Homework 13

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b13.4

We would need some sort of information on the actual number of warheads from each participant. We would also need to know if the two participants were on equal footing, meaning that the warheads each side had were equal. If the warheads aren't equal it complicates things significantly.

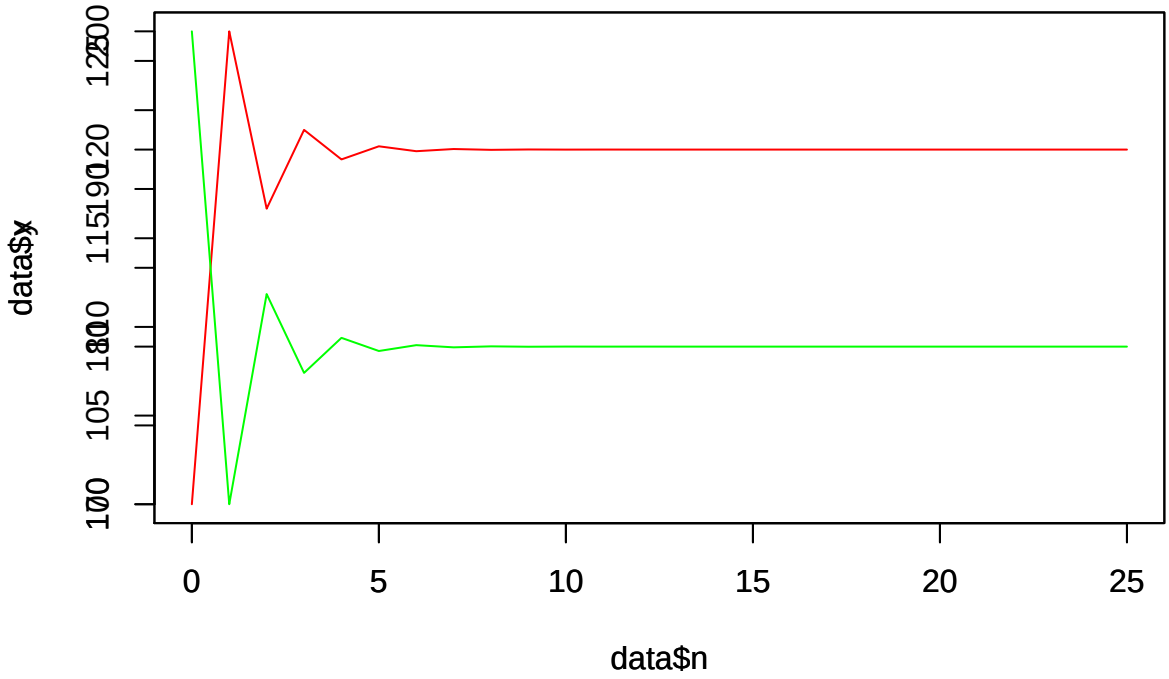
Realistically we could not make this model because countries would not share this information. We could look at something like budgets, but this could also be untruthful.

b17.1

a.

```
graphit <- function(x0,y0,xs,ys,limit) {
  n <- 0
  data <- data.frame(x = x0, y = y0, n = n)
  while (n < limit) {
    y <- 120 + ys * tail(data$x, 1)
    x <- 60 + xs * tail(data$y, 1)
    n <- tail(data$n,1) + 1
    data <- rbind(data, c(x, y, n))
  }
  plot(x=data$n, y=data$x, type = "l", col = "red")
  par(new=TRUE)
  plot(x=data$n, y=data$y, type = "l", col="green")
  print (data)
}

graphit(100,200,1/3,1/2,25)
```




```
##           x        y  n
## 1  100.0000 200.0000  0
## 2  126.6667 170.0000  1
## 3  116.6667 183.3333  2
## 4  121.1111 178.3333  3
## 5  119.4444 180.5556  4
## 6  120.1852 179.7222  5
## 7  119.9074 180.0926  6
## 8  120.0309 179.9537  7
## 9  119.9846 180.0154  8
## 10 120.0051 179.9923  9
## 11 119.9974 180.0026 10
## 12 120.0009 179.9987 11
## 13 119.9996 180.0004 12
## 14 120.0001 179.9998 13
## 15 119.9999 180.0001 14
## 16 120.0000 180.0000 15
## 17 120.0000 180.0000 16
## 18 120.0000 180.0000 17
## 19 120.0000 180.0000 18
## 20 120.0000 180.0000 19
## 21 120.0000 180.0000 20
## 22 120.0000 180.0000 21
## 23 120.0000 180.0000 22
## 24 120.0000 180.0000 23
## 25 120.0000 180.0000 24
```

```
## 26 120.0000 180.0000 25
```

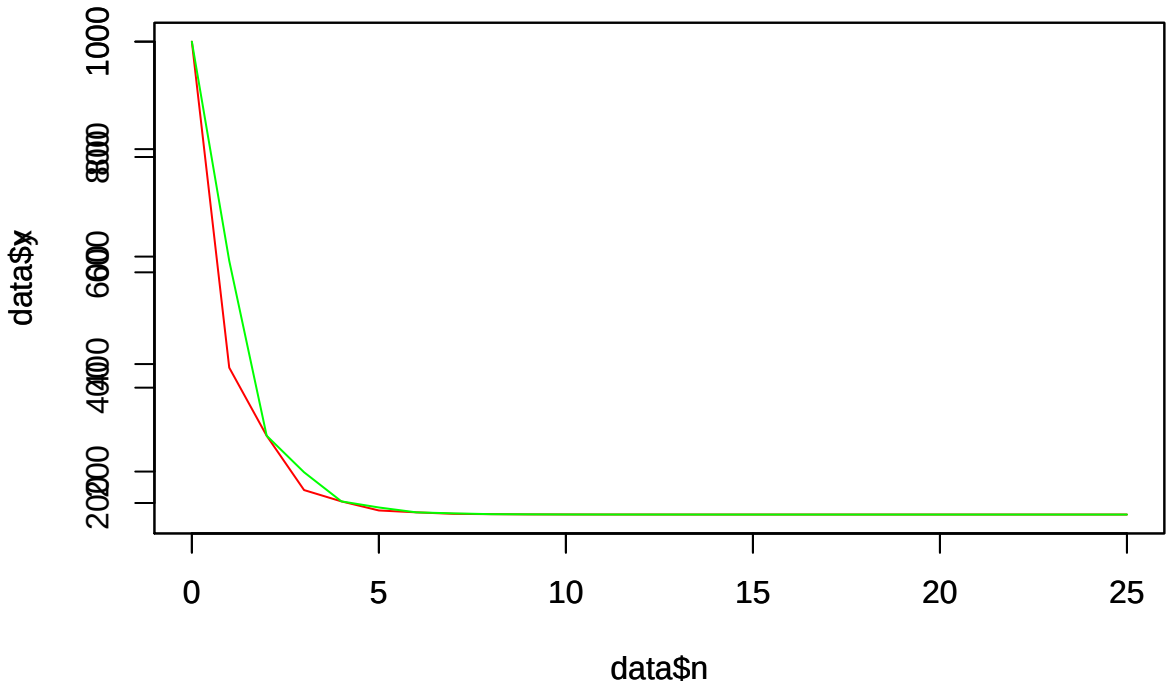
b.

There is an eqilibrium reach at x=120 and y=180.

c.

We can try something stupid like 1000,1000 and see it reaches the same eq.

```
graphit(1000,1000,1/3,1/2,25)
```




```
##           x         y  n
## 1  1000.0000 1000.0000  0
## 2   393.3333  620.0000  1
## 3   266.6667  316.6667  2
## 4   165.5556  253.3333  3
## 5   144.4444  202.7778  4
## 6   127.5926  192.2222  5
## 7   124.0741  183.7963  6
## 8   121.2654  182.0370  7
## 9   120.6790  180.6327  8
## 10  120.2109  180.3395  9
## 11  120.1132  180.1055 10
```

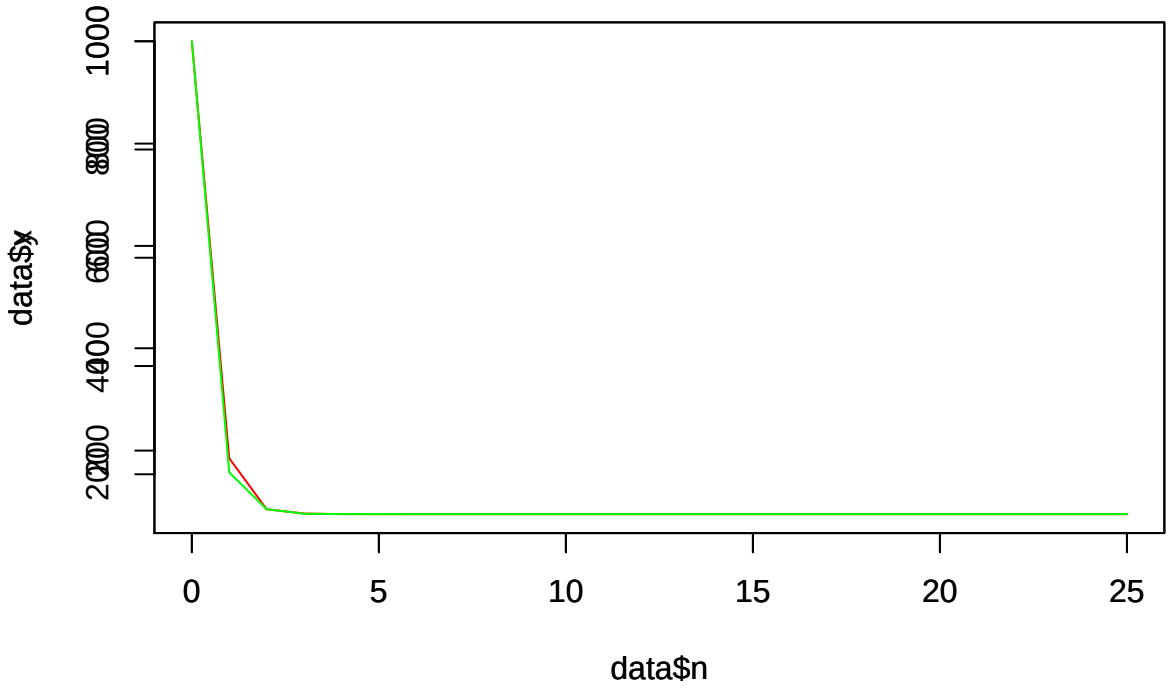
```
## 12  120.0352  180.0566 11
## 13  120.0189  180.0176 12
## 14  120.0059  180.0094 13
## 15  120.0031  180.0029 14
## 16  120.0010  180.0016 15
## 17  120.0005  180.0005 16
## 18  120.0002  180.0003 17
## 19  120.0001  180.0001 18
## 20  120.0000  180.0000 19
## 21  120.0000  180.0000 20
## 22  120.0000  180.0000 21
## 23  120.0000  180.0000 22
## 24  120.0000  180.0000 23
## 25  120.0000  180.0000 24
## 26  120.0000  180.0000 25
```

It looks like the same eq is reach fairly quickly.

d.

And now with different coeff...

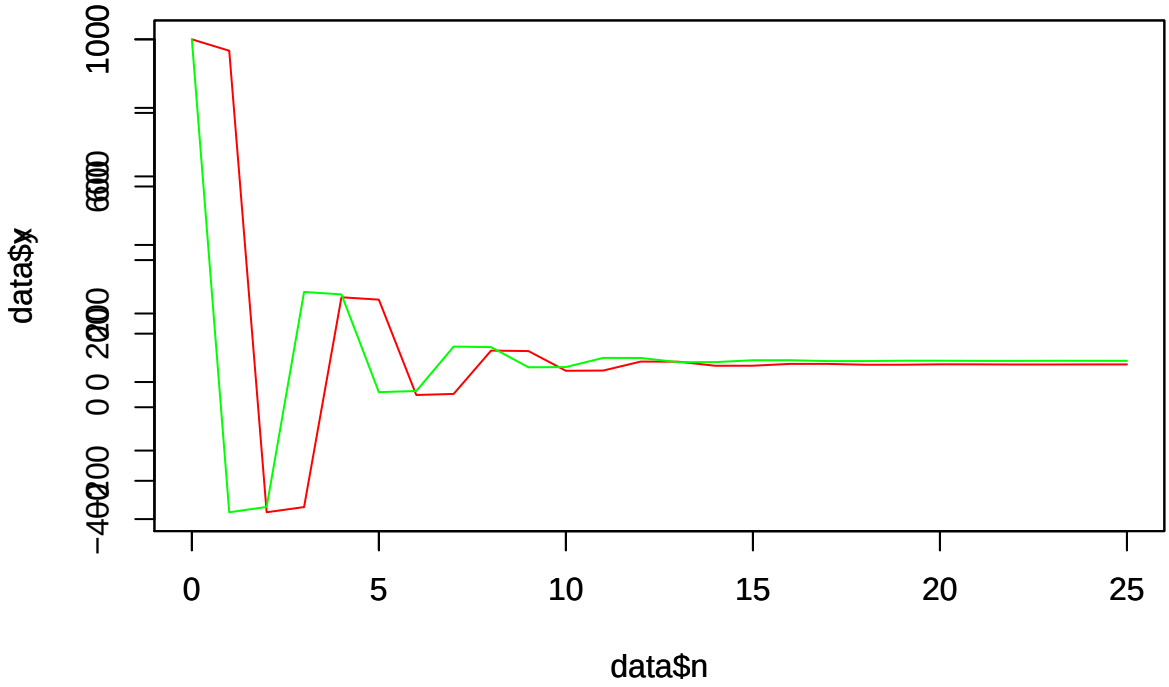
```
graphit(1000,1000,1/8,1/12,25)
```




```
##            x        y  n
```

```
## 1  1000.00000 1000.0000  0
## 2   185.00000  203.3333  1
## 3    85.41667  135.4167  2
## 4    76.92708  127.1181  3
## 5    75.88976  126.4106  4
## 6    75.80132  126.3241  5
## 7    75.79052  126.3168  6
## 8    75.78960  126.3159  7
## 9    75.78948  126.3158  8
## 10   75.78947  126.3158  9
## 11   75.78947  126.3158 10
## 12   75.78947  126.3158 11
## 13   75.78947  126.3158 12
## 14   75.78947  126.3158 13
## 15   75.78947  126.3158 14
## 16   75.78947  126.3158 15
## 17   75.78947  126.3158 16
## 18   75.78947  126.3158 17
## 19   75.78947  126.3158 18
## 20   75.78947  126.3158 19
## 21   75.78947  126.3158 20
## 22   75.78947  126.3158 21
## 23   75.78947  126.3158 22
## 24   75.78947  126.3158 23
## 25   75.78947  126.3158 24
## 26   75.78947  126.3158 25
```

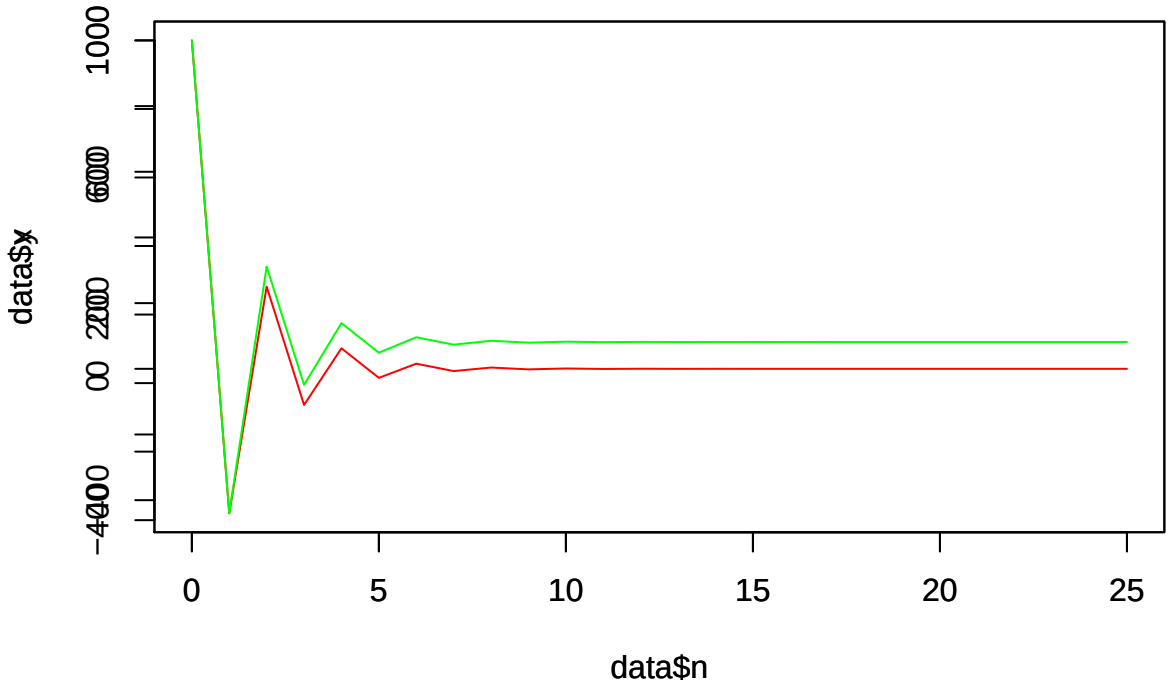
```
graphit(1000,1000,1/1.1,-1/2,25)
```




```
##             x         y  n
## 1  1000.00000 1000.00000  0
## 2   969.09091 -380.00000  1
## 3  -285.45455 -364.54545  2
## 4  -271.40496  262.72727  3
## 5   298.84298  255.70248  4
## 6   292.45680  -29.42149  5
## 7    33.25319  -26.22840  6
## 8    36.15600  103.37340  7
## 9   153.97582  101.92200  8
## 10  152.65636   43.01209  9
## 11   99.10190   43.67182 10
## 12   99.70165   70.44905 11
## 13  124.04459   70.14917 12
## 14  123.77198   57.97770 13
## 15  112.70700   58.11401 14
## 16  112.83092   63.64650 15
## 17  117.86045   63.58454 16
## 18  117.80413   61.06977 17
## 19  115.51798   61.09794 18
## 20  115.54358   62.24101 19
## 21  116.58274   62.22821 20
## 22  116.57110   61.70863 21
## 23  116.09876   61.71445 22
## 24  116.10405   61.95062 23
## 25  116.31875   61.94798 24
```

```
## 26  116.31634   61.84063 25
```

```
graphit(1000,1000,-1/2,-1/2,25)
```




```
##                x         y  n
## 1   1.000000e+03 1000.0000  0
## 2  -4.400000e+02 -380.0000  1
## 3   2.500000e+02  340.0000  2
## 4  -1.100000e+02   -5.0000  3
## 5   6.250000e+01  175.0000  4
## 6  -2.750000e+01   88.7500  5
## 7   1.562500e+01  133.7500  6
## 8  -6.875000e+00  112.1875  7
## 9   3.906250e+00  123.4375  8
## 10 -1.718750e+00  118.0469  9
## 11  9.765625e-01  120.8594 10
## 12 -4.296875e-01  119.5117 11
## 13  2.441406e-01  120.2148 12
## 14 -1.074219e-01  119.8779 13
## 15  6.103516e-02  120.0537 14
## 16 -2.685547e-02  119.9695 15
## 17  1.525879e-02  120.0134 16
## 18 -6.713867e-03  119.9924 17
## 19  3.814697e-03  120.0034 18
## 20 -1.678467e-03  119.9981 19
```

```
## 21  9.536743e-04  120.0008 20
## 22 -4.196167e-04  119.9995 21
## 23  2.384186e-04  120.0002 22
## 24 -1.049042e-04  119.9999 23
## 25  5.960464e-05  120.0001 24
## 26 -2.622604e-05  120.0000 25
```

There is a problem when the coeff are the same, but it looks like predictable behavior.

b21.4

$$TR = f(q) * q$$

$$MR = f'(q) * q + f(q)$$

b25.1

If demand is high, price will also be high, so customers will have to pay the tax.

If demand is low, price will be low, so industry will have to eat the tax cost.

If supply is high, demand will drop, as will price, so the industry will need to eat the tax again.

If supply is low, demand will rise, as will price, so customers must pay the tax

b29.1

The eq quantity could increase if the demand curve doesn't move to the left because supply could change after the crisis, while demand would likely remain the same.