 Year 12 Mathematics Standard 1

| MS-F2 Investment | Unit duration |
| --- | --- |
| Students develop an awareness of mechanisms to optimise their financial position, but now and into the future, justifying their thinking and reasoning mathematically. | 2 weeks |

| Subtopic focus | Outcomes |
| --- | --- |
| The principal focus of this subtopic is to calculate and compare the value of different types of investments over a period of time.Students develop awareness of mechanisms to optimise their financial position, both now and into the future, justifying their thinking and reasoning mathematically.Within this subtopic, schools have the opportunity to identify areas of Stage 5 content which may need to be reviewed to meet the needs of students. | A student:* makes informed decisions about financial situations likely to be encountered post-school MS1-12-5
* chooses and uses appropriate technology effectively and recognises appropriate times for such use MS1-12-9
* uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others MS1-12-10

Related Life Skills outcomes: MALS6-5, MALS6-6, MALS6-13, MALS6-14 |

| Prerequisite knowledge | Assessment strategies |
| --- | --- |
| This unit links to the Stage 5 unit MA5.2-4NA Financial Mathematics and the Stage 6 topic MS-F1 Money Matters |  |

All outcomes referred to in this unit come from [Mathematics Standard Stage 6](https://syllabus.nesa.nsw.edu.au/mathematics-standard-stage6/) Syllabus
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Glossary of terms

| Term | Description |
| --- | --- |
| Appreciated Value | Appreciation is an increase in the value of an asset over time. An appreciated value is the value an asset has increased to over that time. |
| Compound Interest | The interest earned by investing a sum of money (the principal) is compound interest if each successive interest payment is added to the principal for the purpose of calculating the next interest payment.For example, if the principal $P earns compound interest at the rate of r per period, then after n periods the principal plus interest is $P(1+r)n. |
| Depreciation | Depreciation is a decrease in the value of an asset over time. |
| Future Value | The future value of an investment or annuity is the total value of the investment at the end of the term of the investment, including all contributions and interest earned. |
| Inflation | A general increase in prices and fall in the purchasing value of money. |
| Present Value | The present value of an investment is the single sum of money (or principal) that could be initially invested to produce a future value over a given period of time. |
| Simple Interest | Simple interest is the interest accumulated when the interest payment in each period is a fixed fraction of the principal. |

| Lesson sequence | Content | Suggested teaching strategies and resources  | Date and initial | Comments, feedback, additional resources used |
| --- | --- | --- | --- | --- |
| Comparing investments(2 lessons) | * calculate the future value $(FV)$ or present value $(PV)$ and the interest rate $\left(r\right) $of a compound interest investment using the formula $FV=PV(1+r)^{n}$ **Paperclip icon**  Information and communication technology capability icon
* compare the growth of simple interest and compound interest investments numerically and graphically, using technology Critical and creative thinking icon  Information and communication technology capability icon
* investigate the effect of varying the interest rate, the term or the compounding period on the future value of an investment, using technology  Information and communication technology capability icon
* compare and contrast different investment strategies, performing appropriate calculations when needed Critical and creative thinking icon Personal and social capability icon Work and enterprise icon
 | Introducing investments* The teacher introduces the concept of an investment, for example:

There are many different ways to invest money over a period of time. It is important for customers to make informed decisions about available schemes to ensure they receive the most out of their chosen investment. Factors that affect an investment include: initial investment amount, interest rate, chosen time period and selected investment pathway.* Teacher to lead a discussion on what is interest and why do we have it. See maths is fun [introduction to interest](https://www.mathsisfun.com/money/interest.html)

**Comparing simple and compound interest*** The teacher defines the following terminology in the context of an investment: interest rate, term, future value, present value, simple interest, compound interest and compounding period.

**Resources:** [Compound interest explained](https://www.youtube.com/watch?v=wf91rEGw88Q), [Difference between simple interest and compound interest](https://www.youtube.com/watch?v=FsS741Dow30)* Student activity: Students investigate the future value or growth of an investment using technology:
* Students compare the growth of investments under simple and compound interest keeping all variables constant.

An example of a graph depicting how the value of an investment changes over time for simple interest and compound interest.* Students discuss which method they would prefer interest to be calculated using if they were borrowing or investing money.
* Students explain the difference between simple interest and compound interest both numerically and graphically.

**Examining the effect of varying an investment*** Teachers lead a discussion on what factors affect the future value or amount of interest accumulated in a compounding investment scheme.
* Students use digital technologies to create graphs of different investment schemes to:
* examine the effect of varying the interest rate on the investment’s future value.
* examine the effect of varying the term on the investment’s future value.
* examine the effect of varying the compounding period on a compound interest investment’s future value.
* Students summarise their findings. Findings may include:
* Increased compounding time periods results in more accumulated interest and greater future value amount at the end of the investment period.
* An increase in the term or interest rate can significantly increase the future value of the investment scheme. Note: To counter the argument that a higher interest rate is always better, the teacher can lead a discussion about the risk associated with an investment.

**Resources:** compound-versus-simple-interest-template.XLSX, compound-versus-simple-interest-completed.XLSX* The teacher reinforces the students’ findings using an appropriate visual representation such as the interactive Desmos [interest graph (1)](https://www.desmos.com/calculator/aq8s6c3vgp), [interest graph (2)](https://www.desmos.com/calculator/skjxrjtaer) or the money smart [compound interest calculator](https://www.moneysmart.gov.au/tools-and-resources/calculators-and-apps/compound-interest-calculator).
 |  |  |
| Calculating the future value of an investment(2 lessons) | * calculate the future value $(FV)$ or present value $(PV)$ and the interest rate $\left(r\right) $of a compound interest investment using the formula $FV=PV(1+r)^{n}$ **Paperclip icon**  Information and communication technology capability icon
* compare and contrast different investment strategies, performing appropriate calculations when needed Critical and creative thinking icon Personal and social capability icon Work and enterprise icon
 | **Developing the compound interest formula*** The teacher develops the future value formula $FV=PV(1+r)^{n}$ by noting in the financial sector, the compound interest formula, $A=P\left(1+r\right)^{n}$, is known as the future value formula.
* Future value, $FV$, is used in place of $A$
* Present value, $PV$, is used in place of $P$.
* Class activity: Develop a table of compounded values for $1. Collaboratively determine and model how to use the table to calculate the:
* future value of an investment
* present value of an investment

**Resource:** compounded-values-table.XLSX**Evaluating the future value of an investment*** The teacher models calculating the future value of an investment by substituting into the future value formula.
* Teacher to lead the development of students understanding that the ‘time period’ and ‘interest rate’ need to be ‘altered’ to correctly calculate interest given specific compounding period. This could be related back to their results in the Comparing investments lesson.
* Calculations should include:
* a range of compounding periods such as weekly, fortnightly, monthly, bi-annually, quarterly and yearly
* a range of interest rates including non-integer percentages
* interest rates expressed other than as ‘per annum’.
* NESA exemplar question:
* An amount of $3000 is invested and compounded annually at 5%. Use the table of compounded values of $1 to find the value of the investment after three years.

**Resource:** ms-f2-sample-question-solutions.DOCXNote: This resource contains solutions to sample questions referred to throughout the unit.* Other sample question: A principal of $1000 is to be invested for three years. Determine which of the following is the best investment option:
* 6% p.a. simple interest,
* 5.9% p.a. compounded annually, or
* 5.85% p.a. compounded half-yearly.

Resources: * Revision activities could be taken from the ‘[Reaching goals: What’s involved?](https://www.moneysmart.gov.au/media/558606/mst_secondary_maths10_unit.pdf)’ booklet for Year 10 students from ASIC’s Money Smart Program.
* [Comparing different compounding periods (money smart)](https://www.moneysmart.gov.au/managing-your-money/saving/compound-interest)
* [Simple interest calculator (WebMath)](http://www.webmath.com/simpinterest.html)
* [Compound interest calculator (WebMath)](http://www.webmath.com/compinterest.html)
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| Calculating the present value of an investment(1 lessons) | * calculate the future value $(FV)$ or present value $(PV)$ and the interest rate $\left(r\right) $of a compound interest investment using the formula $FV=PV(1+r)^{n}$ **Paperclip icon**  Information and communication technology capability icon
* compare and contrast different investment strategies, performing appropriate calculations when needed Critical and creative thinking icon Personal and social capability icon Work and enterprise icon
 | **Evaluating the present value of an investment*** The teacher initiates conversation by posing the question: You want to have $5000 in 2 years’ time to buy a car. How much do you need to invest today?
* The teacher to lead the students to identify that the single amount that needs to be invested today when the future value is known can be calculated using the formula: $PV=\frac{FV}{\left(1+r\right)^{n}}$
* The teacher models calculating the present value of an investment by substituting into the future value formula.
* NESA exemplar questions:
* Grandparents wish to save $10 000 for their grandchild’s university expenses, which will be available in eight years’ time. Calculate the single sum they need to invest at 5% pa compounded annually.
* Determine the single sum to be deposited if $10 000 is required in five years’ time and a rate of 3% pa, compounded quarterly.
* A principal of $1000 is invested for three years at an interest rate of 5.6% pa compounded half-yearly. Determine how much needs to be invested now to achieve the same interest if the interest rate was 3.5% pa compounded monthly.

**Evaluating the interest rate of an investment*** The teacher models calculating the interest rate of an investment by substituting into the present value formula and solving the resulting equation.
* Ensure students convert the resulting decimal answer into a percentage.

Resources: Revision activities could be taken from the ‘[Reaching goals: What’s involved?](https://www.moneysmart.gov.au/media/558606/mst_secondary_maths10_unit.pdf)’ booklet for Year 10 students from ASIC’s Money Smart Program. |  |  |
| Understanding inflation(1 lesson) | * solve practical problems involving compounding, for example determine the impact of inflation on prices and wages or calculate the appreciated value of items, for example antiques **AAM** **Paperclip icon**  Information and communication technology capability icon Personal and social capability icon Work and enterprise icon
 | **Introducing inflation*** The teacher leads a discussion on:
* Why do we pay more for things than our parents did?
* If a lack of money is a problem, why can’t we just print more of it?
* The teacher can introduce the concept of inflation, its causes and impact to students by showing the videos [explaining inflation](https://www.youtube.com/watch?v=WKZvm_fqYRM&list=PL523D79CFE26753E8&index=21&t=0s), [What causes inflation](https://www.youtube.com/watch?v=iiEiRZhfOl8), [What is inflation? (And why is it bad?)](https://www.youtube.com/watch?v=XwhFAuBSl9g)
* The teacher leads a discussion to:
* formalise the meaning of inflation. i.e. the rate at which the general level of prices for goods and services is increasing.
* Identify the causes of inflation.
* identify examples of the impact of inflation including its effect on prices, wages and the value of money. Consider how this effects household budgets and savings regimes.

**Solving problems involving inflation*** The teacher models how to evaluate the future price of an item by applying the future value formula.
* Sample questions:
* A loaf of bread currently costs $2.50. Calculate its cost in 4 years if the inflation rate is 2.7% p.a.
* The current price of a bag of rice is $20. Calculate its price 10 years ago if the average inflation rate over this time was 3.1%.
* The teacher models how to calculate the average annual rate of inflation by applying the future value formula.
* Student activity: Students examine the price of canteen items in 1978 and compare them to current prices.
* Students calculate the rate of inflation on each item
* Students determine if all items have inflated at the same rate.
* Student activity: Students use the RBA’s [inflation calculator](http://www.rba.gov.au/calculator/) or ABS’s [Inflation price calculator](http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Consumer%2BPrice%2BIndex%2BInflation%2BCalculator) to compare the price of goods in their year of birth to the present day.
* NESA exemplar question:
* A family currently pays $\$320$ for some groceries. Assuming a constant annual inflation rate of $2.9\%$, calculate how much would be paid for the same groceries in 5 years’ time.
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| Understanding appreciation(1 lesson) | * solve practical problems involving compounding, for example determine the impact of inflation on prices and wages or calculate the appreciated value of items, for example antiques **AAM** **Paperclip icon**  Information and communication technology capability icon Personal and social capability icon Work and enterprise icon
 | **Examining appreciation*** The teacher introduces the concept of appreciation by posing a question, how much will a car purchased for $30 000 today be worth in 5 years?
* The teacher leads a discussion to identify that over time an asset may decrease in value (depreciate) or increase in value (appreciate)
* The teacher identifies why items may depreciate, including the wear and tear of items on items like cars; or the emergence of newer technologies making older items more redundant.
* The teacher identifies why items may appreciate, including when the supply of an item is reduced there is increased demand for the item, like artwork. i.e. when an item is rare or becomes collectable.
* NESA exemplar question:
* It is predicted that a particular painting will appreciate at a rate of 5% per annum. Calculate its predicted value in 2020 if it was purchased in 2010 for $48 000.
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Reflection and evaluation

Please include feedback about the engagement of the students and the difficulty of the content included in this section. You may also refer to the sequencing of the lessons and the placement of the topic within the scope and sequence. All ICT, literacy, numeracy and group activities should be recorded in the ‘Comments, feedback, additional resources used’ section.