IB · DP · Maths

56 mins 7 questions

1.3 Financial Applications

1.3.1 Compound Interest & Depreciation / 1.3.2 Amortisation & Annuities

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Total Marks /56

1 (a) Paul is looking at two homes for his family to move into. The first home is located out of town and is listed at $775 000 and the second home is located in town and is listed at $620 000.

The bank offer Paul an identical loan for both homes. Terms of the loan are:

- 20% deposit
- 5.77% nominal annual interest rate, **compounded quarterly**
- Repayments of $4800 to be paid at the end of every month

Calculate the loan amount for the

(i) first home.

(ii) second home.

(2 marks)

(b) Find the number of months and years to pay off the loan for the

(i) first home.

(ii) second home.

(3 marks)

(c) Calculate the total amount Paul will save if he decides to choose the second home. Give your answer to 2 decimal places.

(3 marks)

2 (a) Anna decides she wants to buy a farm and the bank agree to give her a loan provided she makes a 14% deposit of $40 000.

Calculate the value of the farm. Give your answer to the nearest dollar.

(1 mark)

(b) She currently has $15 000 saved up and decides to invest it in some high risk high growth shares forecasted to grow at 65% annually.

Calculate the forecasted number of years it will take for her to be able to afford the deposit.

(2 marks)

(c) 1.5 years later, the shares outperform their forecasted growth rate and Anna is able to afford the deposit on the farm.

Calculate the percentage error between the forecasted annual growth rate and the actual annual growth rate of the shares.

(3 marks)

(d) Anna now takes out the loan from the bank. Terms of the loan are:

- 5.04% nominal annual interest rate, **compounded monthly**
- Repayments of $3900 to be made at the end of every quarter

Calculate the total number of years and months it will take for Anna to go from making the decision to buy the farm to fully paying off the loan.

(3 marks)

3 (a) In this question, give all your answers to the nearest dollar.

Joe has just retired and he has saved $1 500 000. He "rolls over" his savings into an annuity fund which returns a nominal annual interest rate of 3.55%, **compounded semi-annually.** Joe is allowed to withdraw up to $25 000 every month, however if he wants to withdraw more than this he must pay a penalty of 5% of the withdrawal amount.

Joe decides to withdraw $5000 every month.

Calculate the value of the fund after 6 years.

(2 marks)

(b) After 6 years Joe decides to make a 30% deposit on a $1 040 000 home for his daughter's family to move into. He makes the withdrawal for the deposit at the same time as he makes his usual monthly $5000 withdrawal.

Calculate the penalty amount Joe will have to pay.

(3 marks)

(c) Calculate the amount in the fund after he makes the withdrawal and the penalty has been applied.

(3 marks)

4 (a) In this question, give all your answers to the nearest dollar.

Nina's grandson, Jasper, has just turned 5 and for his birthday she has set up two passive income streams that he will have access to when he turns 18. The first passive income stream is a savings account that pays a special annual interest rate of 5.42% for kids under the age of 12. The second passive income stream is a well-diversified investment portfolio expected to give annual returns of 6.88%. Nina deposits $200 into the savings account and $100 into the investment portfolio every month.

Calculate

(i) the total amount in Jasper's savings account when he turns 12.

(ii) the total amount of interest accumulated.

(3 marks)

(b) When Jasper turns 12, the interest rate on the savings account drops to 3.53%.

Given that Nina continues to deposit the same amount every month, calculate the total amount in the savings account when Jasper turns 18.

(3 marks)

(c) When Jasper turns 18 the average annual returns of the investment portfolio is calculated at 12.4%.

Given that Nina continues to deposit the same amount every month, calculate the total amount available to Jasper when he turns 18.

(3 marks)

5 (a) In this question, give all your answers to the nearest dollar

Roy has an outstanding balance of $35 839.75 on a loan with interest that accumulates at a nominal annual interest rate of 9.96%, **compounded monthly.** Roy has been making repayments of $720 at the end of every month for 2 years.

Calculate the initial loan amount.

(2 marks)

(b) After 2 years of repaying back the loan Roy wants to increase his monthly repayments. The bank offers him an option to increase his payments to $980 and pay a nominal annual interest rate of 10.1%, **compounded monthly**.

Determine whether Roy should accept the option and justify your answer.

(6 marks)

6 (a) Jeff has an outstanding balance of \$66 900 on a loan that he has been repaying \$1840 every quarter for 4.5 years. The initial loan amount was \$80 000 with a nominal annual interest rate of r%, **compounded semi-annually.**

Find the value of r.

(2 marks)

(b) Jeff wants to change his repayments such that he makes monthly repayments and pays off the loan within a total of 10 years.

Find Jeff's new monthly repayment amount.

(4 marks)

7 (a) Helen takes out a loan of $105 000 with a nominal annual interest rate of 4.42%, **compounded monthly.** Helen makes 78 monthly repayments to amortise the loan.

Calculate

(i) the monthly repayment amount.

(ii) the amount of interest paid in amortising the loan.

(3 marks)

(b) 4 years into the loan Helen is considering paying off the loan in full, incurring a prepayment penalty of 8.2% of the remaining balance.

Determine whether Helen will save money by paying off the loan early.

(5 marks)