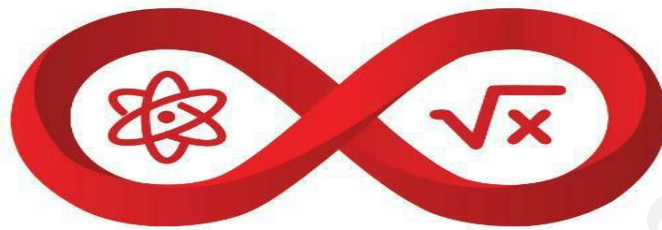




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MSI

MATHEMATICS

MATERIAL FOR GRADE 12

FINANCE

MEMORANDA

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QUESTION 1

1.1	$\left(1 + \frac{i^m}{m}\right)^m = 1 + i_e$ $\left(1 + \frac{i^{12}}{12}\right)^{12} = 1,083 \checkmark$ $\frac{i^{12}}{12} = (\sqrt[12]{1,083} - 1) \checkmark$ $i^{12} = 0,08$ $r = 8\% \checkmark$	$\checkmark$ Substitution $\checkmark$ Simplification $\checkmark$ Answer (3)
1.2.1	$Int = R8696,97 \times 60 = R121\,818,20 \checkmark$	Answer (1)
1.2.2	$400000 = \frac{9000 \left[1 - \left(1 + \frac{11}{1200}\right)^{-n}\right]}{\frac{11}{1200}} \checkmark$ $\left(1 + \frac{11}{1200}\right)^{-n} = \frac{16}{27}$ $n = -\frac{\log \frac{16}{27}}{\log \left(1 + \frac{11}{1200}\right)} \checkmark$ $= 57,34284187 \approx 57 \text{ full payments} \checkmark$	$\checkmark \frac{11}{1200}$ $\checkmark$ Substitution into correct formula $\checkmark$ Use of logs $\checkmark$ Answer (4)
1.2.3	$y \left(1 + \frac{11}{1200}\right)^{-58} \checkmark = 400000 - \frac{9000 \left[1 - \left(1 + \frac{11}{1200}\right)^{-57} \checkmark\right]}{\frac{11}{1200}} \checkmark$ $= 3094,83261 \approx 3094,83 \checkmark$	$\checkmark \checkmark n=57, 58$ $\checkmark$ Substitution $\checkmark$ Answer (4)
1.2.4	$Int = 121\,818,20 - \{[(9000 \times 57) + 3094,83] \checkmark$ $- 400\,000\}$ $= 5723,37 \checkmark \text{ is saved}$	$\checkmark$ Simplification $\checkmark$ Answer (2)
		[14]

QUESTION 2

2.1		$A = P(1 + i)^n$ $P = \frac{A}{(1 + i)^n}$ $= \frac{8450}{\left(1 + \frac{0,12}{12}\right)^{120}}$ $= R2560,31$	✓ ✓ ✓	making P subject of formula correct substitution answer	(3)
2.2		Let the original amount be Q $A = P(1 - i)^n$ $\frac{1}{2} Q = Q(1 - 0,047)^n$ $\frac{1}{2} = (1 - 0,047)^n$ $\log \frac{1}{2} = n \log(1 - 0,047)$ $n = 14,40 \text{ years/jare}$	✓ ✓ ✓	subst. logs answer	(3)
2.3	2.3.1	The scrap value of the tractor is $Rx(1 - 0,2)^5$	✓	scrap value	(1)
	2.3.2	so Price of new tractor will be $R x(1 + 0,18)^5 \text{ after 5 years}$	✓	Price of new tractor	(1)
	2.3.3	$F = \frac{x[(1 + i)^n - 1]}{i}$ $F = \frac{8\,000 \left[\left(1 + \frac{0,10}{12}\right)^{60} - 1\right]}{\frac{0,10}{12}}$ $= R619\,496,58$ NB: i and n only get marks when used in an annuity formula	✓ ✓ ✓ ✓	$i = \frac{0,10}{12}$ $n = 60$ subst. into an annuity formula answer	(4)

	2.3.4	Sinking fund = New tractor price – Scrap value $R619\,496,58 = R x(1 + 0,18)^5 - Rx(1 - 0,2)^5$ $= Rx(1 + 0,18)^5 - (1 - 0,2)^5)$ $R619\,496,58 = x(1 + 0,18)^5 - (1 - 0,2)^5)$ $x = \frac{R619\,496,58}{[(1 + 0,18)^5 - (1 - 0,2)^5]}$ $x = R316\,057.15$ NB! If learners found answer to 2.3.1 and 2.3.2 in decimal numbers i.e. 0,33x and 2,29x, their answer here might differ slightly due to rounding. Answer might be: R316 069,68 , depending on the number of digits they rounded off to.	✓ ✓ ✓ ✓	$R619\,496,58 =$ $x(1 + 0,18)^5 - (1 - 0,2)^5)$ factorising answer	(4) [16]
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QUESTION 3

3.1	$1 + i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m$ $\left(1 + \frac{i_m}{12}\right)^{12} = \left(1 + \frac{0,13}{4}\right)^4$ $= 1,136475928...$ $1 + \frac{i_m}{12} = 1,010718046...$ $\frac{i_m}{12} = 0,0107180464...$ $i_m = 0,1286165568...$ $\therefore r_m = 12,86\% \text{ p.a. compounded monthly}$	$\checkmark \left(1 + \frac{i_m}{12}\right)^{12}$ $\checkmark \left(1 + \frac{0,13}{4}\right)^4$ $\checkmark$ $1 + \frac{i_m}{12} = 1,010718046...$ (3)
3.2	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $9\,000 \left[1 - \left(1 + \frac{0,1286165568}{12}\right)^{-n}\right]$ $600\,000 = \frac{0,1286165568}{12}$ $0,7145364267 = 1 - \left(1 + \frac{0,1286165568}{12}\right)^{-n}$ $\left(1 + \frac{0,1286165568}{12}\right)^{-n} = 1 - 0,7145364267$ $= 0,2854635733$ $-n = \log_{\left(1 + \frac{0,1286165568}{12}\right)} 0,2854635733$ $= -117,5911312$ $n = 117,59$ $\therefore 117 \text{ payments of } R9\,000$	$\checkmark \text{ substitution into the correct formula}$ $\checkmark \text{ simplify RH}$ $\checkmark \text{ correct log}$ $-n = \log_{1,010718...} 0,28546$ $\text{or } -n = \frac{\log 0,28546...}{\log 1,010718...}$ $\checkmark n = 117,59$ $\checkmark 117 \text{ payments}$ (5)

3.3	$A = P(1 + i)^n$ $= 600\,000 \left(1 + \frac{0,1286165568}{12} \right)^{117}$ $= R2\,088\,640,059$ $F_v = \frac{x \left[(1 + i)^n - 1 \right]}{i}$ $= \frac{9\,000 \left[\left(1 + \frac{0,1286165568}{12} \right)^{117} - 1 \right]}{0,1286165568}$ $= R2\,083\,364,827$ Outstanding balance after 117 payments: $= R2\,088\,640,059 - R2\,083\,364,827$ $= R5\,275,232$ Final payment = $5\,275,232 \left(1 + \frac{0,1286165568}{12} \right)$ $= R5\,331,77$ OR $A = P(1 + i)^n$ $= 600\,000 \left(1 + \frac{0,1286165568}{12} \right)^{118}$ $= R2\,111\,026,2$ $F_v = \frac{x \left[(1 + i)^n - 1 \right]}{i}$ $= \frac{9\,000 \left[\left(1 + \frac{0,1286165568}{12} \right)^{118} - 1 \right]}{0,1286165568}$ $= R2\,114\,694,428$ Outstanding balance after 118 payments $= R2\,111\,026,2 - R2\,114\,694,428$ $= -R3\,668,228$ Final payment = $R9\,000 - R3\,668,228$ $= R5\,331,77$	✓ substitution into the correct formula ✓ substitution into the correct formula ✓ subtract: $A - F$ ✓ interest of 1 month ✓ answer (5) ✓ substitution into the correct formula ✓ substitution into the correct formula ✓ subtract: $A - F$ ✓ subtract from 9 000 ✓ answer (5)
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	OR $P_v = \frac{x[1 - (1 + i)^{-n}]}{i}(1 + i)$ $= \frac{9\,000 \left[1 - \left(1 + \frac{0,1286165}{12} \right)^{-0,5911} \right]}{\frac{0,1286165568}{12}} \left(1 + \frac{0,1286165}{12} \right)$ $= R5\,331,77$	✓✓ substitution of i and n into the correct formula ✓ one-month interest ✓✓ answer (5)
3.4	$117(R\,9\,000) + R5\,331,77$ $= R1\,058\,331,77$	✓ 117(9 000) ✓ R1 058 331,77 (2) [15]

QUESTION 4

4.1	$A = P(1 + i)^n$ $30\,440 = 12\,500 \left(1 + \frac{0,09}{4}\right)^{4k}$ $\frac{1522}{625} = \left(\frac{409}{400}\right)^{4k}$ OR $2,4352 = (1,0225)^{4k}$ $\therefore 4k = \log_{1,0225} 2,4352$ $\therefore 4k = 40,0002 \dots$ $\therefore k = 10 \text{ years}$	✓ substitution into correct formula (A and P) ✓ $i = \frac{0,09}{4}$ OR $\frac{9}{400}$ ✓ $\therefore 4k = \log_{1,0225} 2,4352$ ✓ answer	(4)
4.2.1	$1 + i^{eff} = \left(1 + \frac{i^n}{n}\right)^n$ $i^{eff} = \left(1 + \frac{0,18}{12}\right)^{12} - 1 = 1,195618 \dots - 1 = 0,195618 \dots$ $i^{eff} = 19,56\%$	✓ substitution into correct formula ✓ $i = \frac{0,18}{12}$ ✓ answer	(3)
4.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $500\,000 = \frac{x \left[1 - \left(1 + \frac{0,18}{12}\right)^{-60}\right]}{\frac{0,18}{12}}$ $x = R12\,696,71$	✓ substitution into correct formula ✓ $P = 500\,000$ ✓ $-n = -60$ ✓ answer	(4)
4.2.3	$\text{balance/saldo} = 500\,000 \left(1 + \frac{0,18}{12}\right)^{24} - \frac{12700 \left[\left(1 + \frac{0,18}{12}\right)^{24} - 1 \right]}{\frac{0,18}{12}}$ $= 714\,751,406 - 363\,645,7142$ $= R351\,105,69$ OR $P = \frac{x[1 - (1 + i)^{-n}]}{i} = \frac{12700 \left[1 - \left(1 + \frac{0,18}{12}\right)^{-36} \right]}{\frac{0,18}{12}}$ $= R351\,290,69$	✓ substitute into correct formula ✓ $n = 24$ or/of $n = -36$ ✓ $\frac{0,18}{12}$ ✓ answer	(4)
4.2.4	$500\,000(1 - i)^2 = 304\,200$ $(1 - i)^2 = 0,6094$ $i = 22\%$	✓ substitute into correct formula ✓ answer	(2)
			[17]

QUESTION 5

5.1	$A = P(1 - i)^n$ $= 500000(1 - 0,2)^6$ $= 131\,072$	✓ substitution into correct formula ✓ answer (2)
5.2	$A_e = P(1 + i)^n$ $= 500000(1 + 0,07)^6$ $= 750\,365,1759$ Cost of the new server: $750\,365,18 - 131\,072,00 = 619\,293,18$	✓ subst. into correct formula ✓ $= 750\,365,1759$ ✓ $619\,293,18$ (3)
5.3	$F_v = \left[\frac{x(1 + i)^n - 1}{i} \right]$ $619\,293,18 = \frac{x \left[\left(1 + \frac{0,08}{12} \right)^{73} - 1 \right]}{\frac{0,08}{12}}$ $x = 6\,613,636652 \approx 6\,613,64$	✓ $n = 12 \times 6 + 1$ ✓ $i = \frac{0,08}{12}$ ✓ substitution into correct formula ✓ answer (4)
5.4	$F_v = \frac{x[(1 + i)^n - 1]}{i}$ $1\,000\,000 = \frac{15000 \left[\left(1 + \frac{0,08}{12} \right)^n - 1 \right]}{\frac{0,08}{12}}$ $n = \log_{\frac{151}{150}} \left(\frac{1\,000\,000 \times \frac{1}{150}}{15000} + 1 \right)$ $n = 55,3423758$ After 56 months there will be more than R 1 000 000 in the fund.	✓ $i = \frac{0,08}{12}$, ✓ correct substitution into formulae. ✓ use of logs ✓ $n = 55,3423758$ ✓ answer (5)
		[14]

QUESTION 6

6.1	$A = P(1 - i)^n$ $A = 255000(1 - 0,125)^7$ $= R \quad 100 \, 137,45$	A✓ formula A✓ correct substitution CA✓ answer	(3)
6.2.1	$A = P(1 + i)^n$ $= 10 \, 000 \left(1 + \frac{0,095}{12} \right)^5$ $= R10 \, 402,15$	A✓ correct substitution into correct formula CA✓ answer	(2)
6.2.2	$P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $10 \, 402,15 = \frac{450 \left[1 - \left(1 + \frac{0,095}{12} \right)^{-n} \right]}{\frac{0,095}{12}}$ $\frac{10 \, 402,15 \times \frac{0,095}{12}}{450} = 1 - \left(1 + \frac{0,095}{12} \right)^{-n}$ $\left(1 + \frac{0,095}{12} \right)^{-n} = 0,816999213$ $-n = \frac{\log 0,816999213}{\log \left(1 + \frac{0,095}{12} \right)}$ $n = 25,6315128$ $\therefore n = 26 \text{ payments}$	CA✓ correct substitution of P into formula A✓ $x = 450$ CA✓ n as subject M✓ using logs CA($n \in \mathbb{N}$)✓ answer	(5)

6.2.3	Balance on Loan after the 25th payment $= 10\,402,15 \left(1 + \frac{0,095}{12}\right)^{25} - \frac{450 \left[\left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ $= R12668,90 - R12386,54$ $= R282,36$ OR $P = \frac{x[1 - (1 + i)^{-n}]}{i}$ $= \frac{450 \left[1 - \left(1 + \frac{0,095}{12}\right)^{-0,6315128} \right]}{\frac{0,095}{12}}$ $= R282,36$	M✓ (A - F_v) formula A✓ n = 25 CA✓ $10\,402,15 \left(1 + \frac{0,095}{12}\right)^{25}$ CA✓ $\frac{450 \left[\left(1 + \frac{0,095}{12}\right)^{25} - 1 \right]}{\frac{0,095}{12}}$ CA✓ answer OR A✓ formula A✓ subst. 450 CA✓ subst $\frac{0,095}{12}$ CA✓ subst 0,6315128 CA✓ answer	(5) (5)
			[15]

QUESTION 7

7.1		$A = P(1 - i)^n$ $= 800\,000(1 - 0.03)^{10}$ $= R589939,30$	✓ ✓	substitution in a decrease formula answer	(2)
7.2	7.2.1	$80\% \times 500\,000 = R400\,000$ OR $20\% \times R\,500\,000 = R100\,000$ $R500\,000 - R100\,000 = R400\,000$	✓ OR ✓	answer OR answer	(1)
	7.2.2.	$P(1 + i)^n = \frac{x[(1 + i)^n - 1]}{i}$ $400\,000(1 + \frac{0,125}{12})^{240}$ $= \frac{x[(1 + \frac{0,125}{12})^{240} - 1]}{\frac{0,125}{12}}$ $x = 400\,000 \frac{(1 + \frac{0,125}{12})^{240} \times \frac{0,125}{12}}{[(1 + \frac{0,125}{12})^{240} - 1]}$ $= R4544,56$ OR $P = \frac{x[1 - (1 + \frac{0,125}{12})^{-240}]}{\frac{0,125}{12}}$ $400\,000 = \frac{x[1 - (1 + \frac{0,125}{12})^{-240}]}{\frac{0,125}{12}}$ $x = \frac{400\,000 \times \frac{0,125}{12}}{(1 - (1 + \frac{0,125}{12})^{-240})}$ $= R4544,56$	✓ ✓ ✓ ✓ OR OR ✓ ✓ ✓ ✓	subst. into annuity formula i and n in an annuity formula making x subj of formula answer OR subst. into annuity formula/ <i>vervang in annuïteitsformule</i> i and n in an annuity formula making x subj of formula answer	(4)
	7.2.3	$Fv = \frac{x[1 - (1 + i)^{-n}]}{i}$	✓ ✓ ✓	 i n	

		$= \frac{4544,56[1 - (1 + \frac{0,125}{12})^{-120}]}{\frac{0,125}{12}}$ $= R310471,30$ OR $\text{Balance} = 400\,000(1 + \frac{0,125}{12})^{120} -$ $\frac{4544,562199[(1 + \frac{0,125}{12})^{120} - 1]}{\frac{0,125}{12}}$ $R1387139,499 - R107668,045$ $= R310471,30$ NB accept R310471,45 caused by early rounding	✓ OR ✓ ✓ ✓ ✓	Substitution answer OR Substitutions Answer	(4)
	7.2.4	amount paid: $= R\,4544,56 \times 120 + R310471,30 + R100\,000$ $= R865817,50$	✓ ✓ ✓	R 4544,56 × 120 adding R100 000 answer	(3)
					[14]

QUESTION 8

8.1	$0,10 \times R980\ 000$ $= R98\ 000$ $\therefore \text{Loan} = 980\ 000 - 98\ 000$ $= R882\ 000$ OR $\text{Loan} = R980\ 000 - 0,10 (R980\ 000)$ $= R882\ 000$ OR $\text{Loan} = 0,9 \times R980\ 000$ $= R882\ 000$	$\checkmark 0,10 \times R980\ 000$ $\checkmark R882\ 000 \quad (2)$ $\checkmark 0,10 \times R980\ 000$ $\checkmark R882\ 000 \quad (2)$ $\checkmark 0,9 \times R980\ 000$ $\checkmark R882\ 000 \quad (2)$
8.2	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $882\ 000 = \frac{10\ 000 \left[1 - \left(1 + \frac{0,11}{12} \right)^{-n} \right]}{\frac{0,11}{12}}$ $\frac{1617}{2000} = 1 - \left(1 + \frac{0,11}{12} \right)^{-n}$ $\left(1 + \frac{0,11}{12} \right)^{-n} = \frac{383}{2000}$ $-n = \log_{\left(1 + \frac{0,11}{12} \right)} \frac{383}{2000}$ $-n = -181,14$ $n = 181,14$ $\therefore \text{It takes 182 months}$ OR	$\checkmark i = \frac{0,11}{12}$ $\checkmark$ substitution into the correct formula $\checkmark \left(1 + \frac{0,11}{12} \right)^{-n} = \frac{383}{2000}$ $\checkmark$ introducing logs $-n = \log_{\left(1 + \frac{0,11}{12} \right)} \frac{383}{2000}$ or $-n = \log_{\left(\frac{1211}{1200} \right)} 0,1915$ or $-n = \frac{\log 0,1915}{\log 1,00916667}$ $\checkmark n = 181,14$ $\checkmark 182 \text{ months}$ (6)

	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $882\ 000 = \frac{10\ 000 \left[1 - \left(1 + \frac{0,11}{12} \right)^{-n} \right]}{\frac{0,11}{12}}$ $\frac{383}{2000} = \left(1 + \frac{0,11}{12} \right)^{-n}$ $\log \left(\frac{383}{2000} \right) = \log \left(1 + \frac{0,11}{12} \right)^{-n}$ $\log \left(\frac{383}{2000} \right) = -n \log \left(1 + \frac{0,11}{12} \right)$ $-n = -181,14$ $n = 181,14$ $\therefore$ It takes 182 months	✓ $i = \frac{0,11}{12}$ ✓ substitution into the correct formula ✓ $\frac{383}{2000} = \left(1 + \frac{0,11}{12} \right)^{-n}$ ✓ introducing logs $-n = \frac{\log \left(\frac{383}{2000} \right)}{\log \left(1 + \frac{0,11}{12} \right)}$ or $-n = \frac{\log 0,1915}{\log 1,00916667}$ ✓ $n = 181,14$ ✓ 182 months (6)
8.3	$n = 181,1379918 - 90$ $= 91,1379918$ $P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $P_v = \frac{10\ 000 \left[1 - \left(1 + \frac{0,11}{12} \right)^{-91,1379918} \right]}{\frac{0,11}{12}}$ $= R615\ 991,70$	✓ $n = 91,1379918$ ✓ substitution into the correct formula ✓ answer (3)

	OR $A = P(1 + i)^n$ $= 882\,000 \left(1 + \frac{0,11}{12}\right)^{90}$ $A = R2\,005\,069,01$ $F_v = \frac{x[(1 + i)^n - 1]}{i}$ $= \frac{10\,000 \left[\left(1 + \frac{0,11}{12}\right)^{90} - 1\right]}{\frac{0,11}{12}}$ $F_v = R1\,389\,077,31$ Outstanding balance after 90 instalments: $= R2\,005\,069,01 - R1\,389\,077,31$ $= R615\,991,70$	✓ substitution into the correct formula (or 2 005 069,01) ✓ substitution into the correct formula (or 1 389 077,31) ✓ answer (R615 991,70) (3)
8.4	$A = P(1 + i)^n$ $= 615\,991,70 \left(1 + \frac{0,11}{12}\right)^5$ $= 644\,747,02$ $P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $644\,747,02 = \frac{x \left[1 - \left(1 + \frac{0,11}{12}\right)^{-87}\right]}{\frac{0,11}{12}}$ $x = R10\,786,84$	✓ substitution into the correct formula ✓ answer ✓ substitution into the correct formula ✓ $n = 182 - 95 = 87$ ✓ answer (5) [16]

QUESTION 9

#	SUGGESTED ANSWER	DESCRIPTORS	Ma
9.1	$A = P(1 - i)^n$; $P = R128\ 000$; $A = R45\ 500$; $n = 6$; $i = ?$ $45\ 500 = 128\ 000(1 - i)^6$ $\therefore \sqrt[6]{\frac{45\ 500}{128\ 000}} = 1 - i$ $\therefore i = 1 - \sqrt[6]{\frac{45\ 500}{128\ 000}}$ $\therefore i = 0,15834 = 15,83\% \text{ p.a.}$	✓ Subst. of $P = 128\ 000$ into depreciation formula ✓ Subst. of $45\ 500$ and/ or $n = 6$ ✓ i the subject ✓ Answer	(4)
9.2.1	$A = P(1 + i)^n$; $A = ?$; $P = 250\ 000$; $n = 12y = 48$ quarters; $i = 9,5\% \text{ p.a.} = \frac{9,5}{400}$ per quarter $\therefore A = 250\ 000(1 + \frac{9,5}{400})^{48}$ $= R\ 771\ 343,67$	✓ Subst $i = \frac{9,5}{400} = 0,02375$ ✓ Subst $n = 48$ in correct formula ✓ Answer	(3)
9.2.2	Home loan $= 2\ 920\ 000 - 771\ 343,67$ $= R2\ 148\ 656,33$	✓ Answer	(1)
9.2.3	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$; $P_v = 2\ 148\ 656,33$; $i = 10,3\% \text{ p.a.}$ $= \frac{10,3}{1200} \text{ p/m}$; $n = 20 \text{ y} = 240 \text{ m}$ $\therefore 2\ 148\ 656,33 = \frac{x[1 - (1 + \frac{10,3}{1200})^{-240}]}{\frac{10,3}{1200}}$ $\therefore x = R\ 21\ 163,87$ OR $F_v = \frac{x[(1 + i)^n - 1]}{i}$ $\therefore 2\ 148\ 656,33(1 + \frac{10,3}{1200})^{240} = \frac{x[(1 + \frac{10,3}{1200})^{240} - 1]}{\frac{10,3}{1200}}$ $\therefore x = R\ 21\ 163,87$	✓ Subst into correct formula ✓ Subst $i = \frac{10,3}{1200}$ ✓ Subst $n = 240$ ✓ Answer/ Antw	(4)
9.2.4	Interest = Amount paid- original loan $= 21\ 163,87 \times 240 - 2\ 148\ 656,33$ $= R\ 2\ 930\ 672,47$	✓ Calculation ✓ Answer	(2)
			[14]