+i)^{-n}}$$

$$x = \frac{18\,000 \cdot \frac{0.086}{12}}{1-\left(1+\frac{0.086}{12}\right)^{-60}}$$

$$x \approx \text{£}370.17 \text{ per month}$$

Teachers Evaluation and Handouts

Balance Outstanding – Worksheet

In each question round your answer off to two decimal places (if necessary).

Section A.

1. A loan of £200 000 is to be repaid in equal monthly payments at the end of each month for 10 years. The interest rate is 4% per annum, compounded monthly.
 - (a) Calculate the size of the equal payments.
 - (b) What is the balance outstanding at the end of 7 years?

2. A loan of £6 000 is to be repaid in equal payments at the end of each half year (six months) for 6 years. The bank charges interest at a rate of 4.2% per annum, compounded semi-annually.
 - (a) Calculate the size of the equal payments.
 - (b) What is the balance outstanding at the end of 4 years?

Section B.

1. A loan of £20 000 is to be repaid in equal payments at the end of each quarter for 3 years. The bank charges interest at a rate of 5% per annum, compounded quarterly.
 - (a) Calculate the size of the equal payments.
 - (b) What is the balance outstanding at the end of 27th month?

2. A family plans to purchase a house for £500 000. They will pay a deposit of 12% and take a loan for the remaining amount for 30 years at 3.2% per annum, compounded monthly.
 - (a) What is the amount of the loan?
 - (b) What should their installments be if they wish to repay the bank equal amounts at the end of each month?
 - (c) What is the balance outstanding on the loan right after they pay their 84th payment?

Section C.

1. Olivia takes a loan of £250 000 from the bank to buy a house. She must pay equal instalments at the end of each month for 30 years. The interest rate is 4.25% per annum, compounded monthly.
 - (a) Calculate the monthly payments.
 - (b) Together with her 240th payment Olivia pays a lump sum of £20 000. What is the balance outstanding on the loan immediately after the combined payments?
 2. Martin takes a loan of £230 000 to buy a house. The bank charges interest of 3.5% per annum, compounded monthly. He will repay the loan by means of equal monthly payments at the end of each month for 25 years.
 - (a) Calculate the monthly payments.
 - (b) What is the balance outstanding after the first payment?
 - (c) How much of the first payment is interest?
 - (d) How much of the principal amount of the loan is repaid with the first payment?
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Answers:

Section A:

1. a) £2 024.90
b) £68 584.91
2. a) £570.85
b) £2 168.38

Section B:

1. a) £1 805.17
b) £5 282.88
2. a) £440 000.00
b) £1 902.85
c) £371 415.62

Section C:

1. a) £1 229.85
b) £100 058.53
2. a) £1 151.43
b) £229 518.56
c) £670.83
d) £480.60