

FINANCIAL MATHS

Before we begin → when dealing with money, we must always round off our answers to **TWO** decimal places. Why?

Simple INTEREST

Simple interest is a fixed percentage of the amount invested or borrowed and is calculated on the original amount. Simple interest entails adding a constant amount to the principle (original amount) at regular intervals. The formula used to calculate simple interest is:

$$\text{simple interest, } A = P(1 + in)$$

Where:

A = accumulated amount (end total)

P = principal amount (starting amount)

i = interest (written as a decimal)

n = number of years

Examples:

1. Themba borrows R7 000 from a bank to build a new wall around his yard and house. The bank charges him 12% simple interest per year. Calculate how much he will pay on his loan over four years.

$$A = P(1 + in) \quad \therefore A = 7000(1 + 0,12 \times 4) = R10\ 360$$

2. Claire invested R5 000 for 6 years, at 6,25% per annum. Calculate the amount of simple interest she will earn in total.

$$A = P(1 + in) \quad \therefore A = 5000(1 + 0,0625 \times 6) = R6\ 875$$

Total payment – original payment = Total interest paid

$$R6\ 875 - R5\ 000 = R1\ 875$$

NB: 'per annum'
means
'per year'

Exercise 1

1. Mr Mlangeni buys furniture for R12 500 at 13% simple interest p.a. over 3 years.
 - a. How much will he pay altogether?
 - b. How much interest will he have paid?
2. Greg was given R2 000 by his grandmother but he was not allowed to spend it until he left school. He invested it for 4 years at 9% p.a. simple interest. How much did he have at the end of the 4 years?

3. Basil Faulty needs to repair the kitchen cupboards, which Manuel has broken, at Manuel's expense. The cost of the repairs is R21 500 but Manuel needs to borrow money from Mr Faulty in order to afford this. Mr Faulty charges Manuel 11½ % simple interest p.a. over a 5 year period. How much did Manuel end up paying for the repair job?
4. A woman invests a sum of R10 000 in a fixed-term deposit account for 3 years. Calculate:
 - a. The total value of the investment if the rate of interest is 6,5% per annum
 - b. The simple interest earned
5. Your uncle takes out a personal loan of R20 000 for a period of 5 years, at a simple interest rate of 12% p.a. Find the amount he owes after 5 years.
6. Tamara takes out a loan of R1 200 at a simple interest rate of 14,5% p.a. How much does she owe after 1 year?
7. A company invests R1 000 000 in the short term money market, at 11% simple interest p.a. After 3 years they take the interest earned on this investment and they invest it in a high-risk account that earns 17% simple interest p.a. If these monies are left in their respective accounts for a further 5 years,
 - a. How much money will the company have in both accounts
 - b. How much money did they earn from their investments over the 8 year period?

Re-arranging the simple interest formula → the formula for simple interest can be used to find any one of the variables when the values of the other three variables are known.

Example:

Calculate how long you need to invest R5 000 to make R6 800 at 12 % p.a. simple interest.

$$A = P(1 + in)$$

$$6800 = 5000(1 + 0,12n)$$

$$1,36 = 1 + 0,12n$$

$$0,36 = 0,12n$$

$$n = 3 \text{ years}$$

Exercise 2

1. Nomiso invests R2 000 in a savings account. The bank pays her simple interest at 7,5% p.a. How long will it take her to earn R975 on her savings?
2. Jackie puts R5 000 into a savings account. After 3 years, she has a total of R6 500 (including her principle). Calculate the rate of simple interest.
- *** 3. When Sizwe was 12, he put some money in the bank. The amount earns 4,25% p.a. simple interest. By the time he was 22, he had earned R514,25 on his money. How much did he originally have?

Compound INTEREST

We have learnt about simple interest but in reality banks charge compound interest on loans and investments. That is, the interest charged / earned in each period is added to the principal amount. This means that as the principal increases so does the interest each period.

Example:

Your brother invests R250 at 10% p.a. The interest is added to his account at the end of each year. How much money will he have in his account at the end of the third year?

In the first year:

$$I = \frac{pin}{100} \quad \therefore I = \frac{250 \cdot 10 \cdot 1}{100} = R25$$

So at the end of the first year, the amount of money in the account is $R250 + R25 = R275$

In the second year:

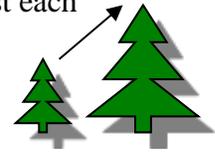
$$I = \frac{pin}{100} \quad \therefore I = \frac{275 \cdot 10 \cdot 1}{100} = R27,50$$

So at the end of the second year, the amount of money in the account is $R275 + R27,50 = R302,50$

In the third year:

$$I = \frac{pin}{100} \quad \therefore I = \frac{302,5 \cdot 10 \cdot 1}{100} = R30,25$$

So at the end of the first year, the amount of money in the account is $R302,50 + R30,25 = R332,75$



Grow your money faster:

Earn interest on your interest!

$I = \frac{pin}{100}$ is the formula to work out how much simple interest was earned in one year.
(the actual interest amount – not the accumulated amount)

This would take us forever to work out this way. Instead we use a formula. The formula is

$$A = P(1 + i)^n$$

where,

- A = accumulated amount (end total)
- P = principal amount (starting amount)
- i = interest (written as a decimal)
- n = number of years

Example:

Ashraf invests R5 000 at 6% p.a. compounded interest for 5 years. Calculate the final value of his investment.

$$A = ?$$

$$P = R5\ 000$$

$$i = 0,06$$

$$n = 5$$

$$\begin{aligned} A &= P(1 + i)^n \\ &= 5000(1 + 0,06)^5 \\ &= R6\ 691,13 \end{aligned}$$

Exercise 3

1. Lucy invests R3 500 at 5% compound interest p.a. for 5 years. Calculate the final amount in her account.
2. Nazeem invests R7 000 at 8% p.a. for 4 years. Calculate the total amount of compound interest he earns.
3. James borrows R1 250 at 7,5% compound interest p.a. for 3 years. Calculate the total amount he needs to repay.
4. Calculate the difference between simple interest and the compound interest on a loan of R50 000 at 7% over
 - a. 5 years
 - b. 20 years
5. Calculate the amount of money that would be needed to be invested at $6\frac{3}{4}$ % p.a. compound interest to achieve a sum of R36 000 in 4 years.
6. Calculate the interest paid on a loan of R2 750 at 11%, compounded annually for 4 years.
7. How much money must you invest at 12,5% per annum, compounded annually, if you know that you will need R65 000 in 5 years time for a new car.
8. Tshidi's parents opened an investment account when she was born, in which they deposit R5 000. They intend to withdraw the money on her 18th birthday. If the account earns 8% p.a. for the first 10 years and 6% p.a. for the next 6 years and 10% p.a. for the final 2 years, all compounded, how much money will Tshidi receive?

Hire Purchase

One way of buying expensive items such as lounge suits or television sets when you don't have the cash available immediately is to enter into a hire-purchases agreement. This means the purchaser agrees to hire the item from the seller, and to make payments of an agreed amount, at a specified time interval. At the end of the period of agreement, the purchaser owns the item.

Examples:

1. A student buys a laptop computer priced at R13 500. She pays a deposit of 20% and interest at 15% p.a. on the balance. If she pays off the loan in 12 monthly payments, then

- a. How much is the deposit?
- b. What is the student's total repayments, including interest?
- c. How much is each payment?
- d. What is the total cost of buying the laptop by hire purchase?

- a. Deposit = 20% of R13 500 = R2 700
- b. Balance left to pay = R13 500 – R2 700 = R10 800
Interest on the balance = $\frac{15 \cdot 10800}{100} = R1\ 620$
Thus total repayment = R10 800 + R1 620 = R12 420

- c. Therefore, monthly repayments = $\frac{12420}{12} = R1\ 035$
- d. Total cost of the computer = deposit + total repayment
= R2 700 + R 12 420
= R15 120

2. A car radio has a market price of R960. A purchaser agrees to a hire purchase contract of R100 deposit and 12 monthly payments of R100. Calculate:

- a. The total amount paid
- b. Total interest paid

- a. Total repayments = R100 + R100 × 12 = R1 300
- b. Thus, total interest = R1 300 – R960 = R340

3. A hire purchase contract for a sound system requires Josh to pay a deposit of R400 and then make 6 monthly repayments of R185. If the price of the sound system is R1 400:

- a. What was Josh's total payment?
- b. How much interest will he pay?

- a. Total repayments = deposit + repayments
= R400 + R185 × 6
= R1 510
- b. Thus, total interest = R1 510 – R1 400
= R110

Exercise 4 (all interest is simple)

1. The cash price of a tennis racquet is R330. To buy it on hire purchase requires a deposit of R30 and 12 equal monthly payments of R28. Calculate:
 - a. The total cost of the tennis racquet via hire purchase
 - b. The extra cost of buying by hire purchase
2. A bicycle has a marked price of R3 000. It can be bought through hire purchase with a deposit of R600 and 10% interest on the outstanding balance, to be repaid in 12 monthly installments. Calculate:
 - a. The amount of each monthly installment
 - b. Total cost of buying the bicycle by hire purchase
3. A fridge is advertised for R5 575 cash or R600 deposit and 24 monthly installments of R268,75. Calculate the amount of interest paid via hire purchase.
4. A microwave oven is advertised with a marked price of R1 576 and the opportunity to buy it on hire purchase, with no deposit and an interest rate of 10% repayable over a year in 4 equal installments. Calculate
 - a. Total amount to be repaid
 - b. The amount of each installment
 - c. The amount of interest
5. A customer bought a car for R36 010 on hire purchase. A deposit of R4 000 was paid and the loan plus interest is to be repaid over 18 months in 9 equal payments of R5 295, 30. Calculate:
 - a. The amount repaid
 - b. The interest paid
6. A student bought a computer costing R22 250 on hire purchase at 11% p.a. He traded in an old computer for R2 000 and paid a deposit of R1 500. The balance was paid by monthly installments over 2 years. Calculate the monthly installments paid.

Inflation rates

Inflation is the increase in the national average price level (CPIX linked). Inflation causes the buying power of your money to diminish year to year. If inflation is at 10% per year, goods and services will cost 10% more at the end of the year than they did at the beginning.

People will only have more buying power if their salary or wages increase by more than inflation. So if inflation is at 5% and salaries and wages went up by 7%, then their real buying power only went up by 2%.

Example:

A movie ticket costs R20. How much will it cost in 3 years' time, if inflation continues to be 6% per annum?

Because the value compounds annually, use the compound interest formula.

$$\begin{aligned}A &= P(1 + i)^n \\ &= 20(1 + 0.06)^3 \\ &= R23,82\end{aligned}$$

Exercise 5

Assume a constant inflation rate of 5% for the following:

1. Find the expected cost in 2 years time of a new car that costs R100 000 today.
2. How much will a DVD player priced at R950 cost to replace in 4 years time?
3. An overseas holiday costs R40 000. How much will it cost in 3 years time?
4. If workers salaries increase to match inflation, what could a worker earning R120 000 p.a. expect to be earning in 2 years time? What would their financial position be in real terms? Explain?

Exchange Rates

The exchange rate is the price of one currency in terms of another. The figures below are accurate as of 1 September 2010.

R7,32	=	1 US dollar	(\$)
R11,39	=	1 British pound	(£)
R9,30	=	1 euro	(€)
R1,05	=	1 Botswana pula	(P)
R1,83	=	1 Argentina peso	(\$)
R6,57	=	1 Australian dollar	(\$)
R1	=	6,41 Indian rupees	(₹)
R1	=	11,56 yen	(¥)

Go to <http://www.x-rates.com/d/ZAR/table.html> if you would like to get updated exchange rates.

Example:

1. Thabo is on his way to the USA. He buys US dollars from the bank at R7,32 per US dollar. How many dollars can he get for R20 000?

$$\begin{aligned} R7,32 &= \$1 \\ \text{So } R20\,000 &= \frac{20000}{7,32} = \$2\,732,24 \end{aligned}$$

2. Preveda's aunt lives in Lesotho. She plans to visit Preveda in South Africa, so she exchanges 1 000 Lesotho Loti for rands at R0,62 per loti. How many rands does she get?

$$\begin{aligned} 1 \text{ loti} &= R0,62 \\ \text{So } 1\,000 \text{ loti} &= 1000 \times R0,62 = R620 \end{aligned}$$

Exercise 6

Use the exchange rates given previously to calculate:

1. Convert these amounts to rands
 - a. \$23 456
 - b. 5 294 Botswana Pula
 - c. £398 672
 - d. 59 307 ¥
2. Convert the following into the currency in brackets
 - a. R23 456 (British Pound)
 - b. R582,39 (Euro)
 - c. R6 367 (Indian Rupees)

3. Sibusiso exports machines to Botswana. His selling price is R56 782. What amount should he receive in Botswana pula?
4. It costs 5 500 Australian dollars to study at university.
 - a. How much would this cost in rands?
 - b. If you acquired a scholarship to the value of R3 500, what would tuition cost in Australian dollars?
5. A certain model car is manufactured in South Africa and exported to Argentina at a cost of R105 000. An import cost of 19% is added to this price and transport is calculated at 9% of the cost of the car (after import duty is added). What will the car cost in Argentina ??
6. A selection of Indian curios were bought in India by a South African dealer. He paid 190 000 rupees for them.
 - a. How much did he pay in rands
 - b. If he sells them for a profit of 40% in South Africa, how much does he sell them for?

Exercise 7

1. You are going on holiday to Europe, starting in England. You have spending money of R20 000 that you convert into pounds, how many pounds do you receive?
2. You buy lunch and a cool drink at Heathrow airport for £6,45. How much is that in rands?
3. You want to spend a maximum of R80 on a present for a friend. You see something that you know they will like but it costs £5.
 - a. Will this fall within your intended budget for the present
 - b. How much over/under your budget will this be
4. From England you travel to Belgium and convert 50% of your initial spending money from pounds into Euros. How many Euros do you have?
5. While in Belgium you go on a tour of The Hague that costs €70. You also buy souvenirs there costing €30 and have a bus tour of the local country side costing €120. How much did this trip to Belgium take up of your spending money in rands?