Growing Interest
Student Activity

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TI-Nspire CAS **Investigation** **Student** **180min**

Aim

To compare the different growth patterns for a sum of money invested under a simple interest plan and a compound interest plan.

Equipment

For this activity you will need:

- TI-Nspire CAS (or TI-Nspire)

Problem Description

Daisy is a hard-working maths student who was the lucky winner of a scholarship lump sum payment of $2000. She was absolutely delighted but she did not need to use the money straight away. She decided to put it into an investment account so that she could withdraw it at a later time to help her with her studies. When she went to her bank, Daisy saw that there were two different investment options available:

a) Simple interest paid at 5% p.a.
b) Compound interest at 4% p.a.

INVESTMENT ACCOUNT	INVESTMENT ACCOUNT
5% per annum	**4% per annum**
(simple interest paid annually)	(compound interest paid annually)

Which investment option should Daisy choose?

Are there any other factors that could affect her decision?

Essential Understanding

It is essential for this investigation to understand that simple interest and compound interest are two different ways that interest can be calculated and paid into an investment account. This investigation will help you understand that compound interest is repeated applications of simple interest.

Simple Interest is when an interest amount is calculated on the principal and then that fixed amount is paid into the investment account at the end of each investment period.

Compound Interest is when the first interest payment is made into an account and the new account balance is then used to calculate the interest that is due for the next investment period and so on. Because the account balance grows after each interest payment, each subsequent interest payment also increases.

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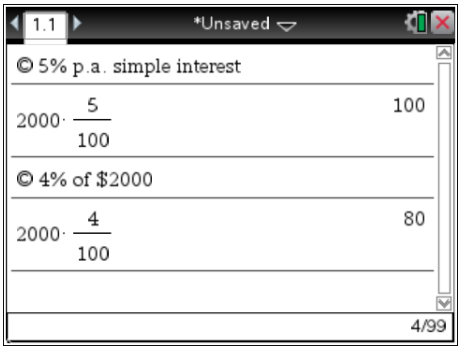
Technology

Calculating the interest amount for the first year

Open a new **Calculator** page. Determine how much interest would be paid for the first year by each of the two investment plans. Remember that 'percent' means 'per hundred'. A good way to do this is to input **2000** and then use the fraction template to multiply it by the percentage over **100**.



Simple Interest

First, we need build a spreadsheet that shows how the investment account balance grows under the simple interest plan.

Step 1. Open a new **Lists & Spreadsheet** page.

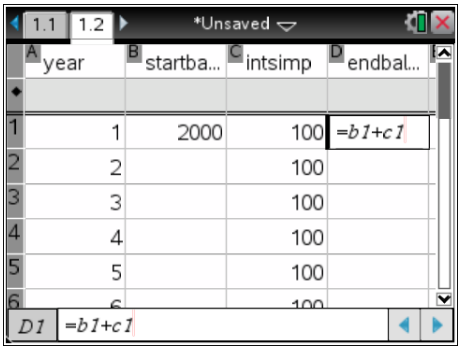
Step 2. Input column headings of **year**, **startbalsimp**, **intsimp**, and **endbalsimp**.

Step 3. In the **year** column input the data: **1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10**.

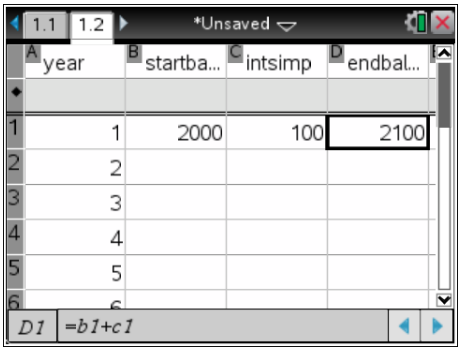
Step 4. In the **intsimp** column enter the value **100** into each of the first ten cells of that column.(Note: the 100 is the amount of simple interest that will be paid into the account each year, as determined on the calculator page in the previous section.

Step 5. In cell **B1** input **2000**.

Step 6. In cell **D1** input **=b1+c1**.



Step 7. Press **enter** and the formula will convert to **2100**, which is the balance at the end of the first year.



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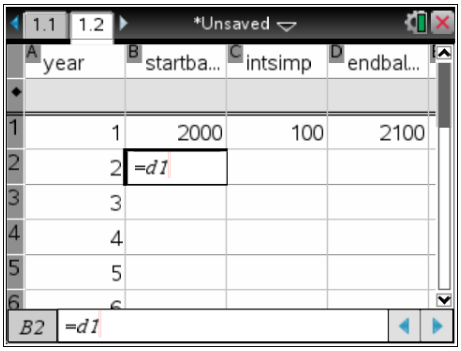
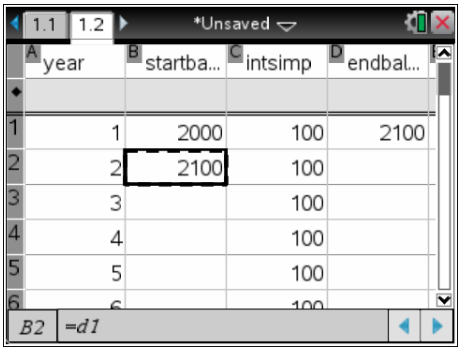
Step 8. Move to cell **B2** and input **=d1**.
(Note that the spreadsheet will insert the value **2100** into cells **D1** and **B2**.)



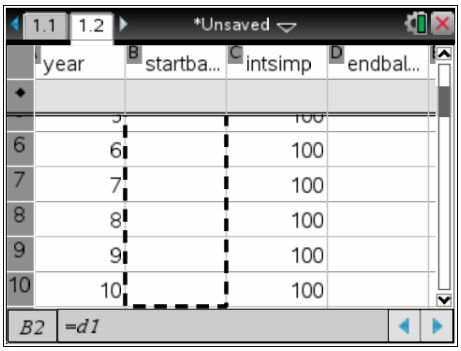
Step 9. We now want to do a relative copy of the formulas in cells **D1** and **B2** to the other cells of those columns. There are several ways in which this can be done. If you are unsure how to do this, then you may wish to perform the following steps:

a. Use the arrow keys to highlight cell **B2**.

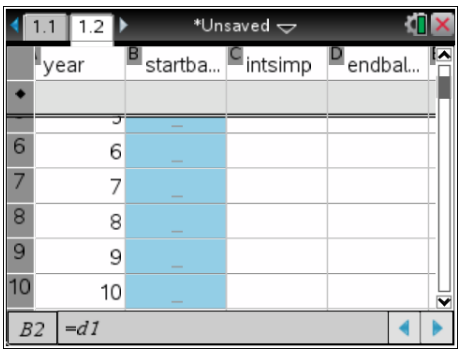
b. Press and hold the **mouse** key until a broken dashed line indicates that the cell has been selected.



c. Use the **down arrow** key to 'stretch' the selected area downwards until you get to row 10.



d. Press **enter**. (Note: No values will be displayed yet as the **startbal** for each year needs the figures of the **endbal** from the previous year, which are yet to be calculated).



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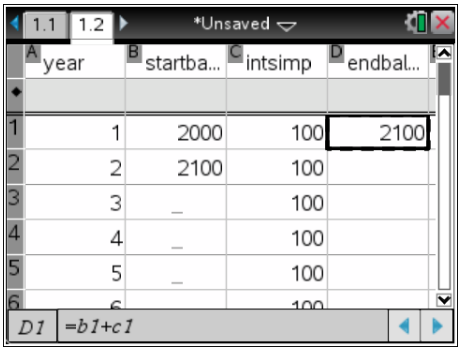
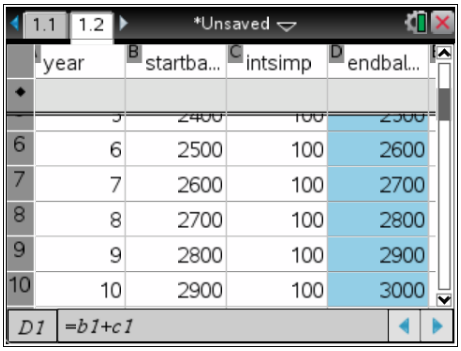
e. Move the cursor to cell **D1**.



Step 10. Perform the following steps to set up the **endbal** formula in column **D**:

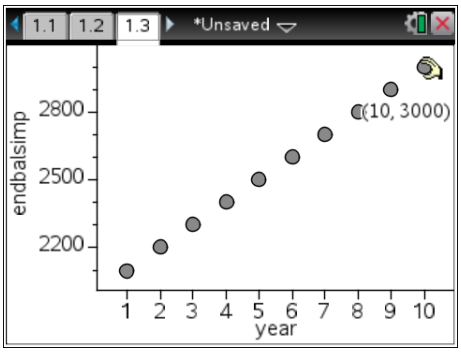
a. Use the arrow keys to highlight cell **D1**.
b. Press and hold the **mouse** until a dashed line indicates that the cell has been selected.
c. Use the **down arrow** to 'stretch' the selected area downwards until you get to row 10.
d. Press **enter**. (Note that all the values for both columns **B** and **D** will now be displayed.



Question: By referring to the spreadsheet, what amount will Daisy's $2000 investment have grown to after 10 years?

Step 11. Open a **Data & Statistics** page. Set **year** as the independent variable (horizontal axis) and **endbalsimp** as the dependent variable (vertical axis).

Question: How would you describe the shape of the scatterplot?



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Compound Interest

Now let's build a spreadsheet that shows how the investment account balance will grow under the compound interest plan.

Step 1. Open a new **Lists & Spreadsheet** page.

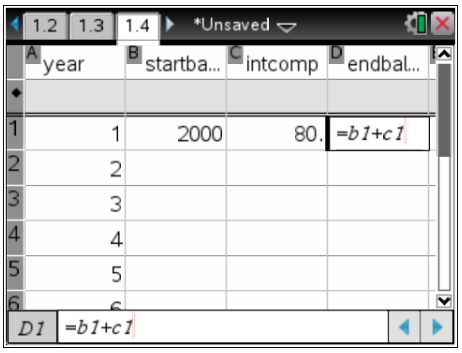
Step 2. Set the column headings as **year**, **startbalcomp**, **intcomp**, and **endbalcomp**.

Step 3. In the **year** column, the previous data **1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**, **9**, **10** will be displayed. If not, input these values again.

Step 4. In cell **B1** input **2000**.

Step 5. In cell **C1** input **=b1×0.04**.

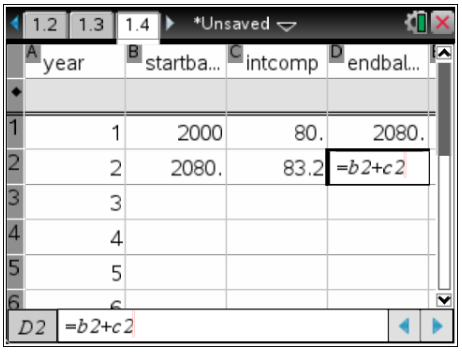
Step 6. In cell **D1** enter **=b1+c1**.



Step 7. In cell **B2** input **=d1**.

Step 8. In cell **C2** input **=b2×0.04**.

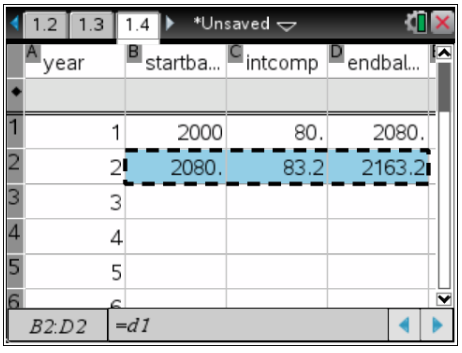
Step 9. In cell **D2** input **=b2+c2**.



Step 10. Perform the following steps to relatively copy the row two formulas:

a. Use the arrow keys to move to cell **B2**. Press and hold the **mouse** key and then press the **right arrow** to move across to column **D**.

b. Press and hold the **mouse** key until a broken dashed line indicates that the three cells have been selected.



c. Use the **down arrow** to 'stretch' the selected area downwards until you get to row 10.

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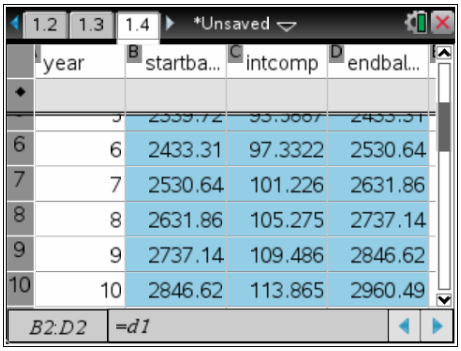
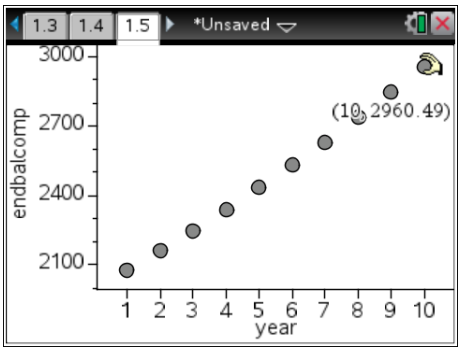
d. Press **enter**. (Note that all the values for columns **B**, **C** and **D** will now be displayed.



Question: By referring to the spreadsheet, what amount will Daisy's $2000 investment have grown to after 10 years?

Question: Over a *ten year* period, which investment option has been better?

Step 11. Open a **Data & Statistics** page. Set **year** as the independent variable (horizontal axis) and **endbalcomp** as the dependent variable (vertical axis).



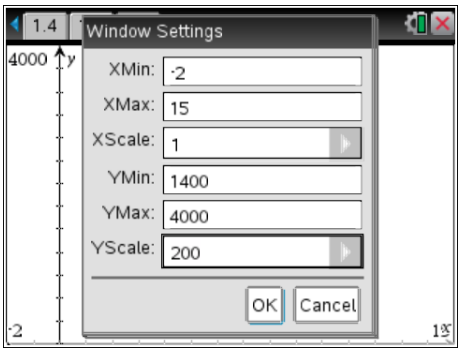
Question: How would you describe the shape of the scatterplot?

Examining the investment over the longer term

Will your answer to the question in the last section always be the case? Let us now consider what happens over a longer time period.

Step 1. Open a **Graphs** page.

Step 2. Press **menu > Window/Zoom > Window Settings**. Set a domain of **$-2 \le x \le 15$** and a range of **$1400 \le y \le 4000$**.



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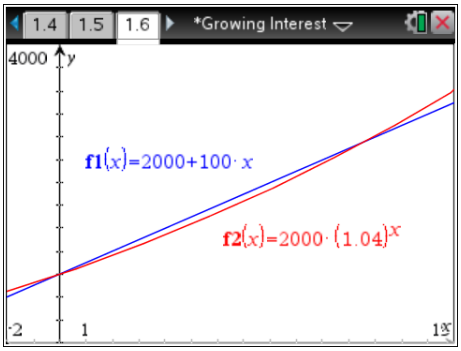
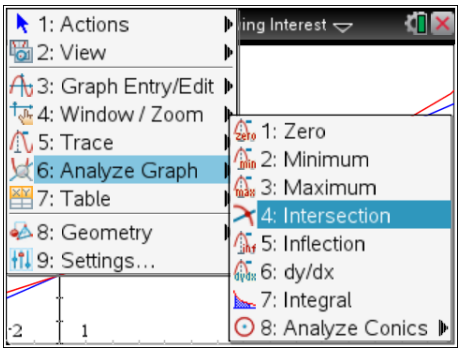
Step 3. Input **f1(x)=2000+100x** to show the growth of the account balance under the simple interest plan.



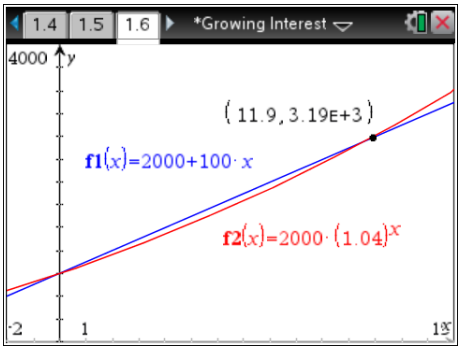
Step 4. Input **f2(x)=2000(1.04)^{x}** to show the growth of the account balance under the compound interest plan.

Step 5. Notice that both the **f1(x)** and **f2(x)** investment graphs start at the same point on the y-axis ($2000). Initially, the simple interest line grows at a faster rate but eventually the compound interest curve crosses the line and grows at a faster rate.

Step 6. Press **menu > Analyse Graph** > **Intersection** and click on either side of the point to determine the coordinates of the point of intersection.



Question: What do the *x* and *y*-values of these coordinates mean?



Conclusion

Look again at the original questions posed in the Problem Description.

Question Which investment option should Daisy choose?

Question Are there any other factors that could affect her decision?

To further extend this investigation, you may wish to:

a. Fill down your spreadsheet formulas to compute values for a longer time period.

b. Experiment by amending the formulas to show different interest rates.

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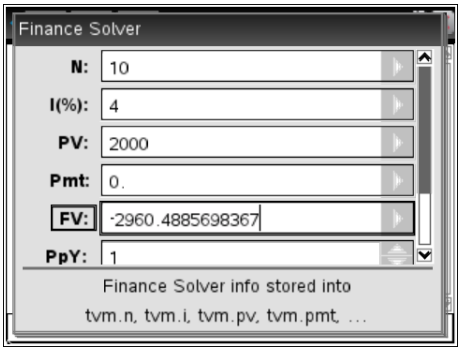
The Finance Solver

Another feature of TI-Nspire CAS that is useful for quickly seeing the effect of changing different compound interest variables (such as the interest rate) is the **Finance Solver**. To access it, open a **Calculator** page and press **menu > Finance > Finance Solver**.



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