

The Legacy

Teacher Notes

Introduction

This activity originates from a problem posed on the NRIC website. (<http://nrich.maths.org>)

Your school has been left £1,000,000 in the will of an ex-pupil.
The pupil made some conditions on how the money should be invested and used.
These were:

- the school must benefit by spending part of the money every year.
- the investment should have a lifetime of at least 50 years.

You are asked to produce models of investment and expenditure based on any balance being invested at a fixed interest rate (it is suggested that you could start with a rate of 4%). Your model could also consider different inflation rates.

What model would you choose to ensure the best return for the school over a period of 50 years?

A TI-Nspire document poses the problem and invites students to try 5 different models. Spreadsheets have already been set up for each model and once students can try different values of the key variables (r , the interest/inflation rate, e the initial annual expenditure, etc.) The data generated by the spreadsheet can be used to plot time series graphs for expenditure or remaining investment over the years.

Resources

The tns document TheLegacy.tns can be displayed on a large screen for class teaching and can also be loaded onto handhelds so that students can explore the various models individually or in pairs.

There is also a file containing a three-page handout for students.

Skills required

Students will need to be able to carry out the following simple processes on their handhelds.

- Open a tns document.
- Move from one page to another.
- Move from one part of a split screen to another..
- Move from cell to cell and scroll on a Lists & Spreadsheet page.
- Choose and change variables on a Data & Statistics page.

The activity

Introduction.

The image shows three screenshots of a TI-Nspire document titled "The Legacy". Each screenshot shows a different page of the document, with page numbers 1.1, 1.2, and 1.3 visible in the top navigation bar.

- Page 1.1:** The title "The Legacy" is centered. Below it, the text reads: "A problem from the NRIC website. Your school has been left £1,000,000 in the will of an ex-pupil. The school must benefit by spending part of the investment every year. The money must last at least 50 years."
- Page 1.2:** The text reads: "There are five different models to investigate in this file. Variables are: r the rate of interest (assume this equals the rate of inflation), e is the amount spent each year, f is a fixed sum used to alter the expenditure each year. Change these values by typing e.g. $r : = 5$ ".
- Page 1.3:** The text reads: "For each model check the cells of the spreadsheet to see how the expenditure and remainder at the end of the year have been calculated. For each model you can also plot the expenditure or remainder against the years. Typing **totalexp** will show you how much the school will be able to spend over 50 years."

Each of the five models are set out like this.

Model A

Investigate a model based on:

- a fixed interest rate, r ;
- constant expenditure each year, e .

Try changing r and e . For example try typing $e := 25000$

A	years	B	expe...	C	remainder
1	0.	—	—	—	1000000.
2	1.	20000.	—	—	1020000.
3	2.	20000.	—	—	1040800.
4	3.	20000.	—	—	1062432.
5	4.	20000.	—	—	1084929.

totalexp

1000000.

Click to add variable

Some possible results for various models.

$r = 4.$

$e = 20000.$

totalexp 3053342.

A	years	B	exp...	C	remainder
48	47.	93600.	—	—	221092.
49	48.	95200.	—	—	134736.
50	49.	96800.	—	—	43325.
51	50.	98400.	—	—	-53342.

totalexp 1305171.

