



Amortisation tables

Year 12 General Maths
Units 3 and 4

www.maffsguru.com

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.



Recap

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

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

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**.



BankStatements.net

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

Mr John Doe
20 Sherwood St,
London W1F 7ED



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

International Bank Account Number
ABCDHUK0000001234567894
Branch Identifier Code
JUBKGB12345F

15 October to 14 November 2020

Account Name
Mr John Doe

Sortcode **Account Number Sheet Number**
40-25-02 123456979 16

Your Bank Account Details

Date	Payment type and details	Paid out	Paid in	Balance
14 Oct 20	BALANCE BROUGHT FORWARD			0.57
15 Oct 20	BP GBCLONLTD construction		9,000.00	
	BP C Florea For help Victor Popa	1,225.00		
	BP For my V Dminet	1,900.00		5,875.57
16 Oct 20	BP For help V Birca	1,710.00		
	BP Fie felp G Grajden	600.00		
	BP For help C Florea	1,000.00		2,565.57
21 Oct 20	BP For rent Victor Popa	300.00		
	BP For my D CHITAN	265.00		2,000.57
Oct 20	BP Gift Victor Spinei	560.00		1,440.57
Oct 20	BP For help Victor Popa	360.00		
	BP For my Victor Spinei	500.00		
	BP For help VICTOR POPA	60.00		
	CR for my		70.00	590.57
	BALANCE CARRIED FORWARD			590.57

127 High Street Hounslow Middlesex TW3 1QP

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

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

Principal amount of the loan

Monthly (or other) payment

How much interest has been charged on the previous balance

How much the loan has been reduced by



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:

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

$$1.25\% \text{ of } 278.56$$
$$1.25 \div 100 \times 278.56$$

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

4 250.00

So, for the previous example:

$$\text{Interest} = \frac{12.50}{1000} * 100\% = 1.25\% \text{ per compounding period}$$

It is very important to know that this is the rate per compounding period.



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. $\$20\ 000$
- b Calculate the initial interest charged on the principal. $\$16\ 00$
- c Determine the impact of the first annual payment to find the principal reduction. 900
- d Calculate the new balance.
- e Complete the row in the table below with your calculations.

$$r = 8\%$$

$$8\% \text{ of } 20\ 000$$

$$1600$$

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

$$20\ 000 - 900$$



Example: Amortisation tables

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

₹ of 18 128

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	2500	1600	900	19100.00
2	2500	1528	972	18128.00
3	2500	1450.24	1049.76	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.

$$\frac{8}{4} = 2\%$$

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

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

$$2\% \text{ of } 10\ 000$$



Example: Amortisation tables

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

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	38.55 A	2161.45 B	5547.85

- 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.

\$12 000 , \$60

$$\frac{60}{12000} \times 100 = 0.5\%$$

$$A = 38.55$$

$$B = 2161.45$$



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

$$r = \frac{3}{1200} \times 100 = 0.25\%$$

$$0.25\% \text{ of } 1359.40$$

$$0.25\% \text{ of } 1412.80$$

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

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



VCAA Questions

Pina invests \$540 000 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.

- What is the value of payment number 3?
- Calculate the interest associated with payment number 3. Round your answer to the nearest cent.
- 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.

VCAA 2022 Further Maths
Exam 2
Question 7

$$r = 0.25\%$$

$$e = 1 + \frac{0.25}{100}$$

$$V_0 = 540\,000, \quad V_{n+1} = 1.0025V_n - 5214.28$$

Payment number	Payment (\$)	Interest (\$)	Principal reduction (\$)	Balance (\$)
0	0.00	0.00	0.00	540 000.00
1	5214.28	1350.00	3864.28	536 135.72
2	5214.28	1340.34	3873.94	532 261.78
3	5214.28	1330.63	3883.65	



VCAA Questions

VCAA 2021 Further Maths
Exam 1
Question 18

Deepa invests \$500 000 in an annuity that provides an annual payment of \$44 970.55

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. \$17 962.40
- B. \$25 969.37
- C. \$27 008.15
- D. \$28 088.47
- E. \$44 970.55

Payment number	Payment (\$)	Interest (\$)	Principal reduction (\$)	Balance (\$)
0	0.00	0.00	0.00	500 000.00
1	44 970.55	20 000.00	24 970.55	475 029.45
2	44 970.55	19 001.18	25 969.37	449 060.08
3	44 970.55	17 962.40	27 008.15	422 051.93
4	44 970.55	16 882.08	28 088.47	393 963.46



VCAA Questions

VCAA 2020 Further Maths
Exam 2
Question 8

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.

$$r = \frac{3.6}{12} = 0.3\%$$

- a. Using the values in the amortisation table
- calculate the principal reduction associated with payment number 3
 - 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	319 360.00
2	1600.00	958.08	641.92	318 718.08
3	1600.00	956.15	643.85	318 074.23
4	1600.00	954.22	645.78	317 428.45



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