```
### SIR MODEL ===== ===== ===== ===== =====

# last updated: March 31, 2023

library(cowplot)
library(deSolve)
library(ggplot2)
library(graphics)
library(reshape2)
library(tidyverse)

rm(list=ls()) # clear environment


### Initialize ===== ===== ===== ===== =====

# time
tvals = seq(0,200,by=0.05)

# parameters
pars = c(beta=0.00009, gamma=0.05)

# initial conditions
N = 10000
inits = c(S=N-1, I=1, R=0, Cases=0)


### Model ===== ===== ===== ===== =====

SIR = function(t, inits, pars){
  with(as.list(c(inits, pars)), {
    dS = (-beta*S*I)
    dI = (beta*S*I-gamma*I)
    dR = (gamma*I)
    dCases = beta*S*I
    list(c(dS, dI, dR, dCases))
  })
}

# solve model
sol = as.data.frame(ode(y=inits, times=tvals, func=SIR,
parms=pars))
```

```
### Total Cases ===== ===== ===== ===== =====

TotC = round(sol$Cases[length(sol$Cases)], digits=0)
print(TotC)


### Plot ===== ===== ===== ===== =====

sol %>% gather(key, individuals, S, I, R) %>%
  ggplot(aes(x=time, y=individuals, color=key)) +
  geom_line() +
  ggtitle("SIR model") +
  xlab("days") + ylab("individuals")
```