

# Saving for retirement.

**Note that we suggest you complete the activity called *Simple Annuities – Present Value* before starting this set of activities.**

## 'How much money will I need to retire?'

Almost every worker, from the youngest trainee upwards, is planning for retirement – whether they know it or not. This is because, due to government legislation, all employers pay 9% of their employee's salaries into a superannuation fund (with a possible exception of casual workers with low monthly earnings).

The self-employed are required, by the same legislation, to contribute money into a superannuation fund.



## So, what is a superannuation fund?

A superannuation fund is a special sort of savings account. Money that is paid in *cannot* be withdrawn (usually) until retirement age, in most cases 60 or 65 years of age.

So, the question of how much money one needs to retire becomes, for those of us who *aren't* counting on winning X-Lotto, *how much money do we need in our superannuation fund?*



This question is difficult to answer as people's individual circumstances differ. It comes down to how well you want to live and how long you plan to live in your retirement.

According to one investment firm the required figure is \$370 000. This figure can be arrived at by calculating the *present value* of an annuity from which about \$30 000 will be withdrawn for 20 to 25 years – check this for yourself using the skills learned in the last section.

## How am I going to save up *that much* money?

Obviously that amount of money takes a bit of saving. For example, regular deposits of \$200 per month would take over 150 years to accrue to \$370 000 by saving alone. As most people plan to work for only around 35 years, without the *magic of interest* we would have little chance of building up a sizable superannuation fund.



So, a superannuation fund grows in two ways, through regular contributions and through the interest that the fund earns. The interest varies with changes in international investment markets but is always a percentage of the balance of the account at a certain point in time (say every month).

The Australian Securities and Investments Commission says that, in the long term, a 7% interest rate can be expected for superannuation funds.

This form of investment is called an *annuity*. For such annuities we are most interested in the value they grow to at some point in the future – called the **future value** of the annuity.

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## Activity 1: Saving for your own super.

To get a feel for the way a super fund grows let's look at how a series of \$200 monthly payments grow if interest of 7% (compounded monthly) is added. On a CASIO 9860G AU do the following:

- Enter  $\text{RUN-MAT}$  mode
- Enter \$200 and commit it to the calculator's answer mode by pressing  $\text{EXE}$ .
- Multiply the  $\text{Ans}$  ( $\text{SHIFT}$  then  $\text{(-)}$ ) by  $(1+7 \div 1200)$  - to calculate the interest paid - then add 200 - the next contribution - and calculate the answer by pressing  $\text{EXE}$ .

What is the value of the annuity after one month?

**Important note.** In most instances, the institution does not pay interest for the first compounding period of this type of annuity (one month in this case). Also the interest is paid at the end of the compounding period paid on the value of the annuity at the end of the previous period.

**Because of this, the above value is the future value of the annuity at the end of the second month. At the end of the first month it will be worth just the \$200 you initially invested.**

By pressing  $\text{EXE}$  repeatedly find the value of the annuity after 3 months.



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## Activity 2: Generalising the calculations to find the future value of an annuity.

A formula exists for computing values associated with future value annuities. Its use saves us from pressing the  $\text{EXE}$  key 420 times in a row and allows other sorts of calculations to be performed. The derivation of the formula relies on knowledge of geometric series. You might like to research this.

Firstly, let's define each quantity as follows:

- Let the **future value** of the annuity (final balance), after  $n$  compounding periods, be  $A$
- Let the regular contributions be  $M$
- Let the percentage interest rate per compounding period be  $r$  (expressed as a decimal)
- Let the number of compounding periods be  $n$

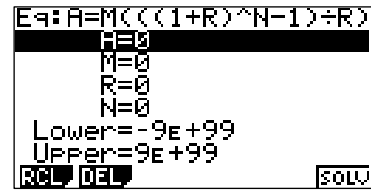
The formula is:

$$A = M \left( \frac{(1+r)^n - 1}{r} \right)$$

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The 9860G AU can be used to compute the value of  $A$ ,  $M$ ,  $r$  or  $n$  if all but one of the variables is known.

In  $\frac{EQVA}{3\% \rightarrow 0}$ , after choosing SOLV(er) **F3** the formula can be entered. Be sure to use brackets carefully.



With the formula entered, a row corresponding to each variable is created. You enter values for the variables that are known and, positioning the selection bar on the row of the variable you wish to find, press SOLV(e) **F6**

Once a result is given you can continue to use the formula you have entered. Simply press REPT **F1** and you will be prompted for the values of the variables again.

1. Use the future value of annuity formula to find out the future value of a superannuation annuity into which \$200 monthly is invested for 35 years which attracts an interest rate of 7% p.a.
2. What must the monthly contribution be so that, at the end of the 35-year period, a future value of \$370 000 is achieved?

*The ASIC interest rate is a prediction only. What would happen if it varied?*

3. Determine the future value of the super fund mentioned in question 1 if
  - a) the interest rate was 5%
  - b) the interest rate was 9%
  - c) Comment on this result.

*For most people money is 'tight' while they are 'starting out' – paying off a home and raising a family. What would happen if less money was contributed into super in these early years, and more was contributed later?*

4. Determine the future value of contributing \$150 for the first 17.5 years and then \$250 for the next 17.5 years (use ASIC's 7% interest rate)
5. Reverse this (\$250 early and \$150 later) and determine the future value.
6. Compare your answers for questions 4 and 5 with the answer to question 1. Which would you choose to do if you could?



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## Activity 3: More on the future value of an annuity.

Suppose we wanted to know how long we would need to invest \$100 per month into an annuity to grow it to \$12000 (so we could buy that Sharp LCD TV) if the interest paid was 4%, compounded monthly.

This would require us to solve the equation  $12000 = 100 \left( \frac{\left(1 + \frac{4}{1200}\right)^n - 1}{\frac{4}{1200}} \right)$  for  $n$ .

1. Find how long it will be until we can buy the LCD TV above, by solving this equation with the 9860G AU.
2. Jillian has just turned 16 years old and has her mind set on buying a new car by the time she is 20 years old. To achieve this goal she decides to save as much money as she can over this period. She can afford to save \$440 per month. She regularly places the money into an annuity that pays 5.5% per annum compounded monthly.
  - a. How much will she have to spend?
  - b. Determine the amount of interest she has earned over this time.
3. Lucy can invest \$150 per month in an annuity for 2 years. What interest rate must she invest at if the annuity is to be worth \$5 000 at the end of the 2 years. Assume the interest is compounded monthly.
4. A 'Christmas Club' savings account has weekly contributions made to it. What size of contributions would be required for the future value of the 'Christmas Club' savings account to be \$2000 if contributions are made for 52 weeks with an interest rate of 3.9% p.a., compounded weekly?



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