An annuity is a stream of equal cash payments, equally spaced in time.

Suppose a student knows that in one year's time, they will require $5000 per year to fund their 4 year university course fees (ie 4 equal cash payments at yearly intervals). How much should they invest today in a bank account offering 8% pa interest compounded annually to enable them to draw $5000 at the start of the next four years?

Start a new spreadsheet.

$4 \times \$5000 = \$20,000$ seems a reasonable estimate for the investment.

Enter **20000** into cell A1.

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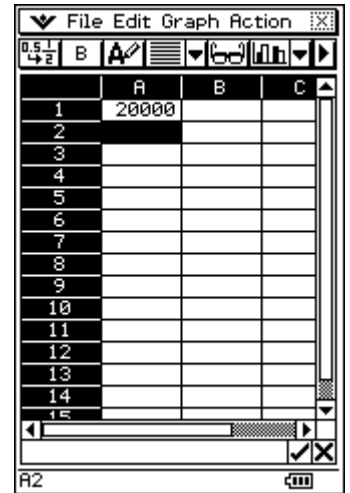
One year later, we must increase the investment by a factor of 1.08 (to add 8% interest) and then withdraw the $5000 cash payment.

Tap into cell B1 and enter **1.08**.

Into cell B2 enter **5000**.

Next tap into cell A2 and enter the formula **=A1×$B$1-$B$2**

*The $ symbols in the cell references mean that the references will NOT be altered as we copy and paste our formulas to other cells in the spreadsheet (called an absolute reference).*

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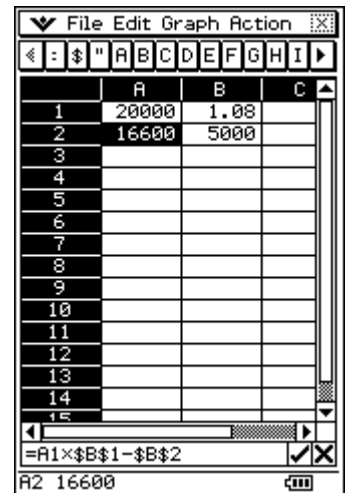
Tap back into cell A2 and then tap again and drag (when cell A2 shows a white border) the cell down to A3.

Repeat the drag operation one line at a time until you reach cell A5.

Increase the width of column A by dragging the AB border to the right.

Tap on the column A heading, tap **Edit**, **Number Format**, **Fix2**, **OK**.

Cell A5 shows that after 4 payments of $5000, $4679.22 remains in the account. Our initial estimate of $20000 to invest was too large, because of the interest added during the life of the investment.

Tap into cell A1 and enter a revised estimate of $16000.

The spreadsheet updates itself, but $16000 is too small as now we have a shortfall of $762.74.

Tap into A1 and adjust until cell A5 shows a final balance of exactly 0.
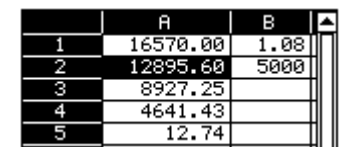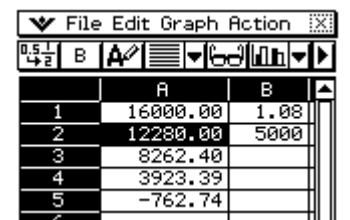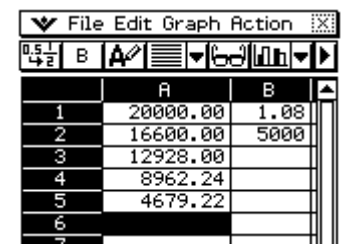
Modify your spreadsheet for the situation where a student required $7000 per year for a 3 year course and the investment attracted 6% pa.

| | A | B |
|---|---|---|
| 1 | 18711.08 | 1.06 |
| 2 | 12833.74 | 7000 |
| 3 | 6603.77 | |
| 4 | 0.00 | |
| 5 | | |

This trial and improvement technique is OK, but let's look at a way to go straight to the required investment by working backwards.

Tap into cell A7 and enter **0**, the required final balance.

| | A | B |
|---|---|---|
| 1 | 18711.08 | 1.06 |
| 2 | 12833.74 | 7000 |
| 3 | 6603.77 | |
| 4 | 0.00 | |
| 5 | | |
| 6 | | |
| 7 | 0.00 | |
| 8 | | |

To reverse ×1.06 then -7000, we must +7000 then ÷1.06.

Tap into cell A8 and enter the formula **=(A7+$B$2)/$B$1**.

Tap back into cell A8 and then tap again and drag (when cell A8 shows a white border) the cell down to A9.

Repeat the drag operation one line at a time until you reach cell A10.

| | A | B |
|---|---|---|
| 1 | 18711.08 | 1.06 |
| 2 | 12833.74 | 7000 |
| 3 | 6603.77 | |
| 4 | 0.00 | |
| 5 | | |
| 6 | | |
| 7 | 0.00 | |
| 8 | 6603.77 | |
| 9 | 12833.75 | |
| 10 | 18711.08 | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |

=(A9+$B$2)/$B$1

A10 18711.08365

Now we can check our solution to the original problem.

$16560.63 is required.

| | A | B |
|---|---|---|
| 1 | 16560.63 | 1.08 |
| 2 | 12885.48 | 5000 |
| 3 | 8916.32 | |
| 4 | 4629.62 | |
| 5 | -0.01 | |
| 6 | | |
| 7 | 0.00 | |
| 8 | 4629.63 | |
| 9 | 8916.32 | |
| 10 | 12885.48 | |
| 11 | 16560.63 | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |

A6

*Note: There is no such thing as a 'standard annuity', so always carefully check the frequency of payments, whether payments are made at the start or end of the compounding period and so on, modifying your spreadsheet to reflect these differences.*