

## CAS Lab #2. Analyzing the measles epidemic with the SIR model

**The SIR program.** We will first enter the program into Sage.

- Log in to your account at <https://cocalc.com> and open the project “Calculus 1”
- Click on “Files” and then “New”
- Enter the name “lab2” for the new file and then select the type “SageMath Worksheet.” A new worksheet with the name “lab2” will open up.
- Copy the SIR program below into this worksheet. Note that the indentation matters!

```
t = 0
S = 45400
I = 2100
R = 2500
deltat = 1
nsteps = 3
for k in range(nsteps):
    Sprime = -.00001*S*I
    Iprime = .00001*S*I - I/14
    Rprime = I/14
    deltaS = Sprime*deltat
    deltaI = Iprime*deltat
    deltaR = Rprime*deltat
    t = t + deltat
    S = S + deltaS
    I = I + deltaI
    R = R + deltaR
    print(t,S,I,R)
```

**Analyzing the measles epidemic.** Work the following problems from the textbook

1. Problem 1 on page 53
2. Problem 2 on page 53 using the following copy of the program:

```
t = 0
S = 45400
I = 2100
R = 2500
deltat = 1
nsteps = 3
for k in range(nsteps):
    Sprime = -.00001*S*I
    Iprime = .00001*S*I - I/14
    Rprime = I/14
    deltaS = Sprime*deltat
    deltaI = Iprime*deltat
    deltaR = Rprime*deltat
    t = t + deltat
    S = S + deltaS
    I = I + deltaI
    R = R + deltaR
    print(t,S,I,R)
```

3. Problem 16 on page 56. Write the table below.

4. Problem 17 on page 6. Write your answers to parts a), b) and c) below.

5. Problem 18 on page 56.

6. Problem 20 on page 56. Write you answer below.

7. Problem 21 on page 56. Write your answer below.

8. Problem 22 on page 56. Make sure to save a copy of the altered program. Write your answer to part (b) below.

9. Problem 23 on page 56. Write your answer below.