An M & M's worksheet for year 12 - 13 students.

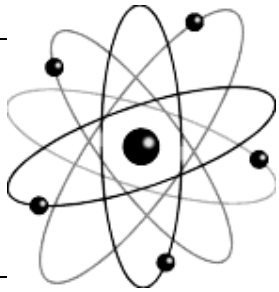
Select STAT mode from the main menu by using the arrow keys to highlight the STAT icon or pressing 2.

Modelling radioactive decay

Radio active decay is modelled by: $N=N_o e^{-(0.693t/T_{½})}$

Timed decay is modelled by: $t = -(T_{½}/0.693) * \ln(N/N_o)$

Where N_o is the initial amount if the isotope present.
$T_{½}$ is the time it takes for the substance present to halved.
Note: ln 2 = 0.6931471806 …. = 0.693 (3dp)



Activity: Students will generate a table for a radioactive decaying isotope (designed to simplify the mathematics), use their data to plot a decay graph, develop the concept of half-life, and use the simulation to graph several examples.

Take a packet of M&M's and after recording the total amount of M&M's present, this is N_o, place them into a cup. Give the cup a good shake to **mix** the M&M's up, then empty the cup out spreading the M&M's over the table top.

Remove from the table top the M&M's that have the 'M' face up (this represents a radioactive isotope, make a discard pile. The M&M's that are left are the ones with the 'M' face down, these are the stable isotopes.

Place these 'stable isotopes' back into the cup, recording the total amount of M&M's present. Give the cup a good shake again to mix the M & M's up, then empty the cup out spreading the M&M's over the table top. Remove from the table top the M&M's that have the 'M' face up (the radioactive isotope, add to the discard pile. And repeat the process until there are no 'stable isotopes' left.

Recording of the simulation:

Example from my 55 gm pack of M&M's

Time Simulation number	M&M's stable isotope	M&M's radioactive isotope
0	**N_o = 67**	0
1	36	31
2	20	47
3	13	54
4	8	59
5	5	62
6	2	65
7	2	65
8	1	66
9	1	66
10	0	67

Theoretically speaking!

Since each **M&M** has an '**M**' printed on one side and nothing on the other the probability of the **M** being 'face up' is 0.5, so the table should have looked like this if it was modelling perfectly.

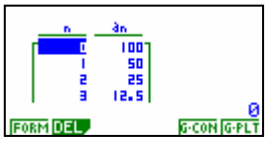
In reality things are no perfect but the mathematical model can be applied to the practices or simulation.

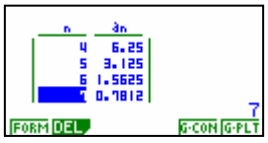
Time	Theoretical (Amount present)
0	100
1	50
2	25
3	12.5
4	6.25
5	3.125
6	1.5625
7	0.78125
8	0.390625
9	0.1953125
10	0.09765625
11	Etc

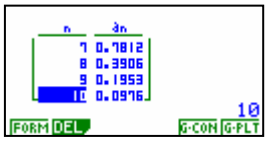
In **RECUR** mode, **ICON 8.**

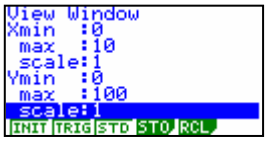
This can be modelled by a geometric sequence: $a_n = ar^n$ where a = 100 and r = 0.5

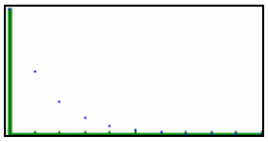
Enter in the equation, as shown Here. Then **F5** for **RANG**e, as shown. **EXIT**, then **F6** for the **TABL**e to be displayed.

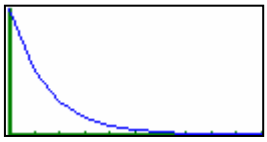








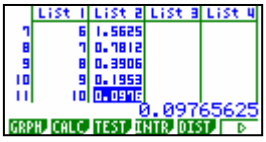


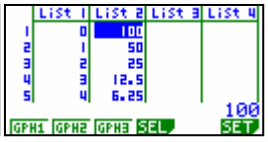


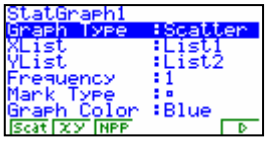
Or in **STAT** mode, **ICON 2.**

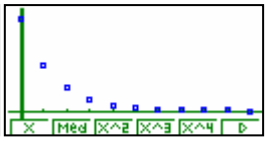
Set the type of graph to be drawn as a Scattergraph.

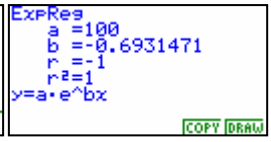
F1 gor **GRaPH**, them **F6** for **SET.**

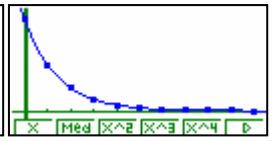




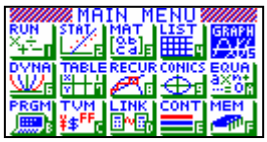




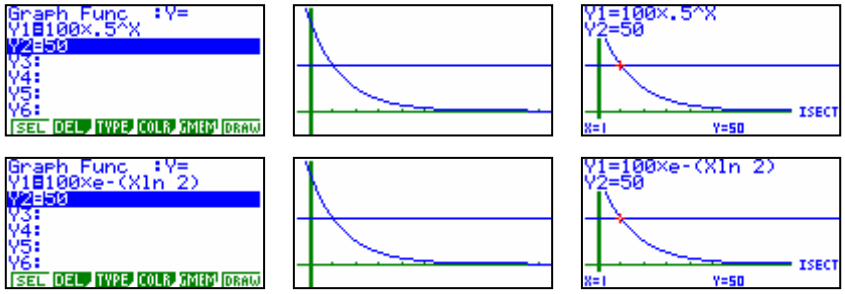




Or in **GRAPH** mode, **ICON 5.**

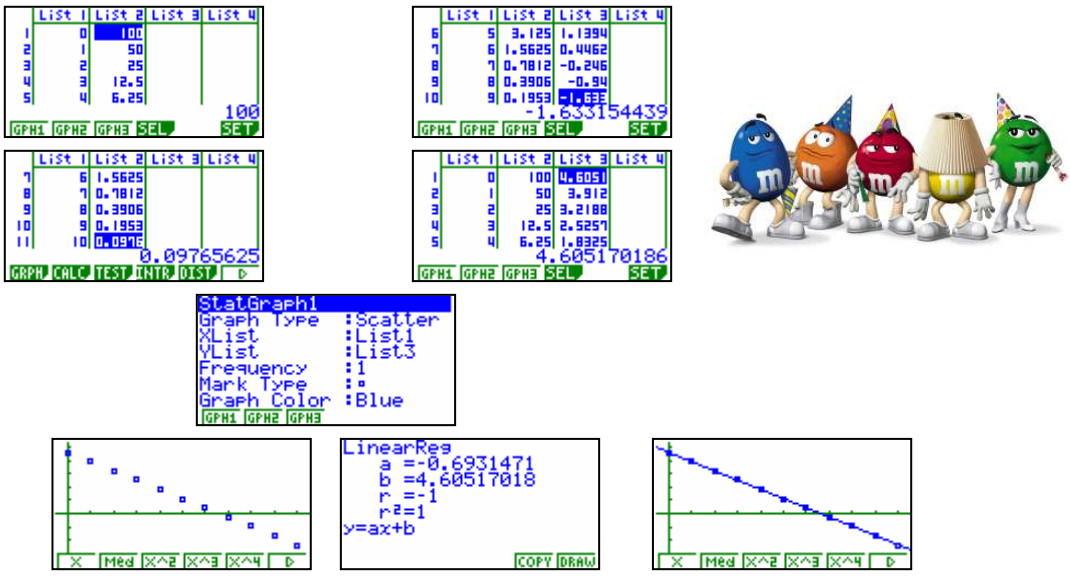


Enter in the equations as shown, to find the solution to $100x0.5^x = 50$. Then **F5** for G-Solve, and **F5** again for intersection point etc.



Or in **STAT** mode again for Log-Linear modelling.

Convert the '**Y**' values to be **lnY,**
place these values into the List 3 'space'.



[N.B. This worksheet are written for practice for part of the N.Z.Q.A. Achievement Standard Statistics and Modelling 3.7, Use a mathematical model involving curve fitting to solve a problem.

- **Model will involve:**

  $y = ax^n$ **or** $y = am^x$ *or* $y = Ae^{kt}$

- **The choice of model will be either a power function or an exponential function and will require: selecting a model to test and constructing an appropriate graph**

- **determining the equation of the model.**

Practice sheets for the modelling of radioactive decay

Time Simulation number	M&M's stable isotope	M&M's radioactive isotope
0	**N_o =**	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Time Simulation number	M&M's stable isotope	M&M's radioactive isotope
0	**N_o =**	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Time Simulation number	M&M's stable isotope	M&M's radioactive isotope
0	**N_o =**	
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

For further tips, more helpful information and software support visit our website
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