4.4 Modelling Exponential Growth and Decay

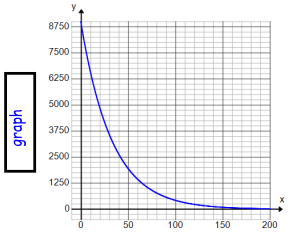
Ex. 1 Late in the summer, the population of black flies decreases at a rate of 3% per day. The population can be modelled by $P = 8850\,(0.97)^t$, where P is the number of black flies and t is the time in days from the start of the study.

a) Use Graphing Technology (desmos) to graph the relation.

Set Graph Settings:
x_{min}: - 10
x_{max}: 200

y_{min}: - 10
y_{min}: 9000

$$P = 8850(0.97)^t$$



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?

97%, of black flies remaining after each day (3% decay)

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

One week => $t = 7$ days $\quad P = 8850(0.97)^7$

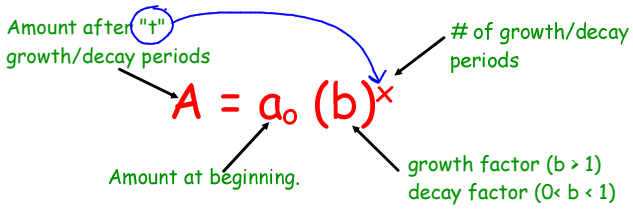
$\doteq 7151$

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

Look at graph $\quad t = 23$ days

May 2-2:09 PM

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.

Let t be # of days $\quad 1 + 0.15 = 1.15$

$P = 200(1.15)^t$

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

Let t be # of years $\quad 1 - 0.13 = 0.87$

$A = 25000(0.87)^t$

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

Let t be # of 4 hour blocks $\quad 1 - 0.05 = 0.95$

$A = 400(0.95)^t$

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

Let t be # of 6 week blocks $\quad$ → Growth rate of 2!

$P = 50(2)^t$

May 2-2:35 PM

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

a) Determine an approximate growth/decay rate.

$\frac{288}{300} = 0.96$ $\left\{\frac{276}{288} \doteq 0.958\right.$ $\left\{\frac{265}{276} \doteq 0.96\right.$

Approx: 0.96

b) Write an exponential equation to model the situation.

$A = 300(0.96)^t$

Let t be # of hours

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

$t = 12$

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

$= 183.8$

∴ There will be approx 183.8g

May 2-2:48 PM

Practice
pg 391
 # 6,7,8,9,12

Apr 30-10:08 PM