MA99 EDUCATION

Focus area 2 Investment and loans: Summary

02

NSW MATHEMATICS STANDARD 11-12 SYLLABUS 2024 FOR HSC 2027 AND LATER

Investment and loans, summarised

Standard 1

Standard 1: everything here applies except shares, and solving loan problems with a repayment table. Loan tables run for up to three periods. Standard 1 also explains how the declining balance and compound interest formulas are alike and differ.

The formulas

What	Formula	Notes
Simple interest	$I = Prn$	r and n in the same period; linear graph, gradient Pr
Compound interest	$FV = PV(1+r)^n$	On the reference sheet; exponential graph
Present value	$PV = \dfrac{FV}{(1+r)^n}$	Also for past values (appreciation backwards)
Rate from FV and PV	$1 + r = \sqrt[n]{FV \div PV}$	\$5000 to \$6000 in 4 years: 4.66%
Inflation, appreciation	$FV = PV(1+r)^n$	CPI rose 4.0% in the year to August 2026 (ABS)
Dividend yield	$\dfrac{\text{annual dividend per share}}{\text{current price}} \times 100\%$	Franked dividends excluded
Shares bought, sold	price × number ± brokerage	Add when buying, subtract when selling
Straight-line	$S = V_0 - Dn$	Reference sheet; linear
Declining balance	$S = V_0(1-r)^n$	Reference sheet; exponential decay
Loan, one period	owing + interest − repayment	Interest = owing × rate per period
Repayment from a table	(amount ÷ 1000) × table value	\$28 000, 7%, 5 years: \$554.40 (table factor 19.80)
Card interest	$P(1 + \frac{\text{annual rate}}{365})^d - P$	Each transaction for its own d days

Compounding periods

Compounded	r per period	n for t years
Annually	annual rate	t
Half-yearly	annual rate ÷ 2	$2t$
Quarterly	annual rate ÷ 4	$4t$
Monthly	annual rate ÷ 12	$12t$
Fortnightly	annual rate ÷ 26	$26t$
Daily	annual rate ÷ 365	$365t$

How to answer the question

1. **Investment questions.** Decide simple or compound. Write r and n for the period. Substitute. Answer with what the value means.
2. **When does it reach a value?** For compound growth or declining balance, try whole periods either side.
3. **Comparing investments.** Value of each at the same date, then the person's need for access, risk and time. Recommend one, with a reason.
4. **Spreadsheets.** Inputs in their own cells; absolute references (`$B$2`) for the inputs; each row from the row above (`=D5`).
5. **Reducing balance table.** Interest on the opening balance, add it, subtract the repayment, carry down.
6. **Effect of a change.** More often, more money or sooner means less owing earlier, so less interest and a shorter term.
7. **Credit card interest.** Daily rate, days for each transaction (count both ends if told), compound each, add.

Common errors

Trap	Instead
Monthly rate with years, or annual rate with months	Match r and n to one period
$(1 + r)$ for depreciation	$(1 - r)$; and not r of the initial value each year
Brokerage forgotten on the sale	Subtract it from the sale amount
Yield on the purchase price when the current price is given	Use the current price
Rounding a time to reach a value down	The first whole period that passes it
Daily rate as annual × 365	Annual ÷ 365
Days counted without the first or last day	Count as the question says: 12 to 30 June inclusive is 19
Comparing totals without the person's situation	Check what they can pay, and when they need it

Checklist

- ☐ Find simple interest, and any one of P, r, n from the others
- ☐ Find FV, PV or r for compound interest with any compounding period
- ☐ Model inflation and appreciation
- ☐ Compare simple and compound interest by table, graph and spreadsheet
- ☐ Read share price tables and graphs; find dividends, yield and brokerage (Standard 2)
- ☐ Compare savings accounts, term deposits, shares and property
- ☐ Find salvage values both ways, and read a depreciation spreadsheet
- ☐ Find the costs of buy now, pay later, payday and long term loans
- ☐ Complete a reducing balance table and read a loan spreadsheet
- ☐ Use a repayment table to find repayments, totals and interest (Standard 2)
- ☐ Read a credit card statement and find daily compound interest
- ☐ Recommend credit for a short, medium or long term goal, and justify it

Written to the NSW Mathematics Standard 11-12 Syllabus (2024), the syllabus Year 12 studies from Term 4 2026, first examined in the 2027 HSC. Year 11 work is assumed, and HSC questions can draw on it.

About this resource

MA99 EDUCATION

Scope

NSW Mathematics Standard, Year 12. Written to the NSW Mathematics Standard 11-12 Syllabus (2024), Standard 2 focus area 2, Investment and loans (MST-12-S2-02), and for Standard 1 Investment (MST-12-S1-02) and Depreciation and loans (MST-12-S1-03), for students sitting the HSC in 2027 and later years. Every value, identity and solution was re-derived independently by computer algebra before printing. Contexts in the questions are invented unless a source is named.

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MA99 EDUCATION

Focus area 2 Investment and loans: Practice Questions

02

NSW MATHEMATICS STANDARD 11-12 SYLLABUS 2024 FOR HSC 2027 AND LATER

How to use this set

Band	What the questions ask	Marks here
Foundation	One idea, applied once	8
Standard	Two steps, or one step plus a decision	10
Advanced	Three or more steps, or a method you must choose first	12
Exam-style	Multi-part, written the way the HSC writes them	12

Total 42 marks. A calculator is needed. Give money to the nearest cent. The broker in Question 11 is FlatTrade from the notes: $9.50 for trades up to $1000; $19.95 over $1000 up to $15 000; 0.14% of the trade value over $15 000.

Standard 1

Standard 1 students: Questions 1 to 4, 6 to 10, 12, 13 and 15 suit you. Questions 5, 11 and 14 are Standard 2 only.

Questions

FOUNDATION One idea, applied once.

Question 1

1 MARK

What is the simple interest on $3000 at 4% p.a. for 30 months?

A $300
B $3600
C $360
D $3300

Question 2

1 MARK

Which best describes the graph of the value of a compound interest investment against time?

A A straight line through the origin
B A straight line with a positive vertical intercept
C An exponential curve
D A horizontal line

Question 3

2 MARKS

Find the future value of $6500 invested for 4 years at 3.6% p.a. compounded monthly.

Question 4

2 MARKS

A television bought for $\$1850$ depreciates by $\$280$ a year by the straight-line method.

(a) Find its value after 5 years. 1 MARK

(b) During which year does the model give it a value of zero? 1 MARK

Question 5

2 MARKS

Hana owns 1200 shares, and the company pays a dividend of 18c per share.

(a) Find the total dividend she receives. 1 MARK

(b) The current share price is $\$4.50$. Find the dividend yield. 1 MARK

STANDARD Two steps, or one step plus a decision.

Question 6

1 MARK

Which expression gives the amount to invest now at 4.4% p.a. compounded quarterly to have $\$15\,000$ in 6 years?

A $15\,000(1.011)^{24}$

B $\dfrac{15\,000}{(1.011)^{24}}$

C $\dfrac{15\,000}{(1.044)^{24}}$

D $\dfrac{15\,000}{(1.011)^{6}}$

Question 7

1 MARK

A machine bought for $\$24\,000$ depreciates at 15% p.a. by the declining balance method. What is it worth after 3 years, to the nearest dollar?

A $\$13\,200$

B $\$36\,501$

C $\$3600$

D $\$14\,739$

Question 8

3 MARKS

A credit card with no interest-free period charges 18.99% p.a. compounded daily. A $\$2150$ purchase is made on 12 August, and interest is charged from 12 August to 31 August inclusive.

(a) Find the number of days and the daily interest rate, as a percentage to four decimal places. 1 MARK

(b) Find the interest charged. 2 MARKS

Question 9

3 MARKS

Jo borrows $\$12\,000$ at 6% p.a., with interest calculated monthly, and repays $\$400$ a month. Complete a table showing the amount owing at the start, the interest and the amount owing at the end for months 1 to 3.

Question 10

2 MARKS

Prices rose 4.0% in the 12 months to August 2026 (ABS). A coffee costs $\$4.80$.

(a) Find its price in 3 years if prices keep rising at 4.0% a year. 1 MARK

(b) Find its price in 3 years at the RBA's target midpoint of 2.5% a year. 1 MARK

ADVANCED Three or more steps, or a method you must choose first.

Question 11

4 MARKS

Rafi buys 1500 shares at $\$6.40$ through FlatTrade. Over the next year he receives dividends of 22c per share, then sells all his shares at $\$7.15$ through FlatTrade.

(a) Find the total cost of buying the shares. 1 MARK

(b) Find the amount he receives from the sale. 1 MARK

(c) Find his total gain, including dividends. 1 MARK

(d) Express the gain as a percentage of the total cost, to one decimal place. 1 MARK

Question 12

4 MARKS

Mia needs $\$1500$ for 4 months. Option 1 is a payday loan charging the maximum fees allowed: an establishment fee of 20% and a monthly fee of 4% of the amount borrowed. Option 2 is a credit union loan at 9% p.a. simple interest with a $\$50$ fee.

(a) Find the total Mia repays with Option 1. 2 MARKS

(b) Find the total she repays with Option 2. 1 MARK

(c) How much does Option 2 save her? 1 MARK

Question 13

4 MARKS

A laptop costing $\$3200$ depreciates at 25% p.a. by the declining balance method. A spreadsheet holds the initial value in B2 and the rate in B3; from row 6 down, column B holds the value at the start of each year, column C the depreciation and column D the value at the end.

(a) Write a formula for C6 that can be filled down. 1 MARK

(b) Find the value at the end of year 2. 1 MARK

(c) Find the depreciation in year 3. 1 MARK

(d) By the straight-line method at $\$600$ a year, which method gives the higher value after 3 years? Show your working. 1 MARK

EXAM-STYLE Multi-part, written the way the HSC writes them.

Question 14

6 MARKS

The table shows monthly repayments per $\$1000$ borrowed.

(a) Sam borrows $\$34\,000$ at 8% p.a. over 5 years. Find his monthly repayment. 1 MARK

(b) Find the total he repays, and the interest. 2 MARKS

(c) Over 4 years instead, how much interest would Sam save? 2 MARKS

(d) Give one other way Sam could reduce the interest on the 5 year loan. 1 MARK

Term	6% p.a.	7% p.a.	8% p.a.	9% p.a.
3 years	30.42	30.88	31.34	31.80
4 years	23.49	23.95	24.41	24.89
5 years	19.33	19.80	20.28	20.76
7 years	14.61	15.09	15.59	16.09

Question 15

6 MARKS

Ava has $8000 to invest for 6 years. Option A is a term deposit at 4.6% p.a. simple interest. Option B is a savings account at 4.4% p.a. compounded monthly.

(a) Find the value of Option A after 6 years. 1 MARK

(b) Find the value of Option B after 6 years. 2 MARKS

(c) Which option is worth more after 6 years, and by how much? 1 MARK

(d) Using a table of values or a spreadsheet, find the first whole year in which Option B is worth more than Option A. 2 MARKS

WORKING SPACE

WORKING SPACE

Worked solutions · Foundation

1

30 months is 2.5 years: $I = 3000 \times 0.04 \times 2.5 = 300$. (A)

B uses $n = 30$ with an annual rate. C uses 3 years. D is the value of the investment, not the interest.

2

$FV = PV(1 + r)^n$ is exponential in n. (C)

A describes simple interest earned; B the value of a simple interest investment; D money that never grows.

3

$r = 0.036 \div 12 = 0.003$, $n = 48$: $FV = 6500(1.003)^{48} \approx \$7505.13$

WHERE THE MARKS ARE	
1 mark	$r = 0.003$ and $n = 48$
1 mark	$\$7505.13$

4

(a) $S = 1850 - 280 \times 5 = \$450$ (b) $1850 \div 280 \approx 6.6$, so during the 7th year.

WHERE THE MARKS ARE	
1 mark	$\$450$
1 mark	the 7th year

5

(a) $1200 \times 0.18 = \$216$ (b) $\dfrac{0.18}{4.50} \times 100 = 4\%$

WHERE THE MARKS ARE	
1 mark	$\$216$
1 mark	4%

Worked solutions · Standard

6

$r = 0.044 \div 4 = 0.011$, $n = 24$, and $PV = \dfrac{FV}{(1 + r)^n}$. (B)

A is a future value. C uses the annual rate with quarterly periods. D uses years with a quarterly rate.

7

$24\,000 \times 0.85^3 = 14\,739$. (D)

A takes 15% of the initial value each year (straight-line). B uses 1.15, growth. C is one year's straight-line loss.

8

(a) $31 - 12 + 1 =$ 20 days; daily rate $= 18.99 \div 365 \approx$ 0.0520%.

(b) $2150\left(1 + \dfrac{0.1899}{365}\right)^{20} - 2150 \approx$ $22.48

WHERE THE MARKS ARE	
1 mark	20 days and 0.0520%
1 mark	the compound expression
1 mark	$22.48

9

Month	Owing at start	Interest (0.5%)	Owing at end
1	$12 000.00	$60.00	$11 660.00
2	$11 660.00	$58.30	$11 318.30
3	$11 318.30	$56.59	$10 974.89

WHERE THE MARKS ARE	
1 mark	month 1
1 mark	month 2
1 mark	month 3

10

(a) $4.80 \times 1.04^3 \approx$ $5.40 (b) $4.80 \times 1.025^3 \approx$ $5.17

WHERE THE MARKS ARE	
1 mark	$5.40
1 mark	$5.17

Worked solutions · Advanced

11

(a) $1500 \times 6.40 = 9600$, brokerage $19.95: $9619.95

(b) $1500 \times 7.15 = 10\,725$, brokerage $19.95: $10 705.05

(c) Dividends $1500 \times 0.22 = 330$; gain $= 10\,705.05 - 9619.95 + 330 =$ $1415.10

(d) $\dfrac{1415.10}{9619.95} \times 100 \approx$ 14.7%

WHERE THE MARKS ARE	
1 mark	$9619.95
1 mark	$10 705.05
1 mark	$1415.10
1 mark	14.7%

12

(a) Establishment $0.2 \times 1500 = 300$; monthly $4 \times 0.04 \times 1500 = 240$; total $1500 + 300 + 240 =$ $2040

(b) $1500 \times 0.09 \times \frac{4}{12} = 45$; total $1500 + 45 + 50 =$ $1595 (c) $445

WHERE THE MARKS ARE	
1 mark	both fees
1 mark	$2040
1 mark	$1595
1 mark	$445

13

(a) `=B6*$B$3` (b) $3200 \times 0.75^2 =$ $1800 (c) $1800 \times 0.25 =$ $450

(d) Declining balance: $1800 - 450 = 1350$. Straight-line: $3200 - 3 \times 600 = 1400$. Straight-line, by $50.

WHERE THE MARKS ARE	
1 mark	formula
1 mark	$1800
1 mark	$450
1 mark	$1400 against $1350

Worked solutions · Exam-style

14

(a) $34 \times 20.28 =$ $689.52

(b) $689.52 \times 60 =$ $41 371.20; interest $41\,371.20 - 34\,000 =$ $7371.20

(c) $34 \times 24.41 = 829.94$; $829.94 \times 48 = 39\,837.12$; interest $5837.12; saving $7371.20 - 5837.12 =$ $1534.08

(d) For example: repay fortnightly (half the monthly amount), make extra repayments, or pay a lump sum early. Each cuts the balance sooner, so less interest is charged.

WHERE THE MARKS ARE	
1 mark	$689.52
1 mark	$41 371.20
1 mark	$7371.20
1 mark	4 year total $39 837.12
1 mark	saving $1534.08
1 mark	a valid way, explained

15

(a) $8000(1 + 0.046 \times 6) = 8000 \times 1.276 =$ $10 208

(b) $8000\left(1 + \dfrac{0.044}{12}\right)^{72} \approx$ $10 412.00

(c) Option B, by $204.00

Year	A: $8000 + 368n$	B: $8000(1 + \frac{0.044}{12})^{12n}$
1	$8368.00	$8359.19
2	$8736.00	$8734.50
3	$9104.00	$9126.66

(d) B is behind in years 1 and 2 and first ahead in year 3, although A's rate is higher: compounding monthly on a growing balance overtakes it.

WHERE THE MARKS ARE	
1 mark	$10 208
1 mark	r and n for monthly compounding
1 mark	$10 412.00
1 mark	B by $204
1 mark	values for years 2 and 3
1 mark	year 3

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