STANMORE SECONDARY SCHOOL

FINANCIAL MATHEMATICS

GRADE 11

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FINANCIAL MATHS

SIMPLE AND COMPOUND INTEREST

$SI = A(P(1+i \times n)$ – SIMPLE INTEREST.

A = accumulated amount ; P = principal amount

n = time period ; i = interest rate = $i/100$

1. Calculate the SI. on R2000 at 8,5% p.a. for 6 years.
2. Peter deposited R400 in a bank and received an accumulated amount of R600 after 2 years. What was the annual interest rate if the simple interest is charged.

COMPOUND INTEREST

$CI = A = P(1+i/100)^n$ – compounded annually

$CI : A = P(1+i/200)^{2n}$ compounded bi-annually

$CI : A = P(1+i/400)^{4n}$ – compounded quarterly

$CI = A = P(1+i/1200)^{12n}$ compounded monthly.

A = accumulated amount ; P = principal amount

n = time period ; i = interest rate

1) Calculate the amount if R12000 is invested for 3 years at 14% pa. compounded annually.
2) John invested a lump sum for 20 years ago at an interest rate of 14,5% compounded annually. How much did he invest if the current value is R92000.

3. Calculate the value of an investment of R50 000 after 3 years at an interest rate of 12% p.a. compounded:

3.1. annually 3.2. half-yearly 3.3. quarterly

3.4. monthly 3.5 daily.

4. Lomo invests his inheritance at an interest rate of 11,5% compounded monthly. After 15 years his investment accumulate to R1000 000. Calculate the value of Lomo's inheritance.

5. R10 000 is invested into a pension fund. The total growth of the fund amounts to R250 000 after 10 years. Calculate the annual interest rate if interest was compounded annually.

6. R10 000 is invested at 9% p.a. compounded monthly. How long will it take for the money to double itself. (2)

7. R10 000 is invested in a bank for 12 yrs at a rate of 9% p.a. compounded monthly. After 5 yrs the rate changes to 10% p.a. and it is now compounded semi-annually. Find the value of the investment at the end of 12 yrs.

8. John deposits R12 000 in the bank at a rate of 8% per annum compounded monthly for 20 years. However, after 4 years he deposits a further lump sum of R30 000 and then after another 5 years he deposits R10 000. How much is his money worth after 20 years if the interest rate remains the same.

Nominal and Effective rate of interest.

A nominal rate of interest is the quoted rate per annum even though the interest may be compounded over periods shorter than a year (eg. daily, monthly, quarterly)
An effective rate of interest is the rate at which the interest accrues at the end of each year as if interest is calculated once a year.

Formula: Let suppose a amount of P is invested at a nominal interest rate of i_{nom} p.a. calculated m times a year. Let i_{eff} interest rate.

$$P(1+i_{eff})^1 = P\left(1+\frac{i_{nom}}{m}\right)^m$$

$$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$$

NOMINAL AND EFFECTIVE RATE OF INTEREST

1. An amount of R15000 is invested for 7 yrs at a nominal interest rate of 10% p.a. compounded monthly. Calculate the effective rate of interest.

2. An amount of R20000 is invested for 8 yrs at a nominal interest rate of 9,3% p.a. compounded quarterly. Calculate the effective rate of interest.

SIMPLE DECAY

Straight line depreciation or constant percentages method. This means the same amount is removed every year. For example suppose a machine costing R5000 is depreciated at a constant amount of 20% per year. This mean that every year the machine loses 20% which is R1000 of its value. $A = P(1 - n.r)$

(1.) A machine costing R2000 is depreciated at 10% p.a. on a straight line basis. What is its value after 4 years?

(2) A car cost R150000 is depreciated by the straight line method over 5 years. What is the value after 5 years.

(3) A car depreciates according to the straight line method to a value of R200 000 after 6 years. If it costs R600 000, what is the rate of depreciation.

(4.) The book value of a car is R164000 four years after it was purchased. The rate of depreciation is 18% on a straight line basis. Calculate the purchase price of the car.

(5) A machine costing R5800 is depreciated by the straight line method at 15% p.a. After how many years does it take to reach half its value.

Compound Decay

(4)

Compound decay means that the same percentage is removed from the reducing balance.

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

1. A machine costing R2000 is depreciated at 10% p.a on a reducing balance basis. What is its value after 5 years.

2. The value of a machine is reduced to R105 000 four years after it was purchased. What was the purchase price of the machine if the rate of depreciation is 2% p.a. calculated on a reducing balance?

3. The scrap value of a minibus is R57 000 five years after it was purchased for R302 000. Depreciation is worked out on a reducing balance. Calculate the rate of depreciation.

4. A machine costing R35 000 has a scrap value of R7000 over n years at a compound depreciation rate of 17,5% p.a. Find n.

5. At one stage there were 2500 tigers in a certain jungle and 4 yrs later the number dropped to 1000.

5.1. Find the rate of depreciation.

5.2. After how many years will there be just one tiger left at this rate.

FINANCE, GROWTH AND DECAY

EXAMPLE (COMPOUND INTEREST)

1. Invested R2000 at 11% p.a. compounded monthly.
   a) How much will you receive after 8 years.

SOLUTION:

$A = P(1+i)^n \rightarrow A = ?,\ P = R2000;\ n = 8 \text{ years} \times 12 \text{ months} = 96 \text{ months}$

$i = 11\% \div 12 \text{ months} = \frac{0,11}{12}$ or $\frac{11}{1200}$

$A = 2000\left(1 + \frac{0,11}{12}\right)^{8\times12}$ or $A = 2000\left(1 + \frac{11}{1200}\right)^{8\times12}$

$= R\ \underline{4802,508219} \simeq \underline{R\,4802,51}$

2. Invested R25000 for 5 years, calculate the value of investment if interest rates are:
   a) 11% compounded quarterly
   b) 11% compounded bi-annually

a) $A = ?,\ P = R25000,\ n = 5 \text{ years} \times 4 = 20 \text{ quarters},$

$i = 11\% \div 4 = \frac{0,11}{4}$ or $\frac{11}{400}$

$A = 25000\left(1 + \frac{0.11}{4}\right)^{5\times4}$ or $A = 25000\left(1 + \frac{11}{400}\right)^{5\times4}$

$= \underline{R\,43010,71078} \simeq \underline{R\,43010,71}$

b) $A = ?\ P = R25000,\ n = 5 \text{ years} \times 2 = 10 \text{ halves}$

$i = 11\% \div 2 = \frac{0.11}{2}$ or $\frac{11}{200}$

$A = 25000\left(1 + \frac{}{2}\right)^{5\times2}$ or $A = 25000\left(1 + \frac{11}{200}\right)^{5\times2}$

$= \underline{R\,42703,61146} \simeq \underline{R\,42703,61}$

CALCULATING THE VALUE OF P, i AND N

EXAMPLE 1 - (CALCULATING P VALUE) - PRINCIPAL VALUE

John received R28500 after 8 years, how much was invested if the rate 12,5% p.a. compounded interest.

$A = R28500$, $P = ?$; $n = 8$ years, $i = 12,5\%$ p.a.

$$28500 = P\left(1 + \frac{12.5}{100}\right)^8$$

$$\frac{28500}{\left(1 + \frac{12.5}{100}\right)^8} = P$$

$$R11107,71 = P$$

$\therefore$ R11107,71 was invested

EXAMPLE 2 (CALCULATING THE i VALUE) - INTEREST RATE

After 6 years, you received R125400 after investing R64900. What is the interest rate if the interest is compounded quarterly.

$A = 125400$, $P = 64900$; $n = 6\text{yrs} \times 4 = 24$ quarters ; $i = ?$

$$125400 = 64900\left(1 + i/400\right)^{6*4}$$

$$\frac{125400}{64900} = \left(1 + i/400\right)^{24} \leftarrow \left(\frac{A}{P}\right)$$

$$\sqrt[24]{\frac{125400}{64900}} = 1 + i/400 \leftarrow \sqrt[n]{\frac{A}{P}}$$

$1,0278 - 1 = i/400 \leftarrow$ (4 decimal places)

$0,0278 \times 400 = i$

$11,12\% = i$

3. EXAMPLE 3 - (CALCULATING THE "n" VALUE) - PERIOD OF INVESTMENT

R 2500 was invested at 8% compounded bi-annually. How long did it take to reach an amount of R 13200.

$A = 13200$, $P = 2500$, $i = 8\% \div 2 = \frac{0.08}{2}$ or $8/200$

$n = ?$

$13200 = 2500\,(1 + 8/200)^n$

$\frac{13200}{2500} = (1 + 8/200)^n$

$\therefore n = \log_{(1+8/200)}\left(\frac{13200}{2500}\right)$

$\therefore n = 42{,}42$ – halves

$\therefore n = \frac{42{,}42}{2}$ (convert to halves to years)

$= 21{,}21$ years

$\therefore \approx$ 22 years

NOMINAL AND EFFECTIVE INTEREST RATE

What is the effective rate if the nominal rate is 7.5% pa compounded monthly.

$1 + i_{effective} = (1 + i_{nominal})^n$

$1 + i_{eff} = (1 + \frac{7.5}{1200})^{12}$

$1 + i_{eff} = 1{,}07763$

$\therefore i_{eff} = 1{,}07763 - 1$

$i = 0{,}07763 \times 100$

$= 7{,}76\%$

Convert a nominal rate of 9% p.a. compounded monthly to effective quarterly interest rate.

$$(1+i_{effective})^M = (1+i_{nominal})^n$$

$$(1+\frac{i_{eff}}{400})^4 = (1+\frac{9}{1200})^{12}$$

$$1+\frac{i_{eff}}{400} = \sqrt[4]{(1+\frac{9}{1200})^{12}}$$

$$1+\frac{i_{eff}}{400} = 1,0226$$

$$\frac{i_{eff}}{400} = 1,0226 - 1$$

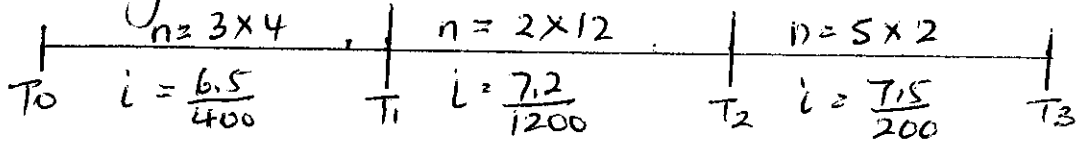
$$i_{eff} = 0,0226 \times 400$$

$$\therefore i_{eff} = 9,06\%$$

TIME LINE

Investments with time and interest rate changes

Invested R10000 at 6,5% pa compounded quarterly for 10 years. After 3 years the interest rate changed to 7,2% pa compounded monthly. After 5 years, the interest rate changed to 7,5% pa compounded bi-annually. How much did you receive after 10 years.



METHOD 1

$$A = 10000\left(1+\frac{6.5}{400}\right)^{3\times4}\left(1+\frac{7.2}{1200}\right)^{2\times12}\left(1+\frac{7.5}{200}\right)^{5\times2} = R\,20241,34$$

METHOD 2

$A = 10000\left(1+\frac{6.5}{400}\right)^{3\times4} = R\,12134,07$ — First 3 years

$A = 12134,07\left(1+\frac{7.2}{1200}\right)^{2\times12} = R\,14007,42$ - next 2 years

$A = 14007,42\left(1+\frac{7.5}{200}\right)^{5\times2} = R\,20241,34$ - next 5 years

$\therefore$ adds up to 10 years

Mr Naidoo invested R74000 at 8% pa compounded monthly for 10 years. After 3 years, Mr Naidoo withdrew R25000 from his initial investment. After 5 years interest rate changed to 8,5% p.a compounded bi-annually. After 8 years, Mr Naidoo returned R25000 into the investment. How much did Mr Naidoo get after 10 years.

$A = 74000\left(1+\frac{8}{1200}\right)^{3\times12} = R\ 93\,997,54$ (3 years)

$\therefore R93997,54 - R25000 = R68997,54$

$A = 68997,54\left(1+\frac{8}{1200}\right)^{2\times12} = R80\,926,38$ (2 years)

$A = 80926,38\left(1+\frac{8,5}{200}\right)^{3\times2} = R103883,49$ (3 years)

$\therefore R103883,49 + R25000 = R128883,49$

$A = 128883,49\left(1+\frac{8,5}{200}\right)^{2\times2} = \underline{R152230,45}$ (2 years)

Total years = 10 years.

SIMPLE AND COMPOUND DECAY

$A = P(1-in)$ – simple decay / $A = P(1-i)^n$ – reducing balance method.

Example1

1) A car cost R350000 depreciates at 12% p.a (on simple interest). What the value of car after 6 years.

$A = P(1-ixn) \therefore A = 350000\left(1-\frac{12\times6}{100}\right) = \underline{R98\,000}$.

2) A truck valued at R800 000 depreciates at 11% pa. (on a reducing balance method). What is the value of the truck after 5 years.

$A = P(1-i)^n \Rightarrow A = 800000\left(1-\frac{11}{100}\right)^5 = \underline{R446724,75}$

PAST YEAR PAPERS

QUESTIONS

&

ANSWERS

QUESTION8 EC /NOVEMBER 2020

8.1 Calculate the effective interest rate per annum if an investment earns 9,5% interest per annum, compounded monthly. (3)

8.2 The value of a house increased to R764 050,60 over a period of 5 years due to inflation. The price of the house increased at a rate of 5% p.a. compounded annually. Calculate the original price of the house. (3)

8.3 Kamvelihle invested R28 000 into a savings account that pays interest at 7,5% p.a. compounded monthly for the first 4 years and 11% p.a. compounded quarterly thereafter. At the end of the 4th year, he withdrew R7 300.

8.3.1 Calculate his balance at the end of the 7th year of his investment. (5)

8.3.2 Assuming that at the end of 7 years, his balance is R42 181, 59, Kamvelihle wants his investment to grow to R80 000 in another 5 years' time. How much must he deposit into the account immediately to achieve this goal if the bank offers 8% p.a. interest compounded monthly? Write your answer correct to the nearest rand. (5) [16]

QUESTION 7 EC/NOVEMBER 2019

7.1 The value of a laptop depreciates on a reducing balance method, at a rate of 13,4% p.a. Calculate the original value of the laptop given that it had depreciated toR7 210 over a period of 5 years. (4)

7.2 Calculate the effective interest rate if an investment offers a nominal interest rate of 8,2% p.a. compounded quarterly. (3)

7.3 Allen invested an amount of R20 000 on 1 January 2015, at an interest rate of 10,3% p.a. compounded monthly. At the start of the second year, he deposited R15 000 into the same account but the interest rate increased to 11,5% p.a. compounded monthly. At the end of the third year, he withdrew a certain amount of money from his savings and kept the rest of the money in his account for a further 2 years at an interest rate of 16,8% p.a. compounded quarterly.

7.3.1 What was the balance of his investment on 31 December 2015? (4)

7.3.2 How much money, to the nearest rand, did he withdraw at the end of the third year, given that his final bank balance at the end of the fifth year was R30 183,64? (6) [17]

QUESTION 8 NOVEMBER 2019

8.1 The purchase price of a car five years ago was R200 000. The current book value of the car is R85 000. Using the reducing-balance method of deprecation, calculate the annual rate of depreciation. (3)

8.2 An amount of money was invested at a rate of 8,5% p.a., compounded quarterly. Calculate the effective interest rate per annum of this investment. (3)

8.3 Susan made an initial deposit of R28 000 into an investment account. Three years later she made another deposit of R12 000. She withdrew R6 500 from the account 5 years after the initial deposit was made. The interest rate for the first 4 years was 12% p.a., compounded monthly. Thereafter the interest rate changed to 12,9% p.a., compounded half-yearly.

8.3.1 Calculate how much Susan had in this investment account 2 years after the initial deposit was made. (2)

8.3.2 How much will the investment be worth 8 years after the initial deposit was made? [13]

(5)

QUESTION 7 NOVEMBER 2018

7.1 Calculate the effective interest rate per annum if an investment earns interest at a rate of 11,5% p.a., compounded monthly. (3)

7.2 Karabo bought a computer for R4 700. The value of the computer depreciated at a rate of 18% p.a. Using the reducing-balance method, calculate the book value of the computer 4 years after it was bought. (3)

7.3 Nhlanhla made an initial deposit of R20 000 into an investment account that paid interest at the rate of 7,2% p.a., compounded quarterly. After 2 years the interest rate changed to 7,8% p.a., compounded monthly. Four years after his initial deposit, Nhlanhla withdrew R2 500 from his investment.

7.3.1 Calculate how much Nhlanhla had in this investment account 2 years after the initial deposit was made. (3)

7.3.2 How much will the investment be worth 7 years after the initial deposit was made? (4) [13]

QUESTION 7 NOVEMBER 2017

7.1 A company bought machinery costing R80 000. Using the reducing balance method, the machinery had a book value of R20 000 after 5 years.

Calculate the rate of depreciation. (3)

7.2 Calculate the effective interest rate if interest is compounded at 5% p.a., compounded quarterly. (3)

7.3 Sipho invested R30 000 for 6 years. The investment earned interest at 12% p.a., compounded monthly for the first two years. Thereafter the interest rate changed to 10,8% p.a., compounded semi-annually for the rest of the period.

Calculate the value of the investment at the end of 6 years. (No other transactions were made on the account.) (4)

7.4 Mary deposited R25 000 into a savings account with an interest rate of 18% p.a., compounded monthly. Mary withdrew R8 000 from the account 2 years after depositing the initial amount. She deposited another R4 000 into this account 3½ years after the initial deposit. What amount will Mary have 5 years after making the initial deposit in this account? (6) [16]

QUESTION 8

8.1 A machine costs R25 000 in 2016. Calculate the book value of the machine after 4 years if it depreciates at 9% p.a. according to the reducing balance method. (3)

8.2 The nominal interest rate of an investment is 12,35% p.a., compounded monthly. Calculate the effective interest rate. (4)

8.3 The value of a property increased from R145 000 to R221 292,32 over 6 years. Calculate the average annual rate of increase of the property over 6 years. (4)

8.4 Tebogo made an initial deposit of R15 000 into an account that paid interest at 9,6% p.a., compounded quarterly. Six months later she withdrew R5 000 from the account. Two years after the initial deposit she deposited another R3 500 into this account. How much does she have in the account 3 years after her initial deposit? (5)
[16]

QUESTION 6

6.1 The price of a new school bus is R540 000. The value of the bus decreases at 11% per annum according to the diminishing-balance method. Calculate the value of the bus after 8 years. (2)

6.2 Determine the effective interest rate if an investment earns interest at a nominal interest rate of 11,5% per annum, compounded quarterly. (3)

6.3 Vishnu and Landi receive R15 000 each. They decide to invest the money for a period of 8 years as follows:

Vishnu: Simple interest at 8,7% per annum. At the end of the 8 years Vishnu receives a cash bonus of 3% on the principal amount.

Landi: Interest at 6,9% per annum, compounded monthly.

6.3.1 Calculate the value of Vishnu's investment after 8 years, including the cash bonus. (3)

6.3.2 Calculate the value of Landi's investment after 8 years. (3)

6.4 James invests a certain amount for 5 years. The investment earns interest at 12% per annum, compounded monthly, for the full term. James withdraws R2 000 from the account after 18 months. After 5 years the value of the investment is R23 564.

What amount did James initially invest? (5)
[16]

NOVEMBER 2015

QUESTION 8

8.1 A school buys tablets at a total cost of R140 000. If the average rate of inflation is 6,1% per annum over the next 4 years, determine the cost of replacing these tablets in 4 years' time. (3)

8.2 An investment earns interest at a rate of 7% per annum, compounded semi-annually. Calculate the effective annual interest rate on this investment. (3)

8.3 A savings account was opened with an initial deposit of R24 000. Eighteen months later R7 000 was withdrawn from the account. Calculate how much money will be in the savings account at the end of 4 years if the interest rate was 10,5% p.a., compounded monthly. (5)

8.4 A car costing R198 000 has a book value of R102 755,34 after 3 years. If the value of the car depreciates at r% p.a. on a reducing balance, calculate r. (5)
[16]

QUESTION 8/*VRAAG 8*

8.1	$i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^{m} - 1$ $= \left(1+\frac{0.095}{12}\right)^{12} - 1$ $= 0{,}099247\ldots$ $\therefore r = 9{,}92\%$	✓ formula / *formule* ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)
8.2	$A = P(1+i)^{n}$ $\text{R}764\,050{,}60 = P(1+0{,}08)^{5}$ $P = \frac{764050.60}{(1+0.08)^{5}}$ $= \text{R}520\,000$	✓ $A = \text{R}764050{,}60$ ✓ substitution / *vervanging* ✓ answer / *antwoord* (3)
8.3.1	$A = \left[28\,000\left(1+\frac{0{,}075}{12}\right)^{48} - \text{R}7\,300\right]\left(1+\frac{0{,}11}{4}\right)^{12}$ $= (\text{R}37\,760{,}78 - \text{R}7\,300)\left(1+\frac{0{,}11}{4}\right)^{12}$ $= \text{R}30\,460{,}78\left(1+\frac{0{,}11}{4}\right)^{12}$ $= \text{R}42\,181{,}59$	✓ $28000\left(1+\frac{0{,}075}{12}\right)^{48}$ ✓ $-\text{R}7\,300$ ✓ $\times\left(1+\frac{0{,}11}{4}\right)^{12}$ ✓ simplification / *vereenvoudiging* ✓ answer / *antwoord* (5)
8.3.2	$A = P(1+i)^{n}$ $A = \text{R}42\,181{,}59\left(1+\frac{0{,}08}{12}\right)^{60}$ $= \text{R}62\,844{,}06$ $\text{R}80\,000 - R62\,844{,}06$ $= \text{R}17\,155{,}94$ $\therefore A = P(1+i)^{n}$ $\text{R}17\,155{,}94 = P\left(1+\frac{0{,}08}{12}\right)^{60}$ $P = \frac{17\,155{,}94}{\left(1+\frac{0{,}08}{12}\right)^{60}}$ $= \text{R}11\,515{,}25$ ∴ He needs to deposit R11 515 / *Hy moet* R11 515 *deponeer*	✓ substitution into correct formula *vervanging in korrekte formule* ✓ R62 844,06 ✓ R17 155,964 ✓ method / *metode* ✓ answer / *antwoord* (5) **[16]**

QUESTION 7/*VRAAG 7*

7.1	$A = P(1-i)^n$ $7210 = P(1-0{,}134)^5$ $7210 = 0{,}4870678P$ $\therefore P = R14802{,}87$	✓formula / *formule* ✓ $n = 5$ ✓substitutionintocorrectformula *vervanging in korrekte formule* ✓answer / *antwoord* (4)
7.2	$i_{eff} = \left(1+\frac{i_{nom}}{n}\right)^n - 1$ $= \left(1+\frac{0{,}082}{4}\right)^4 - 1$ $\approx 0{,}0846$ $\therefore r_{eff} \approx 8{,}46\%$	✓ $n = 4$ ✓substitution/*vervanging* ✓answer / *antwoord* (3)
7.3.1	$A = P(1+i)^n$ $= R20000\left(1+\frac{0{,}103}{12}\right)^{12}$ $\approx R22160{,}09$	✓ $i = \frac{0{,}103}{12}$ and/*en*✓ $n = 12$ ✓substitutionintocorrectformula *vervanging in korrekte formule* ✓answer / *antwoord* (4)
7.3.2	Let themoneythathewithdrewbe$x$ / *Laat die geld wat hy onttrek het x wees* Balanceatstart of 2nd year / *Balans aan die begin van 2de jaar* $R22160{,}09 + R15000 = R37160{,}09$ $\left[\left(R37160{,}09\left(1+\frac{0{,}115}{12}\right)^{24}\right)-x\right]\left[\left(1+\frac{0{,}168}{4}\right)^8\right] = R30183{,}64$ $(46718{,}49558 - x) = \frac{30183{,}64}{\left(1+\frac{0{,}168}{4}\right)^8}$ $-x = \frac{30183{,}64}{\left(1+\frac{0{,}168}{4}\right)^8} - 46718{,}49558$ $-x = -24999{,}9939$ $\therefore x = R25000{,}00$	✓ $R22160{,}09 + R15000$ ✓ $\left(R37160{,}09\left(1+\frac{0{,}115}{12}\right)^{24}\right)$ ✓subtracting$x$ / *trek x af* ✓ $\left[\left(R37160{,}09\left(1+\frac{0{,}115}{12}\right)^{24}\right)-x\right]\left[\left(1+\frac{0{,}168}{4}\right)^8\right]$ ✓equatingto / *stel gelyk aan* R 30 183,64 ✓answer / *antwoord* (6)
		[17]

QUESTION/*VRAAG* 8

8.1	$A = P(1-i)^n$ $85\,000 = 200\,000(1-i)^5$ $i = 1-\sqrt[5]{\frac{85\,000}{200\,000}}$ $i = 15{,}73\%$	✓substitution/*verv.* ✓rewrite in terms of *i*/ *skryf in terme van i* ✓answer/*antw.* (3)
8.2	$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1+\frac{0{,}085}{4}\right)^4$ $i_{eff} = \left(1+\frac{0{,}085}{4}\right)^4 - 1$ $i_{eff} = 8{,}77\%$	✓formula/*form.* ✓$i = \frac{0{,}085}{4}$ ✓answer/*antw.* (3)
8.3.1	$A = P(1+i)^n$ $= 28\,000\left(1+\frac{0{,}12}{12}\right)^{2\times 12}$ $= R\,35\,552{,}57$	✓substitution/*verv.* ✓answer/*antw.* (2)
8.3.2	$A = 28\,000\left(1+\frac{0{,}12}{12}\right)^{12\times 4}\left(1+\frac{0{,}129}{2}\right)^{2\times 4} +$ $12\,000\left(1+\frac{0{,}12}{12}\right)^{12}\left(1+\frac{0{,}129}{2}\right)^{2\times 4} - 6500\left(1+\frac{0{,}129}{2}\right)^{2\times 3}$ $= R87\,267{,}25$ **OR/*OF***	✓ $\frac{0{,}12}{12}$ and $n = 48$ ✓ $\frac{0{,}129}{12}$ and $n = 8$ ✓ $12\,000\left(1+\frac{0{,}12}{12}\right)^{12}\left(1+\frac{0{,}129}{2}\right)^{2\times 4}$ ✓ $-6500\left(1+\frac{0{,}129}{2}\right)^{2\times 3}$ ✓ answer/*antw.* (5)

QUESTION/*VRAAG* 7

7.1

$$1+i_{eff}=\left(1+\frac{i_{nom}}{m}\right)^{m}$$

$$1+i_{eff}=\left(1+\frac{0{,}115}{12}\right)^{12}$$

$$i_{eff}=\left(1+\frac{0{,}115}{12}\right)^{12}-1$$

$$i_{eff}=12{,}13\%$$

✓formula/*form.*

✓$i=\frac{0{,}115}{12}$

✓answer/*antw.* (3)

7.2

$$A=P(1-i)^{n}$$

$$=4\,700(1-0{,}18)^{4}$$

$$=R\,2124{,}97$$

✓formula/*form.*
✓substitution/*verv.*
✓answer/*antw.*
(3)

7.3.1

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

$$=20\,000\left(1+\frac{0{,}072}{4}\right)^{2\times4}$$

$$=R\,23\,068{,}12$$

✓formula/*form.*
✓substitution/*verv.*
✓answer/*antw.*
(3)

7.3.2

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

$$=23068{,}12\left(1+\frac{0{,}078}{12}\right)^{2\times12}$$

$$=R26\,949{,}12$$

$$R26\,949{,}12-R2\,500$$

$$=R24\,449{,}12$$

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

$$=24\,449.12\left(1+\frac{0{,}078}{12}\right)^{3\times12}$$

$$=R30\,871{,}61$$

✓$\frac{0{,}078}{12}$ and $n=24$

✓A(after 2 years) – R2 500

✓$n=36$

✓answer/*antw.*
(4)

OR/*OF*

$$A=23\,068{,}12\left(1+\frac{0{,}078}{12}\right)^{12\times5}-2500\left(1+\frac{0{,}078}{12}\right)^{12\times3}$$

$$=R30\,871{,}48$$

✓$i=\frac{0{,}078}{12}$ and $n=60$

✓✓ $-2500\left(1+\frac{0{,}078}{12}\right)^{12\times3}$

✓ answer/*antw.*
(4)

[13]

QUESTION/*VRAAG* 7

7.1	$A = P(1-i)^n$ $20000 = 80000(1-i)^5$ $0,25 = (1-i)^5$ $\sqrt[5]{0,25} = 1-i$ $i = 1-\sqrt[5]{0,25}$ $i = 0,24214417$ $i = 24,21\%$	✓substitution into correct formula/ *verv. in korrekte vorm* ✓simplification/*vereenv* ✓answer/*antw.* (3)
7.2	$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1+\frac{0,05}{4}\right)^4$ $i_{eff} = 0,050945336...$ Effective rate = 5,09 % p.a.	✓vorm/*vorm* ✓subst/*verv* ✓answer/*antw.* (3)
7.3	$A = P(1+i)^n$ $= 30000\left(1+\frac{0,12}{12}\right)^{2\times12}\left(1+\frac{0,108}{2}\right)^{4\times2}$ $= R\,58\,017,51$	subst/*verv* in form/*vorm* ✓$\left(1+\frac{0,12}{12}\right)^{2\times12}$ ✓$\left(1+\frac{0,108}{2}\right)^{4\times2}$ ✓answer/*antw.* (4)
7.4	$A = 25000\left(1+\frac{0,18}{12}\right)^{5\times12} - 8000\left(1+\frac{0,18}{12}\right)^{3\times12} + 4000\left(1+\frac{0,18}{12}\right)^{1,5\times12}$ $= 25000\left(1+\frac{0,18}{12}\right)^{60} - 8000\left(1+\frac{0,18}{12}\right)^{36} + 4000\left(1+\frac{0,18}{12}\right)^{18}$ $= R\,52636,74$ **OR/*OF***	✓$\frac{0,18}{12}$ ✓$25000\left(1+\frac{0,18}{12}\right)^{5\times12}$ ✓$-8000\left(1+\frac{0,18}{12}\right)^{3\times12}$ ✓$+4000\left(1+\frac{0,18}{12}\right)^{18}$ ✓✓answer/*antw.* (6)

QUESTION/*VRAAG* 8

8.1	$A = P(1-i)^n$ $= R\,25\,000\ (1-0,09)^4$ $= R17\ 143,74$	✓ $A = P(1-i)^n$ ✓substitution/*verv.* ✓answer/*antw.* (3)
8.2	$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1+\frac{0,1235}{12}\right)^{12}$ $i_{eff} = \left(1+\frac{0,1235}{12}\right)^{12} - 1$ $\therefore$ Rate = 0.13073×100 $= 13,07\%$ The effective interest rate/*Die effektiewe rentekoers* is 13.07%	✓ formula/*for.* ✓ substitution//*verv.* ✓simplification*vereenv.* ✓answer/*antw.* (4)
8.3	$A = P(1+i)^n$ $R\,221\,292,32 = R145\,000\left(1+\frac{r}{100}\right)^6$ $\sqrt[6]{\frac{R\,221\,292,32}{145\,000}} = 1+\frac{r}{100}$ $\frac{r}{100} = 0,07300000324$ $r = 7,3\%$	✓correct substitution into correct formula ✓n =6 ✓ $\sqrt[6]{\frac{R\ 221\,292,32}{145\,000}} = 1+\frac{r}{100}$ ✓ answer/*antw.* (4)
8.4	$A = 15\,000\left(1+\frac{0,096}{4}\right)^{12} - 5\,000\left(1+\frac{0.096}{4}\right)^{10} + 3\,500\left(1+\frac{0.096}{4}\right)^4$ $= R17\ 448,46$	✓ $\frac{0.096}{4}$ ✓$15\,000\left(1+\frac{0,096}{4}\right)^{12}$ ✓$5\,000\left(1+\frac{0,096}{4}\right)^{10}$ ✓$3\,500\left(1+\frac{0.096}{4}\right)^4$ ✓answer/*antw.* (5) **[16]**

5.2.2	$-5k - 4 = -219$ $-5k = -215$ $k = 43$ $-k^2 + 6 = -219$ $k^2 = 225$ $k = 15$ $\therefore k = 15$	If ONLY/Indien SLEGS: $-k^2 + 6 = -219$ $k^2 = 225$ $k = 15$ 4 marks/punte. If continues and mentions that $k = 15$ is uneven: 5 marks. As voortgaan en meld dat $k = 15$ is onewe: 5 punte	✓ $-5k - 4 = -219$ ✓ answer/antwoord ✓ $-k^2 + 6 = -219$ ✓ answer/antwoord ✓ choice/keuse (5)
			[17]

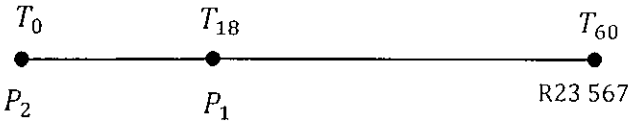
If expansion that leads to correct answer: 5 marks.
As uitbreiding wat tot korrekte antwoord lei: 5 punte.
If ONLY expansion: 2 marks.
Indien SLEGS uitbreiding: 2 punte.

n = uneven	1	3	5	7	9	11	13	*15*						
T_n	5	-3	-19	-43	-75	-115	-163	*-219*						
n = even	2	4	6	8	10	12	14	16	18	20	22	24	26	28
T_n	-14	-24	-34	-44	-54	-64	-74	-84	-94	-104	-114	-124	-134	-144
n = even	30	32	34	36	38	40	*42*	*44*						
T_n	-154	-164	-174	-184	-194	-204	*-214*	*-224*						

QUESTION 6/VRAAG 6

6.1	$A = P(1 - i)^n$ $A = 540\,000(1 - 0{,}11)^8$ $A = R212\,575{,}80$	Wrong formule/verkeerde formule: 0 marks/punte.	✓ substitution/substitusie ✓ answer/antwoord (2)
6.2	$1 + i_{eff} = \left(1 + \frac{0{,}115}{4}\right)^4$ $1 + i_{eff} = 1{,}12005 \ldots$ $i_{eff} = 0{,}12005 \ldots$ $= 12{,}01\%$	Wrong formule/verkeerde formule: 0 marks/punte. If answer given as 12%: 2 marks. Indien antwoord gegee as 12%: 2 punte.	✓ substitution/substitusie ✓ 1,12005 ... ✓ answer/antwoord (3)
6.3.1	$A = 15\,000(1 + 0{,}087 \times 8) + \frac{3}{100} \times 15\,000$ $= 25\,440 + 450$ $= \text{R}25\,890$	If ONLY/Indien SLEGS: $15\,000(1 + 0{,}087 \times 8)$ 1 mark/punt.	✓ $15\,000(1 + 0{,}087 \times 8)$ ✓ $\frac{3}{100} \times 15\,000$ ✓ answer/antwoord (3)
6.3.2	$A = 15\,000\left(1 + \frac{0{,}069}{12}\right)^{96}$ $= \text{R}26\,009{,}69$	Wrong formule/ Verkeerde formule: 1 mark/punt for/vir i.	✓ $i = \frac{0{,}069}{12}$ ✓ substitution/substitusie ✓ answer/antwoord (3)

6.4



$P_2 = \left[23\,564\left(1+\frac{0,12}{12}\right)^{-42} + 2000\right]\left(1+\frac{0,12}{12}\right)^{-18}$
$= \text{R}14\,642,83$

✓ $i = \frac{0,12}{12}$
✓ $23\,564\left(1+\frac{0,12}{12}\right)^{-42}$
✓ $+2000$
✓ $\left(1+\frac{0,12}{12}\right)^{-18}$
✓ answer/antwoord

OR/OF

$P_1\left(1+\frac{0,12}{12}\right)^{42} = 23\,564$
$P_1 = \frac{23\,564}{\left(1+\frac{0,12}{12}\right)^{42}}$

Wrong formule/ verkeerde formule: 1 mark/punt for/vir i

✓ $i = \frac{0,12}{12}$
✓ $P_1\left(1+\frac{0,12}{12}\right)^{42} = 23\,564$

$P_2\left(1+\frac{0,12}{12}\right)^{18} = P_1 + 2\,000$
$P_2 = \frac{P_1+2\,000}{\left(1+\frac{0,12}{12}\right)^{18}}$
$P_2 = \text{R}14\,642,83$

✓ $P_1 + 2\,000$
✓ $P_2\left(1+\frac{0,12}{12}\right)^{18} = P_1 + 2\,000$
✓ answer/antwoord

OR/OF

$\left[x\left(1+\frac{0,12}{12}\right)^{18} - 2000\right]\left(1+\frac{0,12}{12}\right)^{42} = 23564$

✓ $i = \frac{0,12}{12}$
✓ $x\left(1+\frac{0,12}{12}\right)^{18} - 2000$
✓ $\left(1+\frac{0,12}{12}\right)^{42}$

$x\left(1+\frac{0,12}{12}\right)^{18} - 2000 = 15514,98340$
$x\left(1+\frac{0,12}{12}\right)^{18} = 17514,9834$
$x = \text{R}14642,83$

✓ $x\left(1+\frac{0,12}{12}\right)^{18} = 17514,9834$
✓ answer/antwoord

(5)

[16]

QUESTION/*VRAAG* 8

8.1	$A = P(1+i)^n$ $= 140\ 000(1+0,061)^4$ $= \text{R}177\ 414,69$	✓140 000 ✓$(1+0,061)^4$ ✓answer/*antwoord* (3)
8.2	$1+i_{eff} = \left(1+\frac{0,07}{2}\right)^2$ $1+i_{eff} = (1+0,035)^2$ $i_{eff} = (1+0,035)^2 - 1$ $= 0,071225$ The effective interest rate/*Die effektiewe rentekoers* is 7,12% p.a.	✓$\frac{0,07}{2}$ ✓$1+i_{eff} = (1+0.035)^2$ ✓ answer/*antwoord* (3)
8.3	$A = 24000\left(1+\frac{0,105}{12}\right)^{48} - 7000\left(1+\frac{0,105}{12}\right)^{30}$ $= \text{R}27\ 369,56$ **OR/*OF*** $A = \left[24000\left(1+\frac{0,105}{12}\right)^{18} - 7000\right]\left(1+\frac{0,105}{12}\right)^{30}$ $= \text{R}27\ 369,56$ **OR/*OF*** $A_{\text{after 18 months}} = 24000\left(1+\frac{0,105}{12}\right)^{18}$ $= \text{R}28\ 074,70$ $\text{R}28\ 074,70 - \text{R}7000 = \text{R}21\ 074,70$ $A_{after\ 4\ years} = 21\,074,70\left(1+\frac{0,105}{12}\right)^{30}$ $= \text{R}27\ 369,56$	✓$\frac{0,105}{12}$ ✓ n=48 ✓ n=30 ✓correct substitution into correct formula/*korr subst in korr formule* ✓answer/*antwoord* (5) ✓$\frac{0,105}{12}$ ✓ n=18 ✓n=30 ✓correct substitution into correct formula/*korr subst in korr formule* ✓answer/*antwoord* (5) ✓$\frac{0,105}{12}$ ✓ n=18 ✓ 21 074,70 ✓n=30 ✓ answer/*antwoord* (5)
8.4	$102\ 755,34 = 198\ 000\left(1-\frac{r}{100}\right)^3$ $\sqrt[3]{\frac{102\ 755,34}{198\ 000}} = 1-\frac{r}{100}$ $1-\frac{r}{100} = 0,8036119818$ $-\frac{r}{100} = -0,1963880182$ $r = 19,64\%$	✓formula ✓correct substitution into correct formula/*korr subst in korr formule* ✓n =3 ✓$\sqrt[3]{\frac{102\ 755.34}{198\ 000}} = 1-\frac{r}{100}$ ✓ answer/*antwoord* (5)
		[16]