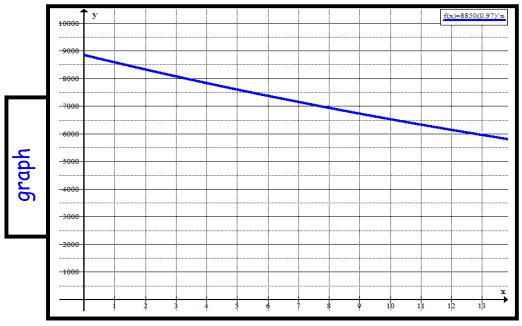
3.5 Modelling Exponential Growth and Decay

Ex. 1 Late in the summer, the population of black flies decreases at a rate of 3% per day. The population can be modelled by $P = 8850\,(0.97)^t$, where P is the number of black flies and t is the time in days from the start of the study.

a) Use Desmos to graph the relation.



b) What is the population of black flies at the start of the study?

8850

c) What does the 0.97 in the equation represent?

How many are left (97%) after each decay

d) What is the population at the end of the first week?

t is days
$\therefore t = 7$

$P = 8850(0.97)^7$
$\doteq 7151$

e) How long will it take for the population to be reduced by 50%?

Goal is 50% of 8850
$= 4425$

$8850(0.97)^{20} \doteq 4801$

$8850(0.97)^{21} \doteq 4668$

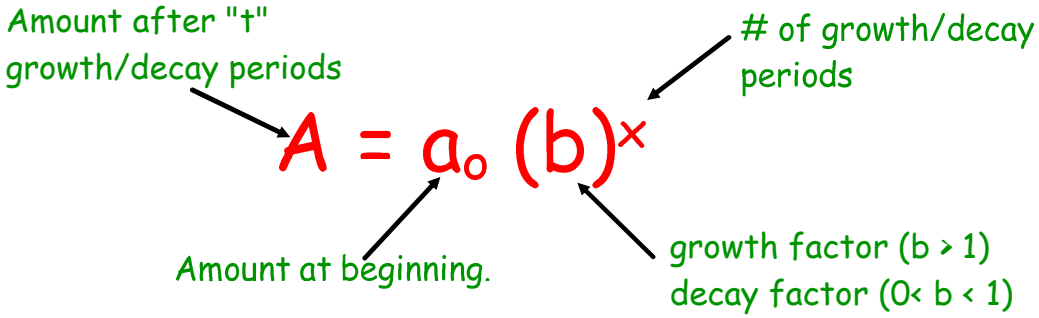
$8850(0.97)^{22} \doteq 4528$

$8850(0.97)^{23} \doteq 4392$

Trial and error

$\therefore$ after 23 days

Exponential growth or decay can be modelled by an exponential equation:



Ex. 2 Model each situation with an exponential equation. Define "x" for each.

a) An initial population of 200 tent caterpillars grows by 15% each day.

$P = 200(1.15)^t$ Let P be population
Let t be days

b) A car worth $25 000, depreciates in value by 13% each year.

$A = 25000(0.87)^t$ Let A be car's value
Let t be years

c) 400 mg of radioactive material deteriorates by 5% every 4 hours.

$A = 400(0.95)^t$ Let A be amount of material
Let t be # of 4 hr periods

d) A rabbit population of 50 doubles every 6 weeks.

$P = 50(2)^t$ Let P be population
Let t be # of 6 wk periods

Ex. 3 The table below shows the amount of radioactive material remaining from a 300 g sample.

Time (hours)	Amount (g)
0	300
1	288
2	276
3	265
4	254
5	244
6	234

×0.96
×0.95
×0.96
×0.95
×0.96
×0.95

a) Determine an approximate growth/decay rate.

0.96

b) Write an exponential equation to model the situation.

Let t be hrs

$A = 300(0.96)^t$

c) Use this equation to determine the amount that will remain after 12 hours.

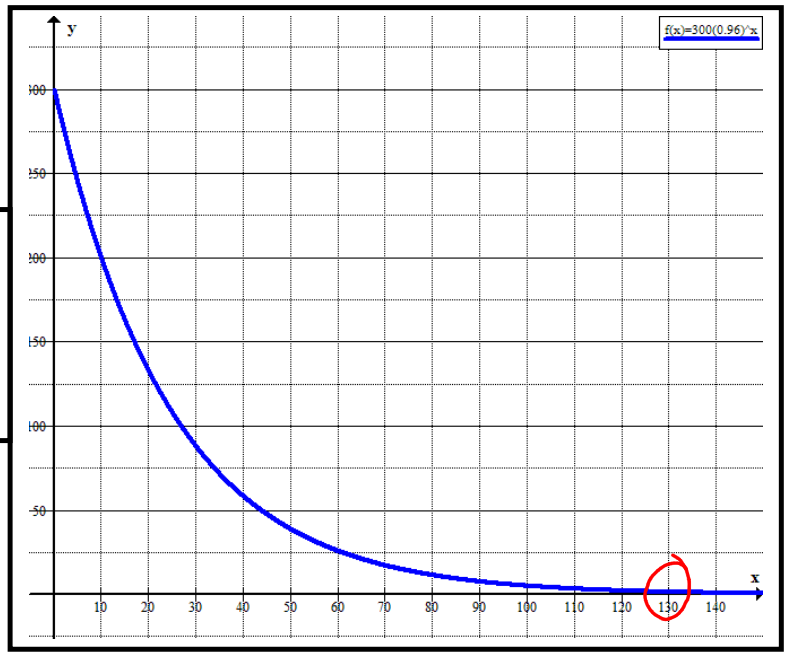
$A = 300(0.96)^{12}$

$\div 183.8$ $\therefore 183.8\text{g}$

d) Use your equation from b) to draw a graph on the graphing calculator. How long will it take for there to be less than 0.5 g?

approx 130 hrs

graph



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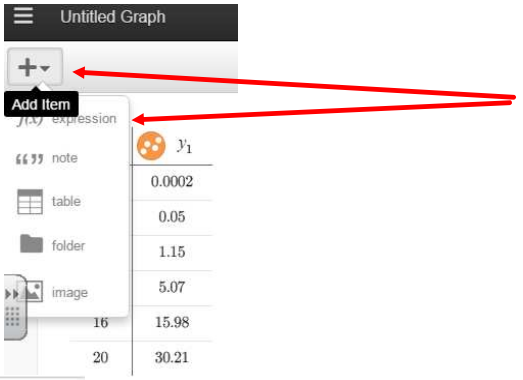
Ex. 4 The table shows the mass of a chicken embryo inside an egg over the first 20 days after the egg is laid.

Day #	Mass (g)
1	0.0002
4	0.05
8	1.15
12	5.07
16	15.98
20	30.21

a) Use Desmos to plot the data.

- enter the data in a table

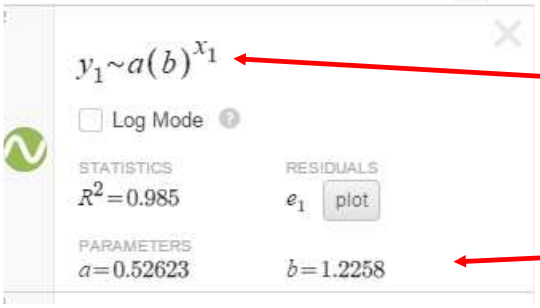
b) Use Desoms to determine the exponential equation of the data.



Click on + button

Choose

f(x) expression



Type in that equation

You need to replace a and b in your equation

c) Use the graph to determine when the embryo will be 45 g.

~22 days

d) Estimate the mass of the embryo after 14 days using:

~ 9g

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P 401 #1,2,6, Regression (3,10)