Full Name: SOLUTIONS

Mathematics Applications
YEAR 12

Investigation 3 – Finance

Semester 2 2017

In-class Section

Time allowed: 35 minutes

Marks Available: 33 marks

Materials required: Writing implements, correction fluid/tape or eraser, ruler, Scientific or CAS calculator

Instructions:

1. Write your answers in the spaces provided in this Question/Answer Booklet.
2. **Show all your working clearly.** Your working should always be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.
3. CAS calculators are be permitted to be used.
4. No notes are allowed.

1. (7 marks)

Two friends buy a housing unit for $183 000. Between them they manage to repay $2 625 per month. The table below summarises their monthly repayments and shows the balance at the end of each month.

Month	Amount owed	Interest	Payment	Balance
1	183 000	1 098	2 625	181 473
2	181 473	1 088.84	2 625	179 936.84
3	179 936.84	1 079.62	2 625	178 391.46
4	178 391.46	1 070.35	2 625	176 836.81
5	176 836.81	1 061.02	2 625	175 272.83
6	175 272.83	**(i)**	2 625	173 699.47
7	173 699.47	1 042.20	2 625	172 116.67
8	172 116.67	1 032.70	2 625	170 524.37
9	170 524.37	1 023.15	2 625	**(ii)**
10	168 922.52	1 013.54	2 625	167 311.06
11	**(iii)**	1 003.87	2 625	165 689.93
12	165 689.93	994.14	2 625	164 059.07

a) Calculate the annual interest rate charged on this loan. [2]

$I = \frac{Prt}{100}$

$1098 = 183000 \times r \times 1 \div 100$ ✓ $\Rightarrow r = 0.006$ $\Rightarrow$ 7.2% p.a ✓

b) Find the values of (i), (ii) and (iii) in the cells above. [3]

(i) 1051.64 ✓

(ii) 168922.52 ✓

(iii) 167311.06 ✓

c) Find the total amount of interest paid in the 12 months. [2]

$12 559.05 ½ (-1 for no cents)

2. (7 marks)

Asher borrowed $15 000 to buy his car. Interest is charged on the opening balance each month at a rate of 12% per annum. Asher repays $1 200 each month (except for the final payment). The final payment cannot exceed the regular payments. The table below shows Asher's account over the life of the loan.

Month	Opening Balance (to the nearest $)	Interest	Repayment	Closing Balance (to the nearest $)
1	15 000	150	1 200.00	13 950
2	13 950	139.50	1 200.00	12 890
3	12 890	128.90	1 200.00	11 818
4	11 818	118.18	1 200.00	10 737
5	10 737	107.37	1 200.00	9 644
6	9 644	96.44	1 200.00	8 540
7	8 540	85.40	1 200.00	7 426
8	7 426	74.26	1 200.00	6 300
9	6 300	63.00	1 200.00	5 163
10	5 163	51.63	1 200.00	4 015
11	4015	40.15	1200	2854
12	2854	28.55	1200	1683
13	1683	16.83	1200	500
14	500	5.00	505	0

✓2

If doesn't stop at zero -1

a) Find the monthly interest rate. [1]

$\frac{12}{12} = 1$ 1% per month ✓

b) Complete the table above to find how long Asher takes to repay the loan. State the amount of the final payment. [4]

14 months or 1 year 2 months ✓

$505 ✓

c) How much interest would Asher has paid for the loan? Show clearly how you obtained your answer. [2]

Add interest column ($1105.21) OR

$1200 × 13 + $505 − 15000 = $1105.00

✓calculation/evidence ✓answer

3. (9 marks)

Robert buys a car for $72 000. He pays a deposit of $12 000 from his savings and borrows the remaining amount from his bank. The interest on the loan is 7.5% per annum and Robert can afford to make monthly repayments of $1 800.

The spreadsheet below shows the balance and interest of the loan for the first 6 months and the last 3 months.

Month	Opening balance at the start of each month	Interest
1	60 000	375
2	58 575	366.09
3	57 141.09	357.13
4	**A**	**B**
5	54 246.34	339.04
6	52 758.38	330.89
. . .		
36	4 442.52	27.77
37	2 670.28	16.69
38	886.97	

a) Calculate the value of A and B, correct to two decimal places. [2]

A $55 698.22 ✓

B $348.11 ✓

accept rounding errors if only decimal places are incorrect.

b) One of the opening balances for the first 6 months is incorrect. Identify which entry is incorrect and state the correct value of the balance. [2]

6th month ✓ should be $52 785.38 ✓

c) How long will it take for the amount owing to fall below $10 000? [1]

33 months

d) Calculate the amount of Robert's final payment. [2]

$886.97 + 5.54 ✓ = $892.51 ✓

e) What is the total amount of interest that Robert has paid? [2]

37 × 1800 + 892.51 − 60000

= $7492.51

4. (10 marks)

In order to buy a second-hand scooter, Kim obtained a personal loan of $5 000 with monthly repayments of $440 to be paid at the end of each month. The table below shows the amount owing at the start of each month, interest payable for that month, the repayment and the amount owing at the end of each month for the first six months.

Month	Amount owing at the start of the month ($)	Interest ($)	Repayment ($)	Amount owing at the end of the month ($)
1	5 000	40	440	4 600
2	4 600	36.80	440	4 196.80
3	4 196.80	33.57	440	3 790.37
4	3 790.37	30.32	440	3 380.70
5	3 380.70	27.05	440	2 967.74
6	2 967.74	23.74	440	2 551.48

a) Calculate the annual interest rate. [3]

$I = Prt$

$40 = 5000 \times r \times 1 \div 100$ ✓

$r = 0.08$ ✓

$r = 9.6\%$ pa ✓

b) Write a recursive formula to determine the amount owing at the end of each month. [2]

$T_{n+1} = T_n \times 1.008 - 440$, $T_1 = 5000$ ✓ ✓

c) In which month would Kim pay off the loan? [1]

12th month ✓

d) How much is Kim's final repayment? [2]

$419.71 + 3.36 = \$423.07$ ✓ ✓

e) How much did Kim actually pay for the scooter? [2]

$11 \times 440 + 423.07 = \$5263.07$ ✓ ✓

End of Investigation

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You may use this space to extend or re-attempt an answer to a question or questions and should you do so then number the question(s) attempted and cross out any previous unwanted working.