Tutorial Letter 201/1/2018

Introductory Financial Mathematics
DSC1630

Semester 1

Department of Decision Sciences

Important Information:

This tutorial letter contains the solutions of
Assignment 01.

Bar code

Define tomorrow.

UNISA | university of south africa

Dear student

The solutions to the questions of the compulsory Assignment 01 are included in this tutorial letter. Study them when you prepare for the examination. I have added comments on how to approach each problem as well as a section on when to use which formula, plus a list of formulas similar to the one you will receive in the exam.

You will also find the key operations for the SHARP EL-738/F/FB, HP10BII and HP10BII+ calculators the end of each answer. I hope it will help you to understand the workings of your calculator. **Just remember that these key operations are not the only method, these are just examples**. You can use any method as long as you get the same answer.

REMEMBER TO CLEAR ALL DATA FROM THE MEMORY BEFORE YOU ATTEMPT ANY CALCULATIONS.

- **SHARP EL-738/F/FB users**: Press 2ndF M-CLR 0 0 if you wish to clear all the memories and 2ndF CA if you just want to clear only the financial keys.

- **HP10BII and HP10BII+ users**: Press ▭ C ALL

Remember to please contact me via email, telephone or appointment if you need help regarding the study material. Please note that only students with appointments will be assisted. My contact details and contact hours are:

Office: Theo van Wijk - Laboratory Building, Room 1-4, Preller street, Muckleneuk, Pretoria
Tel: Out of order at moment. Use e-mail but when up and running: +27 12 4334691
E-mail: immelmf@unisa.ac.za

07:00 until 13:30 - Monday till Friday: **Appointments and Telephone/email**
13:30 until 16:00 - Monday till Thursday: **Telephone or email**

Lastly, everything of the best with Assignment 02. Please work through the self-evaluation exercises on myUnisa **before** you attempt to answer the assignments.

Kind regards,

Mrs Adéle Immelman

Note: the final answer displayed on your calculator depends on how many decimals your calculator's display is set to.

---

1 Solution Summary

The following is a summary of the correct answers:

Q 1	Option 2
Q 2	Option 1
Q 3	Option 4
Q 4	Option 1
Q 5	Option 3
Q 6	Option 2
Q 7	Option 2
Q 8	Option 1
Q 9	Option 1
Q 10	Option 2
Q 11	Option 4
Q 12	Option 3
Q 13	Option 2
Q 14	Option 3
Q 15	Option 4

2 How to approach a question

Below are a few hints to consider when approaching a problem.

1. Read through the question.

2. Try to identify the type of problem asked. Identifying words, for example, the type of interest rate, or payment methods used, will help you to decide which formula to use.

3. Draw a time line of the situation, where applicable.

4. Write down the formula.

5. Go back to the question and identify the given values and substitute them into the formula.

6. Manipulate the formula if necessary.

7. Use your calculator to solve the unknown.

Some solutions are supplied in this format to give you a better idea of the procedure of answering the questions.

3   Assignment 01 – Detailed Solution

Question 1

Question answered using the "how to approach a question" style.

**Step 1: Read through the question and identify the type of problem:**

Tuli has borrowed money from Safari. She has to pay Safari R15 000 two years from now. She decides to pay him back earlier. If

Identification term

a   simple interest rate of 12,5% per year is applicable, then the amount that Tuli will have to pay Safari nine months from now is

Step 2: Draw a time line:

The situation can be represented by a time line as:
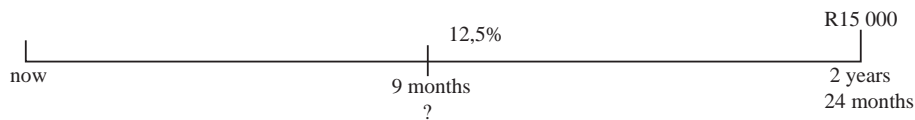
Step 3: Write down the formula:

This is a simple interest rate calculation as the words simple interest are found in the question. The formulas that you can use for simple interest calculations are

$$S = P(1 + rt) \text{ and } I = Prt.$$

Step 4: Identify the given values:

Given is the value Tuli has to pay Safari back in two year's time from now, i.e. the future value (S) of R15 000 and the simple interest rate (r) namely 12,5%. We are asked to determine the value that Tuli has to pay Safari earlier in the loan term, namely at month nine so that she will pay off her debt. We need to determine a present value of the R15 000 or P at month nine. Given are

$$
\begin{aligned}
S &= 15\,000 \\
r &= 12{,}5\% \\
P &= ?
\end{aligned}
$$

As we want to determine the value of the loan at month nine we need to move the R15 000 back in time from 24 months to nine months which is $(24 - 9)$ or 15 months back in time.
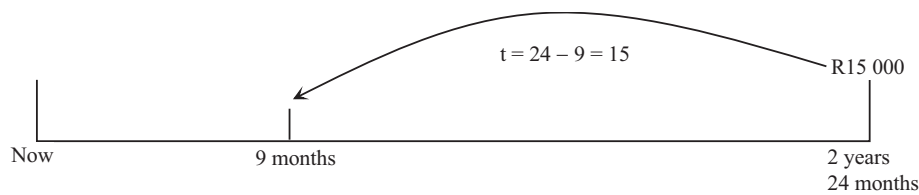
The time period t must always be expressed as years. Thus we need to change the 15 months to a fraction of a year by dividing the 15 months by the number of months in a year, namely 12. Thus

$$t = \frac{15}{12}.$$

Step 5: Substitute the values into the formula and calculate the unknown value using your calculator:

$$
\begin{aligned}
S &= P(1 + rt) \\
15\,000 &= P\left(1 + 0{,}125 \times \frac{15}{12}\right) \\
P &= \left(\frac{15\,000}{1 + 0{,}125 \times \frac{15}{12}}\right) \\
P &= 12\,972{,}97.
\end{aligned}
$$

Step 6: Write down the answer:

Tuli will pay Safari R12 972,97 nine months from now.

EL-738 and EL-738F
2ndF CA
Use normal keys
Enter as
$15\,000 \div (1 + 0.125 \times 15 \div 12) = 12\,972.97$
to two decimals is displayed.

HP10BII and HP10BII+
▭ C ALL
Use normal keys
Enter as
$15\,000 \div$ ▭ $(1 +$ ▭ $(0.125 \times 15 \div$
12 ▭ $)$ ▭ $) =$
$12\,972.97$ *to two decimals is displayed.*

[Option 2]

Question 2

The terms *simple interest* and *simple discount* are found in the wording of the problem. Thus if it was just a simple interest rate calculation the formula used would have been $S = P(1 + rt)$. If it was only a simple discount calculation the formula used would have been $P = S(1 - dt)$. Now as both of them are mentioned we need a formula which expresses the relationship between them. In the solution of Exercise 2.3.2 in the study guide we derived a formula for the relationship between the simple interest rate and the simple discount rate as being: $r = \frac{d}{1-dt}$.

Now given are the simple interest rate and simple discount rate, and asked is the time period. Thus we need to change the formula to have t as the subject of the formula. Now substituting the given values of r as 24% and d as 20,5%, we determine t in years as

$$
\begin{aligned}
r &= \frac{d}{1 - dt} \\
1 - dt &= \frac{d}{r} \\
-dt &= \frac{d}{r} - 1 \\
dt &= 1 - \frac{d}{r} \\
t &= \frac{1 - \frac{d}{r}}{d} \\
t &= \frac{1 - \frac{0,205}{0,24}}{0,205} \\
t &= 0,71138\ldots.
\end{aligned}
$$

Now as all the answers are given as days we need to change the 0,71138 years to days. Now there are 365 days in a year and thus

$$
\begin{aligned}
t &= 0,71138 \times 365 \\
&= 259,65 \\
&\approx 260.
\end{aligned}
$$

The time under consideration is approximately 260 days.

| EL-738 and EL-738F	HP10BII and HP10BII+
2ndF CA	▬ C ALL
Use normal keys	*Use normal keys*
Enter as	*Enter as*
$(1 - 0.205 \div 0.24) \div 0.205 =$	$1 - ▬ (0.205 \div 0.24 \; ▬) = \div 0.205 =$
0.71138 *years is displayed*	0.71138 *years is displayed*
To get days × by 365	*To get days × by 365*
$\times 365 =$	$\times 365 =$
259.65 *to two decimals is displayed.*	259.65 *to two decimals is displayed*

[Option 1]

Question 3

This is a conversion between two types of interest rates as it is asked to write the *effective rate* in terms of the *nominal rate*. Now we have a formula for the effective interest rate if the nominal interest

rate j_m is given, namely $j_{eff} = 100\left(\left(1 + \frac{j_m}{m}\right)^m - 1\right)$. Now given are $j_m = 16{,}5\%$ and $m = 6$. Thus

$$
\begin{aligned}
j_{eff} &= 100\left(\left(1 + \frac{j_m}{m}\right)^m - 1\right) \\
&= 100\left(\left(1 + \frac{0{,}165}{6}\right)^6 - 1\right) \\
&= 17{,}677\ldots.
\end{aligned}
$$

The effective rate is 17,68%.

EL-738 and EL-738F
2ndF CA
Use financial keys
6(x,y) [*on the key next to ENT*]
16.5 2ndF →EFF [*on the PV key*]
17.68 *is displayed if your*
calculator is set to 2 decimal places.

HP10BII and HP10BII+
▭ C ALL
Use financial keys
6 ▭ P/YR [*on PMT key*]
16.5 ▭ NOM% [*on I/YR key*]
▭ EFF% [*on PV key*]
17.68 *is displayed if your*
calculator is set to 2 decimal places.

[Option 4]

Question 4

This is a simple discount calculation as the term *discount rate* is found in the question. The formula for simple discount is $P = S(1 - dt)$.

Given are the future value of the loan (S) which is R30 000, the time period which equals eight months and the discount rate (d) of 16,5%. The time period that we use must always be in years. As the given time is in months we change it to a fraction of a year by dividing the months by the number of months in a year which is 12. Thus $t = \frac{8}{12}$. Now we need to determine the present value of the loan. Thus

$$
\begin{aligned}
P &= S(1 - dt) \\
&= 30\,000\left(1 - 0{,}165 \times \frac{8}{12}\right) \\
&= 26\,700{,}00\ldots
\end{aligned}
$$

Susan receives R26 700 from the bank now.

HP10BII and HP10BII+
▭ C ALL
Use normal keys
$0.165 \times 8 \div 12 = +/- +$
$1 = \to M$
$30\,000 \times RM =$
$26\,700.00 \ldots$ *is displayed.*
Or alternatively,
$30\,000 \times$ ▭ $(1-$
▭ $(0.165 \times 8 \div 12$ ▭ $)$
▭ $)=$
$26\,700.00 \ldots$ *is displayed.*

EL-738 and EL-738F
2ndF CA
Use normal keys
$30\,000 \times (1 - 0.165 \times 8 \div 12) =$
$26\,700.00 \ldots$ *is displayed.*

[Option 1]

Question 5

First we identify the problem. By identifying the type of interest used it gives way to the type of formula used. This is a simple interest rate calculation as the term *simple interest* is found in the question. The formulas for simple interest calculations are

$$S = P(1 + rt) \text{ and } I = Prt.$$

The time line of the problem is:

Given are the value or present value (P) of R9 000 at two months ago, and the simple interest rate of 11,5%. Now we need to determine the investment amount or future value (S) at 10 months .

We need to move the R9 000 from two months ago to 10 months in the future. Thus we need to move the amount, two plus 10 months forward in time. Thus the time under consideration is 12 months in total. Now the time period t must always be expressed as years. We change the 12 months to a fraction of a year by dividing the 12 months by the number of months in a year, namely 12. Thus $t = \frac{12}{12}$ or one year. The future value is

$$
\begin{aligned}
S &= P(1 + rt) \\
&= 9\,000 \left(1 + 0{,}115 \times \frac{12}{12} \right) \\
&= 9\,000(1{,}115 \ldots) \\
&= 10\,035{,}00.
\end{aligned}
$$

8

Now the money that Michael still needs is the difference between the cost of the lens and his savings, which is

$$R10\,500{,}00 - R10\,035{,}00 = R465{,}00.$$

Michael will still need R465,00.

EL-738 and EL-738F
2ndF CA
Use normal keys
Enter as
$9\,000 \times (1 + 0.115 \times 12 \div 12) =$
$10\,035.00$ *to two decimals is displayed.*

HP10BII and HP10BII+
▭ C ALL
Use normal keys
Enter as
$9\,000\times$ ▭ $(1 +$ ▭ $(0.115 \times 12 \div$ 12 ▭ $) =$ ▭ $)$
$10\,035.00$ *to two decimals is displayed.*

[Option 3]

Question 6

This is a simple discount calculation as the term *discount rate* is found in the question. The formula for simple discount is $P = S(1 - dt)$.

The time line is:
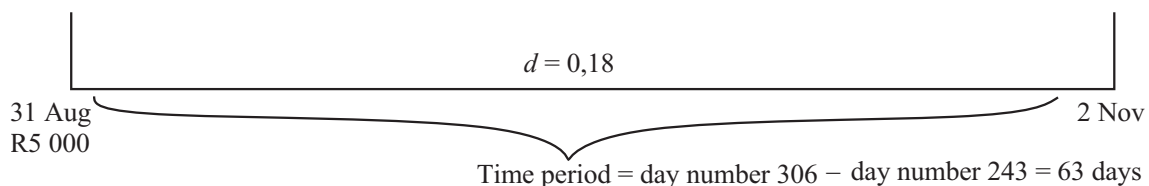
Given are the amount received from the bank or present value (P) of R5 000, the simple discount rate (d) of 18% and the time period which is the period between 31 August and 2 November. Now to calculate the number of days between 31 August and 2 November we make use of the number of days table at the back of study guide, Appendix C. The rows in the table represent the days, the columns the months and where the two intersect we read off the number of the day.

Thus 31 August is day number 243 and 2 November day number 306. The total number of days between 31 August and 2 November is $306 - 243 = 63$ days.

The time period t must always be expressed as years. Thus we need to change the 63 days to a fraction of a year by dividing the 63 days by the number of days in a year, namely 365. Thus $t = \frac{63}{365}$.

Now we need to determine the amount Nina needs to pay the bank on 2 November the future value of the loan.

$$P = S(1 - dt)$$
$$5\,000 = S\left(1 - 0{,}18 \times \frac{63}{365}\right)$$
$$\frac{5\,000}{\left(1 - 0{,}18 \times \frac{63}{365}\right)} = S$$
$$S = 5\,160{,}32.$$

Nina has to pay the bank R5 160,32 on 2 November.

HP10BII and HP10BII+

▭ C ALL
$0.18 \times 63 \div 365 = +/- + 1 = \rightarrow$M
$5\,000 \div$RM=
$5\,160.32$ *to two decimals is displayed.*

Or alternatively,

$5\,000 \div$ ▭ $(1-$

▭ $(0.18 \times 63 \div 365$ ▭ $)$

▭ $)=$

$5\,160.32$ *to two decimals is displayed.*

EL-738 and EL-738F

2ndF CA
$5\,000 \div (1 - 0.18 \times 63 \div 365) =$
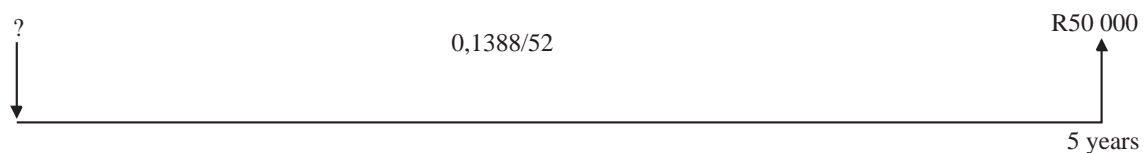$5\,160.32$ *to two decimals is displayed.*

[Option 2]

Question 7

This is a compound interest calculation as the term *compounded weekly* is found in the question. The formula for compound interest calculations is

$$S = P(1 + j_m/m)^{tm}.$$

First we draw a time line of the problem:

Now given are the future value S as R50 000, the interest rate as 13,88% ($j_m = 0{,}1388$), compounded weekly ($m = 52$) and the time period (t) of five years. We need to determine the present value or P. Thus

$$S = P(1 + j_m/m)^{tm}$$
$$50\,000 = P\left(1 + \frac{0{,}1388}{52}\right)^{5\times52}$$
$$P = 25\,001{,}79.$$

Stefan invested R25 001,79 initially.

| EL-738 and EL-738F	HP10BII and HP10BII+
2ndF CA	▬ C ALL
Use financial keys	*Use financial keys*
2ndF P/Y 52 ENT ON/C	52 ▬ P/YR
± 50 000 FV	50 000 ± FV
13.88 I/Y *Remember you do not enter the divide by 52 when entering the interest rates. The calculator does that automatically.*	13.88 I/YR *Remember you do not enter the divide by 52 when entering the interest rates. The calculator does that automatically.*
5 × 52 = N *or use*	5 × 52 = N *or use*
5 2ndF ×P/Y N	5 ▬ ×P/YR
COMP PV	PV
25 001.79 *to two decimals is displayed.*	25 001.79 *to two decimals is displayed.*

[Option 2]

Question 8

Question answered using the "how to approach a question" style.

Step 1: Read through the question and identify the type of problem:

Identification term

If R400 accumulates to R460 at a <u>simple interest rate</u> of 8% per year, then the length of time of the investment is

Step 2: Draw a time line:
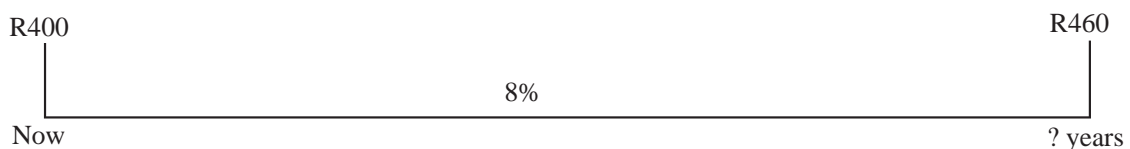
R400   R460

|——————————————————————8%——————————————————————|

Now   ? years

11

Step 3: Write down the formula:

This is a simple interest rate calculation as the term *simple interest* is found in the question. The formulas that you can use for simple interest calculations are

$$S = P(1 + rt) \text{ and } I = Prt.$$

Step 4: Identify the given values:

Now given are the present value (P) of R400, the future value (S) of R460 and the simple interest rate (r) of 8%. We need to determine the time t under consideration.

Step 5: Substitute the values into the formula and calculate the unknown value algebraically:

$$
\begin{aligned}
S &= P(1 + rt) \\
460 &= 400\,(1 + 0{,}08t) \\
\frac{460}{400} &= 1 + 0{,}08t \\
0{,}08t &= \frac{460}{400} - 1 \\
t &= \left(\frac{460}{400} - 1\right) \div 0{,}08 \\
&= 1{,}875.
\end{aligned}
$$

Step 6: Write down the answer:

The time under consideration, t, is equal to 1,875 years.   **[Option 1]**

There was a typing error in TUT101. Option 1 should have been 1,875. Everyone has been awarded the full marks for the question.

EL-738 and EL-738F
2ndF CA
$(460 \div 400 - 1) \div 0{,}08 =$
1.875 *to three*
decimals is displayed

HP10BII and HP10BII+
▭ C ALL
$460 \div 400 =$
$-1 =$
$\div 0.08 =$
1.875 *to three decimal is displayed*

Question 9

Question answered using the "how to approach a question" style.

Step 1: Read through the question and identify the type of problem:

Identification term   *Identification term*

An effective rate of 29,61% corresponds to a nominal rate, compounded weekly, of

Step 2: Draw a time line:

As no time is mentioned, it is not necessary to draw a time line.

Step 3: Write down the formula:

This is a conversion between two types of interest rates as one is asked to express the *effective interest rate* in terms of the *nominal interest rate*. Now we have a formula for the effective interest rate in terms of the nominal interest rate j_m, namely $j_{eff} = 100\left(\left(1 + \frac{j_m}{m}\right)^m - 1\right)$. But asked is j_m. We need to change the formula until j_m is the subject of the formula.

Step 4: Identify the given values:

Now given are $j_{eff} = 29{,}61\%$; $j_m = ?\%$ and $m = 52$ (compounded weekly).

Step 5: Substitute the values into the formula and calculate the unknown value using your calculator or solve algebraically:

$$
\begin{aligned}
j_{eff} &= 100\left(\left(1 + \frac{j_m}{m}\right)^m - 1\right) \\
29{,}61 &= 100\left((1 + \frac{j_m}{52})^{52} - 1\right) \\
0{,}2961 &= (1 + \frac{j_m}{52})^{52} - 1 \\
0{,}2961 + 1 &= (1 + \frac{j_m}{52})^{52}.
\end{aligned}
$$

Take ln on both sides of the equations since $\ln a^b = b \ln a$.

$$
\begin{aligned}
\ln 1{,}2961 &= 52\ln(1 + \frac{j_m}{52}) \\
\frac{\ln 1{,}2961}{52} &= \ln(1 + \frac{j_m}{52}) \\
0{,}00498\ldots &= \ln(1 + \frac{j_m}{52})
\end{aligned}
$$

Now $b = \ln a$ can be written as $e^b = a$. Thus

$$
\begin{aligned}
e^{0,00498\ldots} &= 1 + \frac{j_m}{52} \\
e^{0,00498\ldots} - 1 &= \frac{j_m}{52} \\
52 \times 0,00500 &= j_m \\
j_m &= 0,2600076\ldots \\
j_m &\approx 26\%
\end{aligned}
$$

The unknown value can be calculated by manipulating the formula by hand or using the calculator which is much easier – see calculator steps.

Step 6: Write down the answer:

The nominal interest rate that is equivalent to an effective interest rate of 29,61% is 26%.

EL-738 and EL-738F
2ndF CA
52(x,y) [*on the key next to ENT*]
29.61 2ndF →APR [*on the PMT key*]
26.00076... *is displayed.*

HP10BII and HP10BII+
▭ C ALL
52 ▭ P/YR [*on PMT key*]
29.61 ▭ EFF% [*on PV key*]
▭ NOM% [*on I/YR key*]
26.00076... *is displayed.*

[Option 1]

Question 10

Question answered using the "how to approach a question" style.

Step 1: Read through the question and identify the type of problem:

You won R165 000 and decided to deposit 65% of this amount in an account earning 8,25%

Identification term

interest, compounded every four months. The accumulated amount after five years is

Step 2: Draw a time line:

R107 250
65% of R165 000

$\frac{8,25}{3}$ %

?

Now

5 years
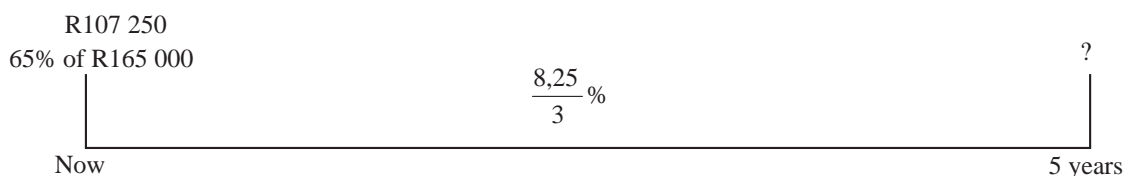
Step 3: Write down the formula:

This is a compound interest calculation as the term compounded *every four months* is found in the question. The formula for compound interest calculations is

$$S = P \left(1 + \frac{j_m}{m} \right)^{tm}.$$

Step 4: Identify the given values:

Now given are the principle value P as 65% of R165 000 or R107 250; the interest rate as 8,25% ($j_m = 0{,}0825$), compounded every four months ($m = 3$, as there are three, four months periods per year), and the time period (t) of five years. We need to determine the future value or S.

Step 5: Substitute the values into the formula and calculate the unknown value using your calculator:

$$
\begin{aligned}
S &= P \left(1 + \frac{j_m}{m} \right)^{tm} \\
&= 107\,250 \left(1 + \frac{0{,}0825}{3} \right)^{3 \times 5} \\
&= 161\,110{,}8389 \\
&\approx 161\,110{,}84.
\end{aligned}
$$

Step 6: Write down the answer:

The accumulated amount after five years is R161 110,84.

EL-738 and EL-738F
2ndF CA
Use financial keys
2ndF P/Y 3 ENT ON/C
± 107 250 PV
8.25 I/Y *Remember you do not enter the divide by 3 when entering the interest rates. The calculator does that automatically.*
3 × 5 = N *or use* 5 2ndF ×P/Y N
COMP FV
161 110.8389. . . *is displayed.*

HP10BII and HP10BII+
▭ C ALL
Use financial keys
3 ▭ P/YR
107 250 ± PV
8.25 I/YR *Remember you do not enter the divide by 3 when entering the interest rates. The calculator does that automatically.*
5 × 3 =N *or use* 5 ▭ ×P/YR
FV
161 110.8389. . . *is displayed.*

[Option 2]

Question 11

This is a simple interest rate calculation as the term *simple interest* is found in the question. The formulas for a simple interest calculation are $S = P(1 + rt)$ or $I = Prt$.

Now given are the present value (P) of R20 000, the future value (S) of R45 200 and the simple interest rate (r) of 12%. We need to determine the time t under consideration. Draw a time line:
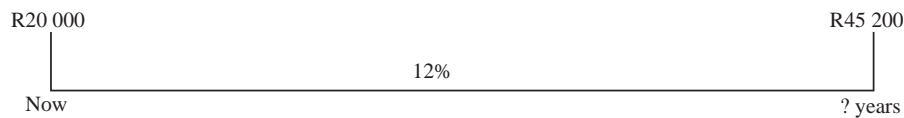
$$
\begin{aligned}
S &= P(1 + rt) \\
45\,200 &= 20\,000(1 + 0{,}12 \times t) \\
\frac{45\,200}{20\,000} &= 1 + 0{,}12t \\
\frac{45\,200}{20\,000} - 1 &= 0{,}12t \\
1{,}26 &= 0{,}12t \\
\frac{1{,}26}{0{,}12} &= t \\
t &= 10{,}50\ldots.
\end{aligned}
$$

The time under consideration is 10,50 years.

| EL-738 and EL-738F	HP10BII and HP10BII+
2ndF CA	▭ C ALL
Use normal keys	*Use normal keys*
$45\,200 \div 20\,000 = -1 = \div 0.12 =$	$45\,200 \div 20\,000 = -1 = \div 0.12 =$
10.50... *is displayed.*	10.50... *is displayed.*

[Option 4]

Question 12

This is a compound interest calculation as the term *compounded semi-annually* is found in the question. The formula for compound interest calculations is

$$S = P(1 + j_m/m)^{tm}.$$

First we draw a time line of the problem:
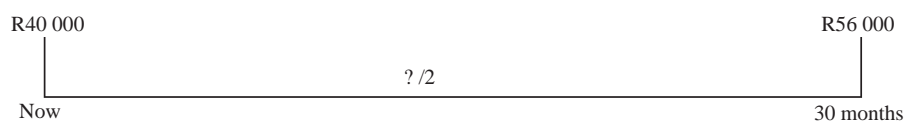
Now given are the principle value P as R40 000, the future value S as R56 000, the interest rate is, compounded semi-annually ($m = 2$) and the time period of 30 months. The interest rate (j_m) is unknown. The time period that we use must always be in years. As the given time is in months we change it to a fraction of a year by dividing the months by the number of months in a year which is 12. Thus $t = \frac{30}{12}$. We need to determine the value of the yearly nominal interest rate j_m. Thus

$$
\begin{aligned}
S &= P\left(1 + \frac{j_m}{m}\right)^{tm} \\
56\,000 &= 40\,000\left(1 + \frac{j_m}{2}\right)^{\frac{30}{12} \times \frac{2}{1}} \\
j_m &= 0{,}1392.
\end{aligned}
$$

The yearly interest rate, compounded semi-annually is 13,92%.

EL-738 and EL-738F	HP10BII and HP10BII+
2ndF CA	▭ C ALL
Use financial keys	*Use financial keys*
2ndF P/Y	
2 ENT ON/C	2 ▭ P/YR
± 56 000 FV	56 000 ± FV
40 000 PV	40 000 PV
30 ÷ 12 × 2 = N *or use*	30 ÷ 12 × 2 = N *or use*
30 ÷ 12 = 2ndF ×P/Y N	30 ÷ 12 = ▭ N
COMP I/Y	I/YR
13.922... *is displayed.*	13.922... *is displayed.*

[Option 3]

Question 13

This is a simple interest rate calculation as the term *simple interest* is found in the question. The formulas for a simple interest calculation are $S = P(1 + rt)$ or $I = Prt$.

Draw a time line:
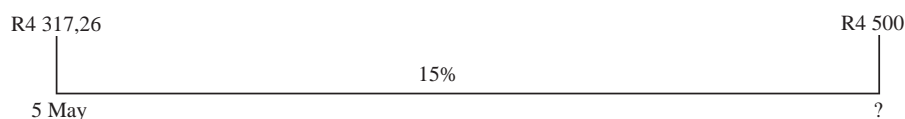
Now given are the present value (P) of R4 317,26, the future value (S) of R4 500 and the simple interest rate (r) of 15%. We need to determine the time (t) under consideration.

$$
\begin{aligned}
S &= P(1 + rt) \\
4\,500 &= 4\,317{,}26(1 + 0{,}15t) \\
1 + 0{,}15t &= \frac{4\,500}{4\,317{,}26} \\
0{,}15t &= \frac{4\,500}{4\,317{,}26} - 1 \\
t &= \left(\frac{4\,500}{4\,317{,}26} - 1\right) \div 0{,}15 \\
&= 0{,}2822\ldots.
\end{aligned}
$$

The time period is $0{,}2822\ldots$ years after 5 May. Now if we can change the years to days, then we can use our number of days table to determine the day number of the future date and thus the date itself. Now to change years to dates we multiply with 365. Thus

$$
\begin{aligned}
&= 0{,}2822\ldots \times 365 \\
&= 103.
\end{aligned}
$$

The loan will be worth R4 500 on 103 days after 5 May. Now 5 May is day number 125, adding 103 gives day number 228 which is 16 August.

The loan will be worth R4 500 on 16 August.

| EL-738 and EL-738F	HP10BII and HP10BII+
Use normal keys *Enter as* $(4\,500 \div 4\,317.26 - 1)$ $\div\, 0.15 \times 365 =$ $102.997\ldots$ *is displayed. Rounded to an integer is 103*	*Use normal keys* ▭ $(4\,500 \div 4\,317.26$ ▭ $)-1 = \div\, 0.15$ $\times 365 =$ $102.997\ldots$ *is displayed. Rounded to an integer*

[Option 2]

Question 14

This is a simple interest calculation as the term *simple interest* rate is found in the question. The formula for simple interest is

$$
S = P(1 + rt).
$$

First we draw a time line:

18
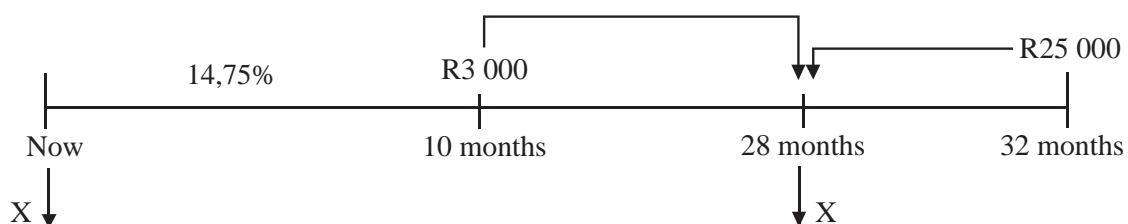
In this question Gert is *rescheduling* his payments towards his loans. We make use of the *equation of value* principal to calculate his new payments, namely

the total of all the loans = total of all the payments.

But you cannot add money values at different time periods together because of time value for money. You must first move them to the same date. We use the date that the question specifies, namely month 28, as comparison date.

First we calculate the value of the R3 000 at month 28. We move the R3 000 from month 10 to month 28, thus 18 months forward in time. We thus calculate a future value.
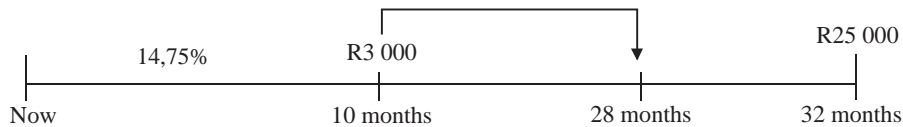
We thus calculate:

R3 000's value at month 28: $3\,000\left(1 + 0{,}1475 \times \frac{18}{12}\right)$.

The R25 000 must be moved back in time from month 32 to month 28, thus four months backwards. We calculate thus a present value.

R25 000's value at month 28: $25\,000/\left(1 + 0{,}1475 \times \frac{4}{12}\right)$.

The total value of the two loans at time 28 months is

$$3\,000\left(1 + 0{,}1475 \times \frac{18}{12}\right) + 25\,000/\left(1 + 0{,}1475 \times \frac{4}{12}\right).$$

Now the payments must also be moved forward in time to month 28. The first payment must be moved from time now to month 28 and the other payment is due at month 28.

Thus the total of the payments is $X\left(1 + 0{,}1475 \times \frac{28}{12}\right) + X$.

Now what you owe you must pay back, thus

the total of all the loans = total of the payments.

$$
\begin{aligned}
3\,000\left(1 + 0{,}1475 \times \frac{18}{12}\right) + 25\,000/\left(1 + 0{,}1475 \times \frac{4}{12}\right) &= X\left(1 + 0{,}1475 \times \frac{28}{12}\right) + X \\
3\,663{,}75 + 23\,828{,}43527\ldots &= 1{,}34416\ldots X + 1X \\
27\,492{,}18527\ldots &= 2{,}34416\ldots X \\
X &= 27\,492{,}18527\ldots/2{,}34416\ldots \\
X &= 11\,727{,}91408\ldots \\
X &\approx 11\,728
\end{aligned}
$$

Gert will pay Jan approximately R11 728.

| **EL-738 and EL-738F**	**HP10BII and HP10BII+**
2ndF M-CLR 0 0	▭ C ALL
Calculate FV of R3 000	*Calculate FV of R3 000*
$3\,000(1 + 0.1475 \times 18 \div 12) =$	$1 +$ ▭ $(0.1475 \times 18 \div 12$ ▭ $) =$
$3\,663.75$ *is displayed. Store for later use*	$\times 3\,000 =$
M+	$3\,663.75$ *is displayed. Store for later use*
	$\rightarrow$M
Calculate PV of R25 000	*Calculate PV of R25 000*
$25\,000 \div (1 + 0.1475 \times 4 \div 12) =$	$25\,000 \div$ ▭ $(1 +$ ▭ $(0.1475 \times 4 \div$
$23\,828.43\ldots$ *is displayed.*	12 ▭ $)$ ▭ $) =$
	$23\,828.43\ldots$ *is displayed.*
Add answer to memory	
M+	*Add answer to memory*
Answer of two values is	M+
RCL M+	*Answer of two values is*
$27\,492.18\ldots$ *is displayed.*	RM
	$27\,492.18\ldots$ *is displayed.*
Calculate the future value of payment X at time now:	*Calculate the future value of payment X at time now:*
$1 + 0.1475 \times 28 \div 12 =$	$1 +$ ▭ $(0.1475 \times 28 \div 12$ ▭ $) =$
$1.34416\ldots$ *is displayed. Add one of payment at month 28:*	$1.34416\ldots$ *is displayed. Add one of payment at month 28:*
$+ 1 = 2.34416\ldots$ *is displayed*	$+1 = 2.34416\ldots$ *is displayed*
Store in memory A:	*Calculate the value of X:*
STO ALPHA A	RM $\div 2.34416\ldots = 11\ 727.91408\ldots$ *is displayed*
Calculate the value of X:	
RCL M+$\div$ ALPHA A$\ldots =$	
$11\,727.91408\ldots$ *is displayed*	

[Option 3]

Question 15

This is a compound interest calculation as the term *interest compounded* is found in the question and only one principle value is mentioned in the question. The formula for compound interest calculations is

$$S = P \left(1 + \frac{j_m}{m}\right)^{tm}.$$

The time line is:
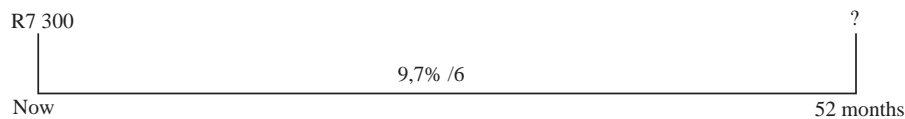
Now given is the principle or present value (P) of R7 300. The interest rate is given as 9,7%, compounded every second month, thus $j_m = 0{,}097$ and $m = 6$, as there are 6 two months periods in one year. We need to determine the future value (S).

$$
\begin{aligned}
S &= P \left(1 + \frac{j_m}{m}\right)^{tm} \\
&= 7\,300 \left(1 + \frac{0{,}097}{6}\right)^{\frac{52}{12} \times \frac{6}{1}} \\
&= 11\,076{,}73
\end{aligned}
$$

You will receive R11 076,73.

EL-738 and EL-738F
2ndF CA
Use financial keys
2ndF P/Y
6 ENT ON/C
$\pm$ 7 300 PV
9.7 I/Y
$52 \div 12 \times 6 =$N *or use*
$52 \div 12 =$ 2ndF $\times$P/Y N
COMP FV
11 076.73 *is displayed to two decimals.*

HP10BII and HP10BII+
▭ C ALL
Use financial keys
6 ▭ P/YR
7 300 $\pm$ PV
9.7 I/YR
$52 \div 12 \times 6 =$N *or use*
$52 \div 12 =$ ▭ $\times$ P/YR
FV
11 076.73 *is displayed to two decimals.*

[Option 4]

NOTE: YOU CAN FIND THE SUMMARY OF WHEN TO USE WHICH FORMULA AND A COPY OF THE FORMULA SHEET USED IN THE EXAMINATION ON myUNISA.