Question One: [2, 2, 2, 2, 2] =10 marks

(a) Elaine borrows $25000 from a bank that pays nominal compound interest of 7.94% per annum, compounding fortnightly.

Calculate the *effective interest rate* (%) for the above loan (to two decimal places)

$$i_{effective} = \left(1 + \frac{0.0794}{26}\right)^{26} - 1 \checkmark$$

$$= 0.08250 \times 100 = 8.25\% \checkmark$$

(b) Peter *invests* $15000 in an account that earns an interest of 4.6% interest per annum. Which compounding period would be best for Peter?

(Weekly) or *Monthly* or *Fortnightly* or *Yearly*. Explain why you chose your answer.

Since it's an investment, greater or more frequent compounding will generate the best return $\checkmark$ (Any suitable wording)

(c) Jacob is considering a loan of $35000 from his bank which charges an interest of 8.2% per annum. Which compounding period would be better for Jacob:

Fortnightly or *Monthly* or *Quarterly* or (Yearly.) Explain why you chose your answer.

Since it's a loan (borrow) the lesser the compounding period, the better is it for Peter $\checkmark$

(Any suitable wording)

(d) Some of these terms are related to each other and can be categorised into two distinct groups. Place the terms in the correct group.

Arithmetic Sequence   Compound Interest   Linear Model

Simple Interest   Constant Ratio $V_{n+1} = 0.85V_n$ Constant Difference

Geometric Sequence   Exponential Model $V_{n+1} = V_n - b$

Group 1	Group 2
Arithmetic	Geometric
Linear Model	Exponential Model ✓
Simple Interest	Compound Interest ✓
$V_{n+1} = V_n - b$	$V_{n+1} = 0.85 V_n$
Constant Difference	Constant Ratio

Maximum one error allowed

(e) A farm machinery costing $40,000 is depreciating at the rate of 6% per year. Write the recursive rule that will give the value of the machinery after 't' years.

$$V_{t+1} = 0.94 V_t \ ✓, \quad V_0 = 40\,000 \ ✓$$

Question Two: [1, 4, 7, 1, 1, 2] = 16 marks

Syazia needs to purchase a car. She finds a reducible interest loan from a bank at a rate of 7.75% per annum compounded fortnightly. The fortnightly repayments are $300. A partial spreadsheet is shown below:

Fortnight	Opening Balance ($)	Interest paid ($)	Repayments ($)	Closing Balance ($)
1	10500	31.30	300	10231.30
2	10231.30	A	300	B
3	C	29.69	300	9691.49
4	9691.49	28.89	300	9420.38
5	9420.38	28.08	300	9148.46
6	9148.46	27.27	300	8875.73
"	"	"	"	"
36	D	E	300	304.67
37	304.67	0.91	300	5.57
38	5.57	F	G	0.00

(a) What loan amount did Syazia borrow from the bank?

$10500 ✓

(b) The recursive formula for this loan that will give the amount at the end of each fortnight can be written as:

$$A_{n+1} = \left[1 + \frac{a}{b}\right] A_n - c \qquad A_0 = d$$

Write down the values of a, b, c, and d.

a = 0.0775 ✓   b = 26 ✓   c = 300 ✓   d = 10500 ✓

Hence rewrite the rule with the answers obtained above.

$$A_{n+1} = \left(1 + \frac{0.0775}{26}\right) A_n - 300 \qquad A_0 = 10500$$

There is no need to evaluate the fraction $\frac{a}{b}$. Leave it as a fraction.

(c) Determine the table entries labelled A to G

$$A = 10231.30 \times \frac{0.0775}{26} = 30.50 \quad \checkmark$$

$$B = 10231.30 + 30.50 - 300 = 9961.80 \quad \checkmark$$

$$C = 9961.80 \quad \checkmark$$

$$D = T_{35} = 602.87 \quad \checkmark$$

$$E = 602.87 \times \frac{0.0775}{26} = 1.80 \quad \checkmark$$

$$F = 5.57 \times \frac{0.0775}{26} = 0.02 \quad \checkmark$$

$$G = 5.57 + 0.02 = 5.59 \quad \checkmark$$

(d) What is the amount of the final repayment?

$$\$5.59 \quad \checkmark$$

(e) How much is owing on this reducible interest loan after the first year?

$$A_{26} = \$3247.13 \text{ is owing} \quad \checkmark$$

(f) Calculate the total amount of interest Syazia will be required to pay on this reducible interest loan.

$$A_{38} = -294.41 \quad \checkmark$$

$$\therefore \text{ Interest is } 37 \times 300 + 300 - 294.41$$

$$= 11105.59 - 10500 \quad \checkmark$$

$$= \$605.59$$

Question Three: [3, 1] = 4 marks

Magda invests $40 000 in an annuity paying interest at the rate of 6% per annum, compounding quarterly. She receives a payment of $10 380 each quarter for one year. This loan can be modelled using the recurrence relation:

$$V_{n+1} = RV_n - D \qquad V_0 =$$

V_n is the balance of the loan after n payments have been received.

(a) State the values of R, D and V_0

$$R = \left(1 + \frac{0.06}{4}\right) = 1.015 \checkmark$$
$$D = 10380 \checkmark \qquad V_0 = 40\,00\,0 \checkmark$$

(b) Determine the balance of the annuity after six months?

Six months = 2 quarters
$$V_2 = \$20\,293 \cdot 30$$

Question Four: [2, 1, 3, 4 mark each] = 10 marks

Fareed borrowed $250000 at a rate of 7.8% per annum compounded monthly. He makes monthly repayments of $2060.09 to repay the loan.

(a) How long will it take Fareed to repay the loan?

$$N = 240$$

240 months or 20 years $\checkmark$

(If using Financial Menu, show all entries in the table on the right. If using Sequence Menu write the recursive rule to show how you got the answer)

N		$\checkmark$
I%	7·8	
PV	250000	
PMT	-2060·09	
FV	0	
P/Y	12	
C/Y	12	

(b) How much of the loan has been repaid by the end of 4 years?

$$N = 48 \qquad FV = 225583 \cdot 01$$

$$250\,000 - 225583 \cdot 01 = \$24416 \cdot 99$$

has been paid off

After 4 years, Fareed increases his monthly repayments to $2250.

(c) Calculate by how many months the length of the loan is reduced by this increase in repayments. You may round to the nearest month.

New PV = 225583.01, New PMT = -2250

N = 162.7 ≈ 163 months

∴ 163 + 48 = 211

240 - 211 = 29 months earlier ✓

(d) How much will Fareed save on this loan by increasing his repayments to $2250 after 4 years.

Originally 240 × 2060.09 = $494421.60

But 48 × 2060.09 = 98884.32 ⎤
162 × 2250 = 364500   ⎥ Total
                            ⎥
$$N = 162$$
$$FV = 1744.83 \qquad 1744.83\left(1 + \frac{0.078}{12}\right) = 1756.17$$ ⎦

Total = 465140.49   ∴   494421.60
                       − 465140.49
                       _____
                        $29281.11 Saved

Question Five: [3, 1] = 4 marks

Najma received an inheritance of $642000 and invested the amount in a **perpetuity** that pays 6.1% per annum, compounding quarterly.

(a) What is the perpetuity amount that Najma receives quarterly?

$642000 × (0.061 ÷ 4)$ ✓

$= \$9790.50$ ✓

(b) After five quarterly payments to Najma, how much money remains of the investment?

$642000 (as it's a perpetuity so investment value stays the same)$ ✓

Question Six : [2, 1, 2, 1] = 6 marks

Khalid borrows $50,000 to refurbish his apartment. At the end of each month interest is added to the outstanding balance and then a repayment is made. Khalid has agreed to repay the loan in full by making equal monthly repayments of $609.29 for 10 years.

(a) Determine correct to one decimal place the annual compounding rate of interest

$N = 120$
$PV = 50000$
$PMT = -609.29$
$FV = 0$
$P/Y = 12$
$C/Y = 12$ ✓
$\boxed{I\%} = 8.1\%$ ✓

(b) Calculate the amount Khalid owes after the first year.

$N = 12$
$FV = \$46614.80$ ✓

(c) How much interest will Khalid pay on this loan?

Amortisation $PM1 = 1$ ✓
$PM2 = 120$ $\Sigma INT = \$23114.80$ ✓

(d) When does the amount Khalid owes first fall below $25000?

$FV = -25000$

$N = 71.7$

During the 72nd month ✓

END OF TEST