education equals

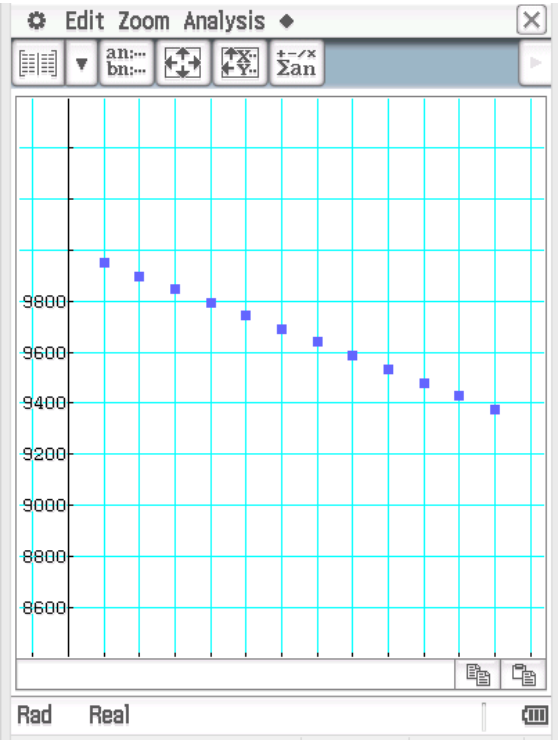
Topic: Reducing Balance on Loans

Time: 45 mins Marks: /45 marks

Calculator Assumed

Question One: [2, 2, 2: 6 marks]

Nigella has a loan of $10 000 which is at 5.9% p.a interest compounding monthly. She is making $100 monthly repayments. Nigella is using her calculator to predict the amount she will have owing at the start of each month for the first twelve months. The graph below depicts that.



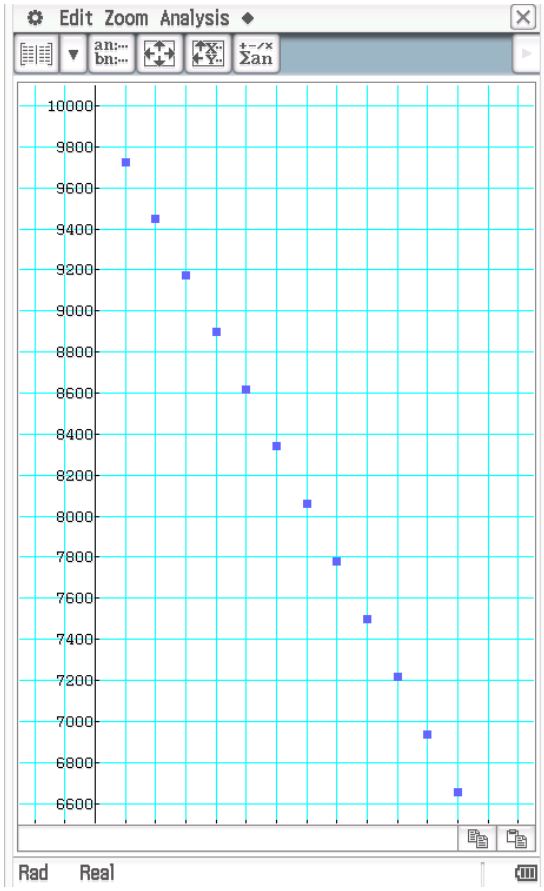
Consider the graphs on the next page. Each graph depicts the balancing owing on the loan at the start of each month for the first twelve months of the loan.

a) Which of the graphs depict the effect of increasing the repayment to $300 per month on the balance at the start of each month?

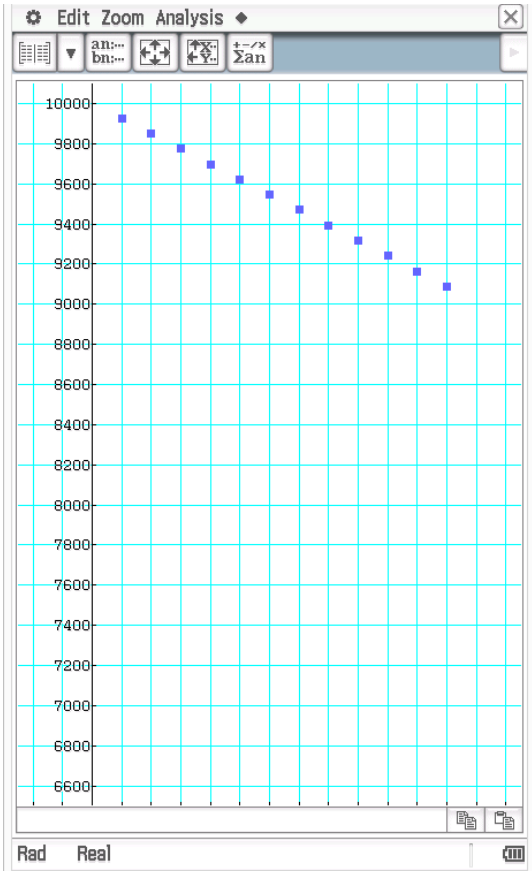
b) Which of the graphs depict the effect of decreasing the interest rate to 3% p.a but keeping the monthly repayments at $100 per month, on the balance at the start of each month?

c) Which of the graphs below depict the effect of decreasing the interest rate to 3% p.a and reducing the monthly repayments to $300 per month, on the balance at the start of each month?

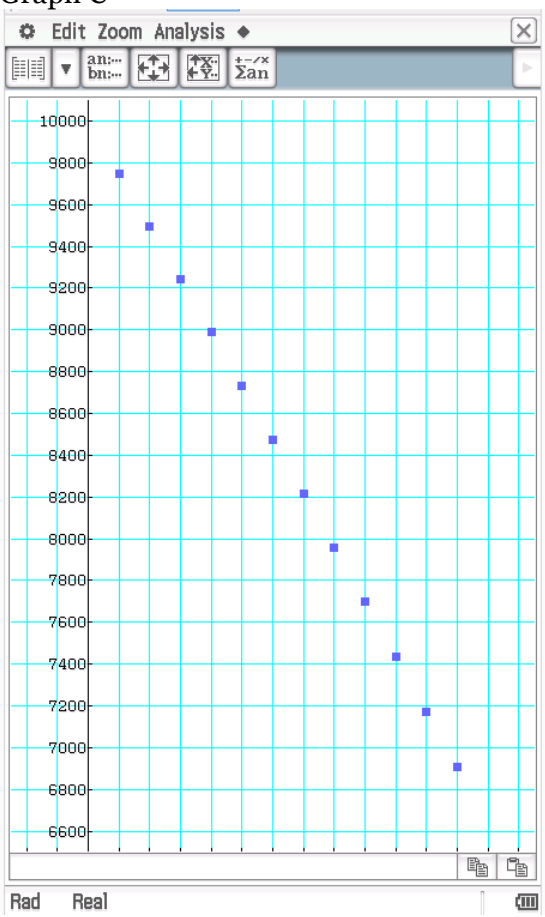
Graph A



Graph B



Graph C



Question Two: [3, 1, 3, 2, 2: 11 marks]

Hayes doesn't enjoy flying on commercial airplanes anymore and decides that he would like to purchase his own plane. He has a lot of money but needs to borrow some money from the bank in order to fund the purchase.

He borrows $200 000 and decides to make regular monthly repayments.

The following table shows the balance of the loan and the amount of interest for the first three months.

Month	Balance at the start of the month	Interest	Balance at the end of the month
1	200 000	750	199 250
2	199 250	747.19	198 497.19
3	198 497.19	744.37	197 741.56

a) What is the annual interest rate on this loan?

b) How much is Hayes repaying each month?

c) Give the recurrence formula to calculate the balance at the start of each month.

d) How much is owing on this loan at the end of the first 12 month?

e) How much interest has been paid in the first 12 months of the loan?

Question Three: [2, 2, 2, 3, 1, 1: 11 marks]

Gordon borrows some money and aims to pay it off in 12 months by making regular monthly repayments. The interest rate he is being charged is 9% p.a compounding monthly.

Consider the following partial table containing details of the loan.

Month	Balance at the start of the month	Interest	Balance at the end of the month
1		18.75	2318.75
2	2318.75	17.39	2136.14
3			
…			
	34.75		0

a) How much money did Gordon borrow?

b) How much are the monthly repayments?

c) What is the balance at the end of the 3rd month?

d) How long does it take Gordon to pay off the loan and calculate the total amount of interest Gordon pays?

Gordon wanted to pay the loan off in 12 months.

e) Calculate how much he would need to pay each month if he is to pay the loan off in 12 months.

d) Besides from increasing the repayments, suggest another way Gordon could decrease the time taken to repay the loan.

Question Four: [5, 3: 8 marks]

Consider the following information from the ANZ website.

Source: http://www.anz.com/personal/personal-loans/personal-loans-overview/fixed-rate/

ANZ

ANZ Fixed Rate Personal Loan

Features

- ✓ Choose to make your repayments weekly, fortnightly or monthly.
- ✓ Borrow from $5,000 up to a maximum of $75,000.
- ✓ You can choose from a loan term from 1 to 7 years.
- ✓ You can make additional repayments. Fees and charges apply.
- ✓ Existing eligible ANZ customers may access funds on the same day as approval.[4]
- ✓ ANZ Loan Protection[1] - Optional insurance cover for the unexpected. If you choose ANZ Loan Protection, you may qualify for a 0.25% interest rate discount.

Use this loan to...

- consolidate debt
- buy a car
- go on a holiday
- update furniture or other household goods

Interest rates

- Interest rate[2] from 13.95% p.a.
- Comparison rate[3] from 14.81% p.a.

Fees and charges

- Loan approval fee: $150, due when the loan is drawn down
- Loan administration charge: $10 per month, charged at the end of each quarter.

Jaime is considering taking a $23 000 loan from ANZ for 12 months. They have offered him 13.95% p.a. compounding monthly. He has taken ANZ loan protection so the interest rate discount will apply. He is using a table to calculate the total amount of interest, fees and charges he will have paid by the end of the 12 months.

Month	Amount Owing at the start of the month	Interest	Repayment	Fees	Amount Owing at the end of the month
1	23 000 + (150 loan approval fee)	264.30	2100	-	21314.30
2	21314.30	243.34	2100	-	
3	19457.64	222.14	2100	30 (monthly admin fee)	17609.78
4	17609.78		2100		
5			2100		
6			2100	30	11877.63
7			2100		
8			2100		
9			2100	30	
10			2100		
11			2100		
12				30	0

a) If Jaime wants to pay the loan off fully in 12 months how much does he need to pay in his final repayment (include the final $30 fee in this figure).

b) What is the total amount of interest payable on this loan?

Question Six: [3, 3, 3: 9 marks]

Compare the total amount of interest payable and the total time taken to pay off a loan of $10 000 under the following varying conditions.

	Interest Rate	Compounding	Repayments	Total length of time to pay off loan	Total amount of interest payable
A	15.95% p.a	Monthly	$160/month		
B	15.95% p.a	Monthly	$80/fortnightly		
C	15.95% p.a	Monthly	$40/week		

Use 52 weeks in a year for your calculations.

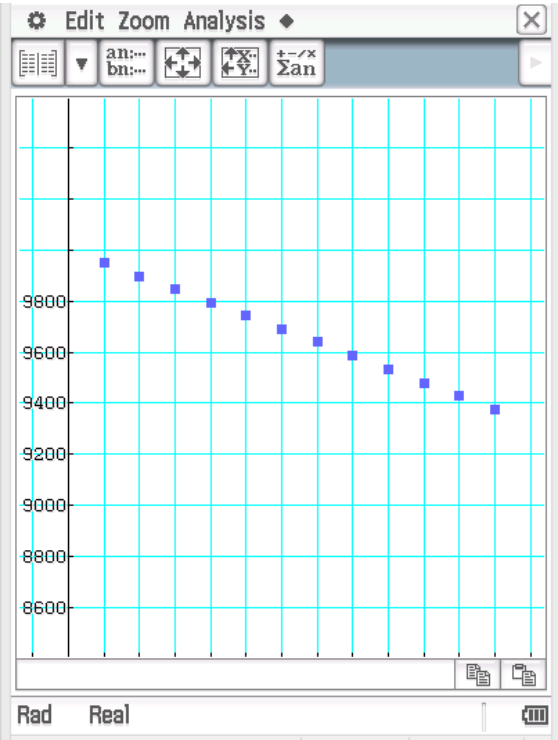
education equals

Topic: Reducing Balance on Loans
SOLUTIONS

Time: 45 mins Marks: /45 marks

Question One: [2, 2, 2: 6 marks]

Nigella has a loan of $10 000 which is at 5.9% p.a interest compounding monthly. She is making $100 monthly repayments. Nigella is using her calculator to predict the amount she will have owing at the start of each month for the first twelve months. The graph below depicts that.



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a) Which of the graphs depict the effect of increasing the repayment to $300 per month on the balance at the start of each month? Estimate the final balance from the graph.

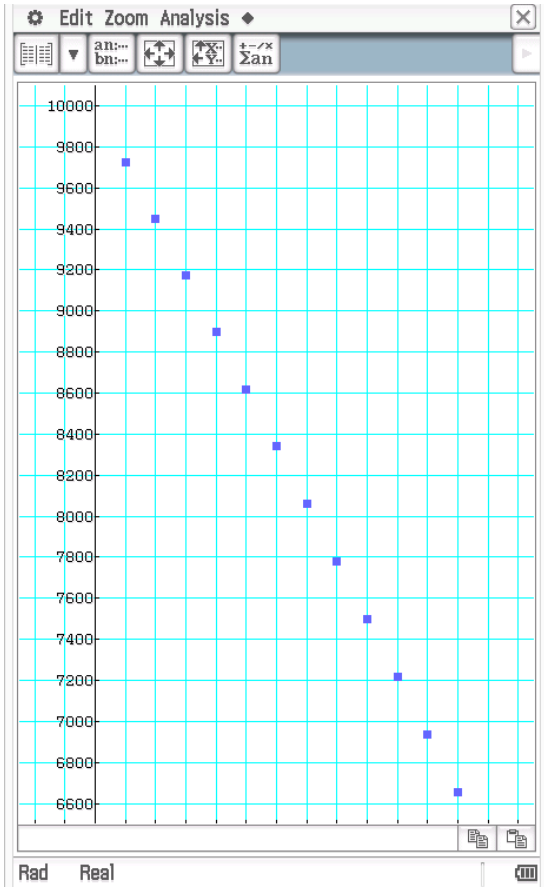
C ~$6 900 ✓ ✓

b) Which of the graphs depict the effect of decreasing the interest rate to 3% p.a but keeping the monthly repayments at $100 per month, on the balance at the start of each month? Estimate the final balance from the graph.

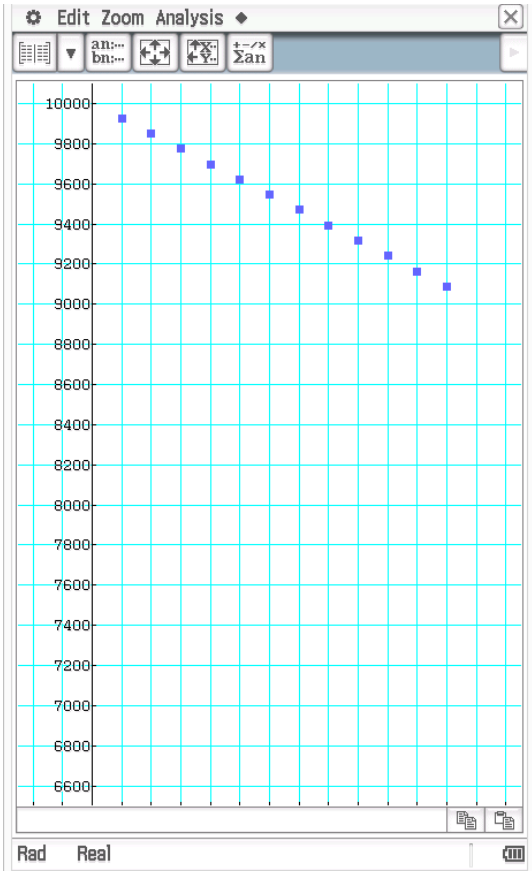
B ~$9 090 ✓✓

c) Which of the graphs below depict the effect of decreasing the interest rate to 3% p.a and reducing the monthly repayments to $300 per month, on the balance at the start of each month? Estimate the final balance from the graph. A ~$6 650 ✓ ✓

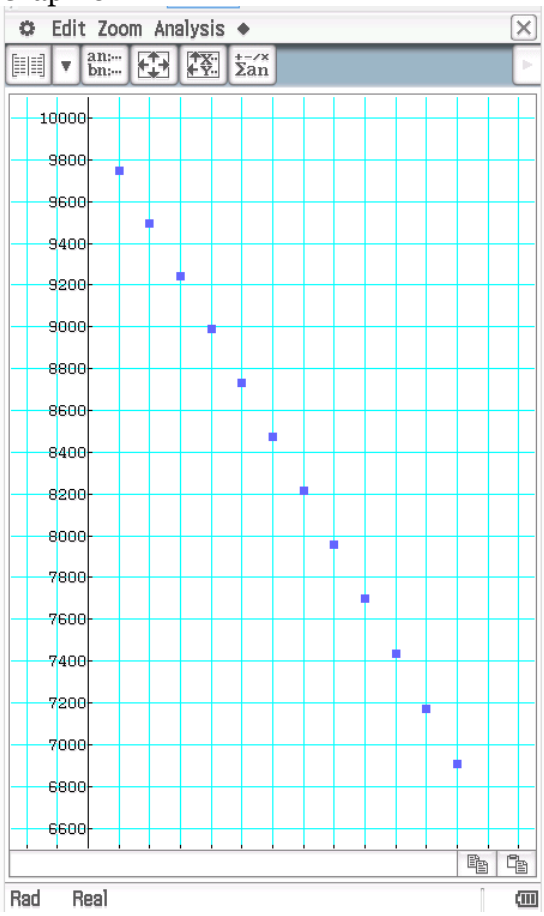
Graph A



Graph B



Graph C



Question Two: [3, 1, 3, 2, 2: 11 marks]

Hayes doesn't enjoy flying on commercial airplanes anymore and decides that he would like to purchase his own plane. He has a lot of money but needs to borrow some money from the bank in order to fund the purchase.

He borrows $200 000 and decides to make regular monthly repayments.

The following table shows the balance of the loan and the amount of interest for the first three months.

Month	Balance at the start of the month	Interest	Balance at the end of the month
1	200 000	750	199 250
2	199 250	747.19	198 497.19
3	198 497.19	744.37	197 741.56

a) What is the annual interest rate on this loan?

$\frac{200\,000}{750} \times 12 \times 100 = 4.5\%\ p.a$

✓ ✓ ✓

b) How much is Hayes repaying each month?

$\$1\,500$ ✓

c) Give the recurrence formula to calculate the balance at the start of each month.

$T_{n+1} = T_n \times 1.00375 - 1500 \quad T_1 = 200\,000$

✓ ✓ ✓

d) How much is owing on this loan at the end of the first 12 month?

$\$190\,812.04$ ($\pm\$0.01$ *for rounding accepted*) ✓ ✓

e) How much interest has been paid in the first 12 months of the loan?

$$1\,500 \times 12 = 18\,000$$

$$200\,000 - 18\,000 = 182\,000$$ ✓

Balance at the end of the 12 *months is* 190812.04

Interest paid in first 12 *months is* $190812.04 - 182\,000 = \$8\,812.04$ ✓
($\pm\$0.01$ *for rounding accepted*)

Question Three: [2, 2, 2, 3, 1, 1: 11 marks]

Gordon borrows some money and aims to pay it off in 12 months by making regular monthly repayments. The interest rate he is being charged is 9% p.a compounding monthly.

Consider the following partial table containing details of the loan.

Month	Balance at the start of the month	Interest	Balance at the end of the month
1		18.75	2318.75
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…			
	34.75		0

a) How much money did Gordon borrow?

$A \times \frac{0.09}{12} = 18.75 \; A = \$2\,500$ ✓✓

b) How much are the monthly repayments?

$200 ✓✓

c) What is the balance at the end of the 3rd month?

$1 952.16 ✓✓

d) How long does it take Gordon to pay off the loan and calculate the total amount of interest Gordon pays? $14\ months$ ✓

$$Total\ amount\ repayed: 13 \times 200 + 35.01 = 2\,635.01$$ ✓

$$Interest = 2\,635.01 - 2\,500 = \$135.01$$ ✓

Gordon wanted to pay the loan off in 12 months.

e) Calculate how much he would need to pay each month if he is to pay the loan off in 12 months. $218.63 ✓

d) Besides from increasing the repayments, suggest another way Gordon could decrease the time taken to repay the loan.

Instead of monthly repayments, repay $50 each week. Find a bank which offers a lower interest rate. ✓

Question Four: [5, 3: 8 marks]

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Source: http://www.anz.com/personal/personal-loans/personal-loans-overview/fixed-rate/

ANZ

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Jaime is considering taking a $23 000 loan from ANZ for 12 months. They have offered him 13.95% p.a. compounding monthly. He has taken ANZ loan protection so the interest rate discount will apply. He is using a table to calculate the total amount of interest, fees and charges he will have paid by the end of the 12 months.

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4	17609.78		2100		
5			2100		
6			2100	30	11877.63
7	11877.63	135.60	2100	-	9913.23 ✓
8	9913.23	113.18	2100	-	7926.41
9	7926.41	90.49	2100	30	5946.90 ✓
10	5946.90	67.89	2100	-	3914.79
11	3914.79	44.69	2100	-	1859.48 ✓
12	1859.48	21.23	1880.71	30	0

a) If Jaime wants to pay the loan off fully in 12 months how much does he need to pay in his final repayment (include the final $30 fee in this figure).

$\frac{13.7\%\ p.a}{12}$ ✓

$1\,880.71 + 30 = \$1\,910.71$ ✓

b) What is the total amount of interest payable on this loan?

$(2\,100 \times 11 + 1\,910.71) - 23\,000 = \$2\,010.71$

✓ ✓ ✓

Question Six: [3, 3, 3: 9 marks]

Compare the total amount of interest payable and the total time taken to pay off a loan of $10 000 under the following varying conditions.

	Interest Rate	Compounding	Repayments	Total length of time to pay off loan	Total amount of interest payable
A	15.95% p.a	Monthly	$160/month	135 months ✓	$134 \times 160 + 82.84 = 21\,522.84$ ✓ $Interest = \$11\,522.84$ ✓ ($11 523.93 from spreadsheet)
B	15.95% p.a	Monthly	$80/fortnightly	238 fortnights ✓	$237 \times 80 + 0.36 = \$18\,960.36$ ✓ $Interest = \$8\,960.36$ ✓ ($8 960.35 from spreadsheet)
C	15.95% p.a	monthly	$40/week	473 weeks ✓	$472 \times 40 + 15.70 = \$11\,895.70$ ✓ $Interest = \$8\,895.70$ ✓ ($8 895.70 from spreadsheet)

Use 52 weeks in a year for your calculations.

(Slight variation in answers depending on finance app or spreadsheet due to unequal year/52 week period)