

# Amortisation

tables

Year 12 General Maths Units 3 and 4

## **Learning Objectives**

By the end of the lesson, I would hope that you have an understanding and be able to apply to questions the following concepts:

- To be able to apply the amortisation process.
- To be able to construct an amortisation table.
- To be able to analyse an amortisation table for a reducing balance loan.
- To be able to read and interpret an amortisation table for an annuity to find the interest rate.
- To be able to interpret and construct an amortisation table for a compound interest investment with additions to the principal.



It seems to appear that the following formula is pretty much all we need to know for General Maths.

$$V_0 = Principal,$$
  $V_{n+1} = R \times V_n \pm D,$  where  $R = 1 \pm \frac{r}{100}$ 

However, we are now going to diverge for a small while and look at something which used to be delivered to everyone each month.

It was something we all spent ages looking over to make sure that we hadn't had money stolen from us.

We called it a **bank statement** but General Maths wants it to be called an **Amortisation Table**.



2,000.57 BP D CHITAN Gift 560.00 1,440.57 BP Victor Spinei For help 360.00 BP Victor Popa For my 500.00 BP Victor Spinei For help 60.00 CR VICTOR POPA for my 70.00 590.57 BALANCE CARRIED FORWARD 590.57

1,710.00

600.00

1.000.00

300.00

265.00

127 High Street Hounslow Middlesex TW3 1QP

For help

G Grajdean

Victor Popa

For my

BP V Birca Fie felp

BP For help

BP C Florea For rent

BP

21 Oct 20

Oct 20

Oct 20

🚔 BankStatements.net

Balance

5,875.57

2,565.57

0.57

Contact tel 03457 404 404 see reverse for call times Text phone 03457 125 563 used by deaf or speech impaired customers www.hsbc.co.uk

#### Your Statement

Account Summary	
Opening Balance	0.57
Payments In	9,820.00
Payments Out	9,803.54
Closing Balance	17.03

Account Number Sheet Number 16

# **Amortisation tables**

These are effectively ways to show the current state of a loan or investment. At the moment we will look at one for a loan.

The most important thing to note is:

Principal reduction = Payment – Interest

Principal amount of the loan

Payment number	Payment	Interest	Principal reduction	Balance
0	0.00	0.00	0.00	1000.00 /
1	250.00	12.50	237.50	762.50
2	250.00	9.53	240.47	522.03
3	250.00	6.53	243.47	278.56
Monthly (or oth			much interact has	
Monthly (or oth	ier) payment	been	much interest has charged on the ous balance	How much the loa been reduced by



Examples have been extracted, with permission, from the Cambridge General Mathematics Units 3 and 4 Textbook

## Amortisation tables: Finding the rate of interest

A common question in exams is to find the rate of interest from an Amortisation table.

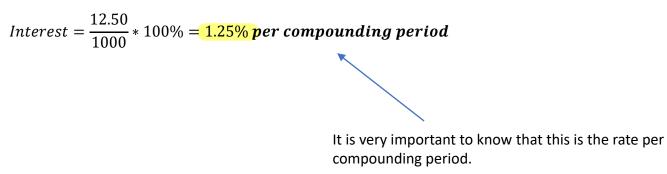
We can use the formula:

Interest per compounding period 
$$=$$
  $\frac{Amount of interest charged}{Balance from previous payment} * 100\%$ 

Payment number	Payment	Interest	Principal reduction	Balance
0	0.00	0.00	0.00	1000.00
1	250.00	12.50	237.50	762.50
2	250.00	9.53	240.47	522.03
3	250.00	6.53	243.47	278.56

250.00

So, for the previous example:





4

## Amortisation tables: What you will be asked for

It is common that they ask you to complete lines of an amortisation table. This is more common in SACs than exams, but it has been asked in exams before.

They would ask you to find:

Payment number	Payment	Interest	Principal reduction	Balance
0	0.00	0.00	0.00	1000.00
1	250.00	12.50	237.50	762.50
2	250.00	9.53	240.47	522.03
3	250.00	6.53	243.47	278.56

- Interest payments and rates of interest
- Final payments (which might be smaller than normal)
- Values of principal reductions given payments and interests
- Balances at any point given past balance and principal reductions



#### **Example: Amortisation tables**

Flora borrows \$20 000 at an interest rate of 8% per annum, compounding annually. She makes annual payments of \$2500.

- **a** State the principal of the loan. 320000
- **b** Calculate the initial interest charged on the principal. 5600
- **c** Determine the impact of the first annual payment to find the principal reduction. 900
- **d** Calculate the new balance.
- Complete the row in the table below with your calculations.

Payment number	Payment	Interest	Principal reduction	Balance
1	2500.00	1600	900	19100

r = 8%



1600

20 000 - 900

# **Example: Amortisation tables**

8700 18 128

Flora borrows \$20 000 at an interest rate of 8% per annum, compounding annually. She makes annual payments of \$2500.

Construct an amortisation table for Flora's reducing balance loan for the first three payments.

Payment Num	Payment	Interest	Principal reduction	Balance
0	\$0.00	\$0.00	\$0.00	\$20,000.00
1	1500	(600	900	60.00191
2	2500	1528	972	18128.00
3	2500	1450.24	- 1049.76	18128.00 17078.24
4	2500			



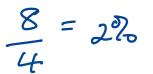
#### **Example: Amortisation tables**

A business borrows \$10 000 at a rate of 8% per annum, compounding quarterly. The loan is to be repaid by making quarterly payments of \$2700.00. The amortisation table for this loan is shown below.

Payment number	Payment	Interest	Principal reduction	Balance
0	0.00	0.00	0.00	10 000.00
1	2700.00	200	2500.00	7500.00
2	2700.00	150.00	2550	4950.00
3	2700.00	99.00	2601.00	2349

- **a** Calculate the interest paid on the initial balance.
- **b** Calculate the principal reduction from the second payment.
- **c** Calculate the balance of the loan after payment 3 has been made.

2% of 10 000





Payment number	Payment	Interest	Principal reduction	Balance
0	0.00	0.00	0.00	12 000.00
1	2200.00	60.00	2140.00	9860.00
2	2200.00	49.30	2150.70	7709.30
3	2200.00	38-55A	2161-45B	5547.85

Consider the following amortisation table for an annuity after 3 monthly payments.

**a** State the principal of the annuity and the amount of interest paid in the first month.

- **b** Calculate the monthly interest rate.
- **c** Find the value of *A* and *B*.

\$12000, \$60

A = 38.55B = 2161.45

#### **Amortisation tables for investments**

These are pretty much the same as they were for loans and annuities however, here isn't a principal **reduction** there is a principal **increase**. The working out for all the other things is pretty much the same except:

Principal increase = Payment + Interest

As, when we have an investment, the interest is added on to the payment.

Payment number	Payment	Interest	Principal increase	Balance
0	0.00	0.00	0.00	1200.00
1	50.00	3.00	53.00	1253.00
2	50.00	3.13	53.13	1306.13
3	50.00	3.27	53.27	1359.40



#### **Example: Amortisation table for investments**

Consider the following amortisation table for a compound interest investment with monthly additions to the principal. Assume that interest compounds monthly.

Payment number	Payment	Interest	Principal increase	Balance
0	0.00	0.00	0.00	1200.00
1	50.00	3.00	53.00	1253.00
2	50.00	3.13	53.13	1306.13
3	50.00	3.27	53.27	1359.40

Complete two additional lines for the table corresponding to payment 4 and payment 5.

(= 3 x 100 = 0.25%. 1200
0.25% of 1359.40
0.25'1. Df 1412.80

Payment Num	Payment	Interest	Principal increase	Balance
4	50	3.40	53.40	1412.80
5	50			



Examples have been extracted, with permission, from the Cambridge General Mathematics Units 3 and 4 Textbook

# **VCAA Questions**

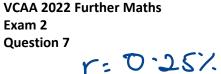
Pina invests \$540000 in an annuity paying 3% interest per annum, compounding monthly. Her annuity will provide a monthly payment of \$5214.28 for 10 years. Four lines of the amortisation table for Pina's annuity are shown below.

The information for payment number 3 is missing.

- **a.** What is the value of payment number 3?
- b. Calculate the interest associated with payment number 3. Round your answer to the nearest cent.
- c. Let  $P_n$  be the balance, in dollars, of Pina's annuity after *n* months.

Write a recurrence relation, in terms of  $P_0$ ,  $P_{n+1}$  and  $P_n$ , that can model this balance from month to month.

Payment number	Payment (\$)	Interest (\$)	Principal reduction (\$)	Balance (\$)
0	0.00	0.00	0.00	540 000.00
1	5214.28	1350.00	3864.28	536135.72
2	5214.28	1340.34	3873.94	532261.78
3	5214.28	1330.65	3883.63	



Vo = 540 000, Vn+1 = 1.0025 Vn - 5214:28

R= 1+ 0-25 001



# **VCAA Questions**

Deepa invests \$500000 in an annuity that provides an annual payment of \$44970.55 Interest is calculated annually.

The first five lines of the amortisation table are shown below.

The principal reduction associated with payment number 3 is

- **A.** \$17962.40
- B \$25969.37
  C. \$27008.15
  D. \$28088.47
- **E.** \$44970.55

Payment number	Payment (\$)	Interest (\$)	Principal reduction (\$)	Balance (\$)
0	0.00	0.00	0.00	500 000.00
1	44 970.55	20 000.00	24970.55	475 029.45
2	44 970.55	19001.18	25969.37	449060.08
3	44 970.55	17962.40	27008.15	422051.93
4	44 970.55	16882.08	28088.47	393963.46

VCAA 2021 Further Maths Exam 1 Question 18



# **VCAA Questions**

Samuel has a reducing balance loan.

The first five lines of the amortisation table for Samuel's loan are shown below. Interest is calculated monthly and Samuel makes monthly payments of \$1600. Interest is charged on this loan at the rate of 3.6% per annum.

- **a.** Using the values in the amortisation table
  - i. calculate the principal reduction associated with payment number 3
  - ii. calculate the balance of the loan after payment number 4 is made.Round your answer to the nearest cent.

Payment number	Payment (\$)	Interest (\$)	Principal reduction (\$)	Balance (\$)
0	0.00	0.00	0.00	320 000.00
1	1600.00	960.00	640.00	319360.00
2	1600.00	958.08	641.92	318718.08
3	1600.00	956.15	643.85	318074.23
4	1600.00	954 22	645.78	317 428.

VCAA 2020 Further Maths Exam 2 Question 8

L = 3.9 = 0.3.72



