Math 118 | Fall 2002

Advanced Placement Calculus

Class 1: Friday August 30

A model for the spread of disease

Suppose we want to model the spread of an infectious disease.

Simplifying assumptions:
– Nobody dies from it!
– Recovery always takes 14 days.
– You're contagious during those 14 days.
– You cannot get it twice.

Notation:
I = # of infected people.
R = # of recovered people (i.e., already had it).
S = # of susceptible people (i.e., haven't had it yet).

Rates of change: I', R', S'.
Units: ____________________ per day.

Q: If I people are currently infected, how many of them do you expect will recover today? _______.

So,

$$R' =$$

True or false?
I' = # of people who get infected per day.
S' = -(# of people who get infected per day).

To write an equation for S', first note that on any given day, the number of people who get infected depends on the number of susceptible people who come into contact with infected people:
–If everything else was the same except there were twice as many *susceptible* people, how would this affect the number of people who *become infected*?

So,

$$S' \propto$$

–If everything else was the same except there were twice as many *infected* people, how would this affect the number of people who *become infected*?

So,

$$S' \propto$$

These combine to give

$$S' =$$

What about I' ? It should equal
(# of people who get infected per day) − (# of people who ___________________________).

So,

$$I' =$$

Thus, **the S-I-R Epidemic Model** is:

$$\begin{aligned} S' &= \\ I' &= \\ R' &= \end{aligned}$$