```
import pandas as pd
import matplotlib.pyplot as plt

deaths = pd.read_csv("avg_deaths.csv") # 1st January to 15 December
2020
deaths
```

	Month	New_deaths
0	1	0
1	2	0
2	3	77
3	4	1844
4	5	1448
5	6	785
6	7	769
7	8	1020
8	9	739
9	10	751
10	11	1225
11	12	2247

```
import calendar

calendar.monthrange(2020,1)
```

```
(2, 31)
```

```
_, num_days = calendar.monthrange(2020,1)

num_days
```

```
31
```

```
deaths["num_days"] = 0

deaths
```

	Month	New_deaths	num_days
0	1	0	0
1	2	0	0
2	3	77	0
3	4	1844	0
4	5	1448	0
5	6	785	0
6	7	769	0
7	8	1020	0
8	9	739	0
9	10	751	0
10	11	1225	0
11	12	2247	0

```
deaths["year"] = 2020
```

```
deaths
```

	Month	New_deaths	num_days	year
0	1	0	0	2020
1	2	0	0	2020
2	3	77	0	2020
3	4	1844	0	2020
4	5	1448	0	2020
5	6	785	0	2020
6	7	769	0	2020
7	8	1020	0	2020
8	9	739	0	2020
9	10	751	0	2020
10	11	1225	0	2020
11	12	2247	0	2020

```
deaths.columns
```

```
Index(['Month', 'New_deaths', 'num_days', 'year'], dtype='object')
```

```
deaths = deaths[['year','Month','num_days' ,'New_deaths', ]]
```

```
deaths
```

	year	Month	num_days	New_deaths
0	2020	1	0	0
1	2020	2	0	0
2	2020	3	0	77
3	2020	4	0	1844
4	2020	5	0	1448
5	2020	6	0	785
6	2020	7	0	769
7	2020	8	0	1020
8	2020	9	0	739
9	2020	10	0	751
10	2020	11	0	1225
11	2020	12	0	2247

```
deaths.columns = ['Year','Month','Num_days' ,'New_deaths', ]
deaths
```

	Year	Month	Num_days	New_deaths
0	2020	1	0	0
1	2020	2	0	0
2	2020	3	0	77
3	2020	4	0	1844
4	2020	5	0	1448
5	2020	6	0	785
6	2020	7	0	769
7	2020	8	0	1020
8	2020	9	0	739

```
9   2020     10          0          751
10  2020     11          0         1225
11  2020     12          0         2247
```

```
def days(year,month):
    _, num_days = calendar.monthrange(year, month)
    return num_days
```

```
deaths.iloc[0]["Month"]
```

```
1
```

```
days = (deaths[["Year", "Month"]]).apply(lambda
row:days(row["Year"],row["Month"]), axis = 1)
```

```
days
```

```
0     31
1     29
2     31
3     30
4     31
5     30
6     31
7     31
8     30
9     31
10    30
11    31
dtype: int32
```

```
deaths.Num_days = days
```

```
2//2
```

```
1
```

```
num = 7
```

```
num += 5
```

```
deaths.loc[11, "Num_days"]//=2
```

```
# deaths.loc[11, "Num_days"] = 15
```

```
deaths
```

```
    Year  Month  Num_days  New_deaths
0   2020      1        31           0
1   2020      2        29           0
2   2020      3        31          77
3   2020      4        30        1844
```

```
4   2020      5         31         1448
5   2020      6         30          785
6   2020      7         31          769
7   2020      8         31         1020
8   2020      9         30          739
9   2020     10         31          751
10  2020     11         30         1225
11  2020     12         15         2247
```

```
deaths["Monthly_deaths"] = deaths.Num_days.mul(deaths.New_deaths)
```

```
deaths
```

```
    Year  Month  Num_days  New_deaths  Monthly_deaths
0   2020      1        31           0               0
1   2020      2        29           0               0
2   2020      3        31          77            2387
3   2020      4        30        1844           55320
4   2020      5        31        1448           44888
5   2020      6        30         785           23550
6   2020      7        31         769           23839
7   2020      8        31        1020           31620
8   2020      9        30         739           22170
9   2020     10        31         751           23281
10  2020     11        30        1225           36750
11  2020     12        15        2247           33705
```

```
deaths.rename({"New_deaths":"Avg_deaths"}, axis = 1, inplace = True)
```

```
deaths
```

```
    Year  Month  Num_days  Avg_deaths  Monthly_deaths
0   2020      1        31           0               0
1   2020      2        29           0               0
2   2020      3        31          77            2387
3   2020      4        30        1844           55320
4   2020      5        31        1448           44888
5   2020      6        30         785           23550
6   2020      7        31         769           23839
7   2020      8        31        1020           31620
8   2020      9        30         739           22170
9   2020     10        31         751           23281
10  2020     11        30        1225           36750
11  2020     12        15        2247           33705
```

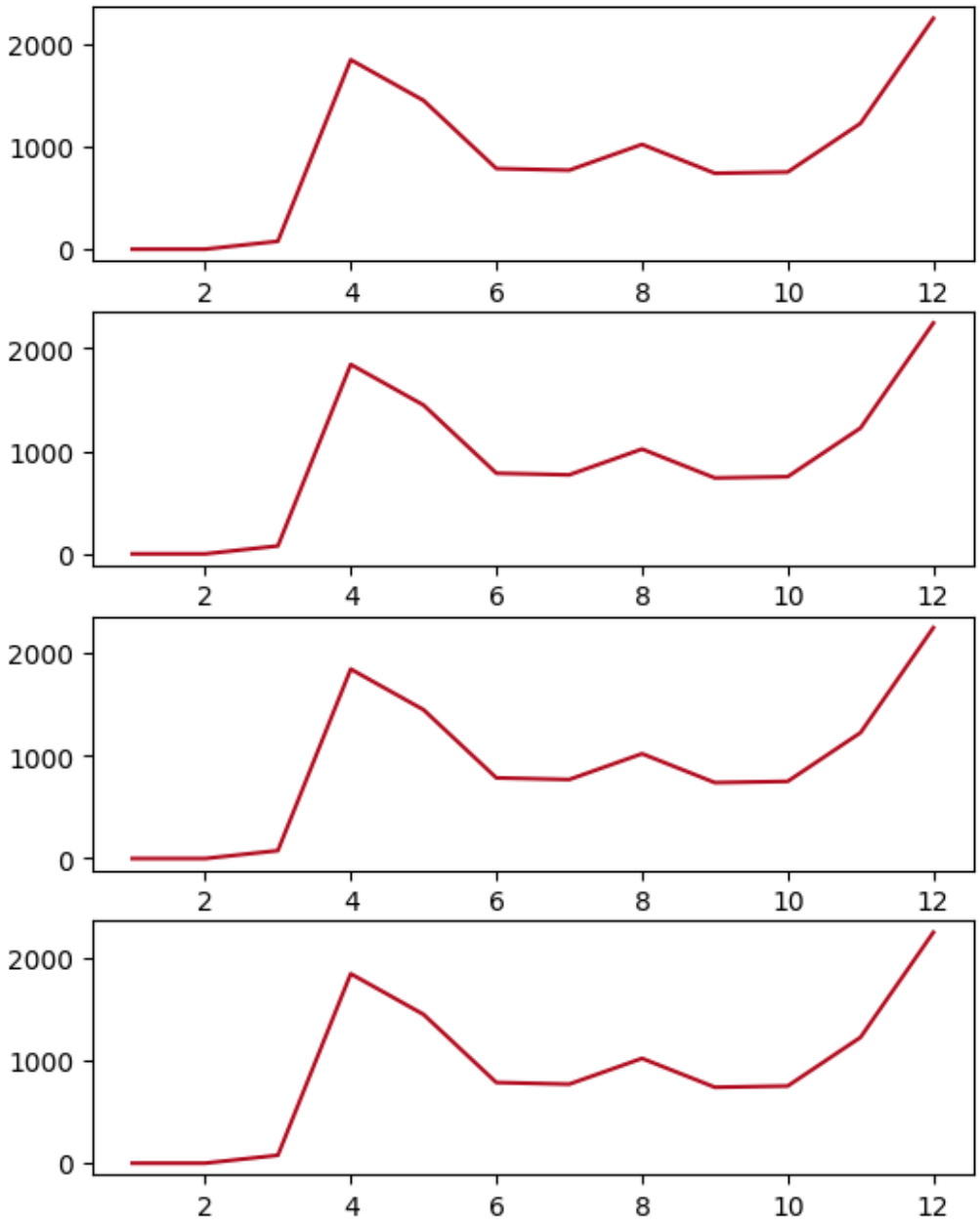
```
deaths["Cum_deaths"] = deaths.Monthly_deaths.cumsum()
```

```
deaths
```

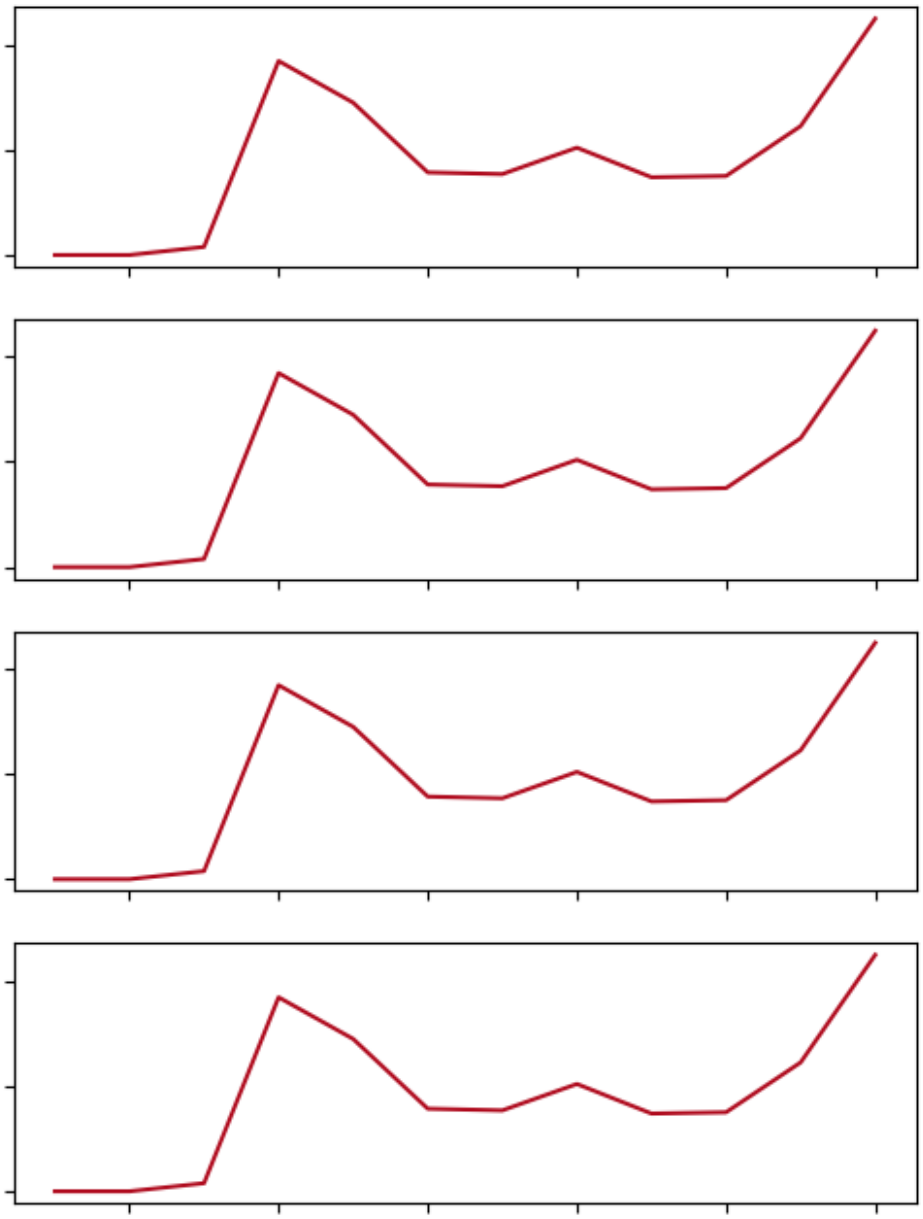
```
    Year  Month  Num_days  Avg_deaths  Monthly_deaths  Cum_deaths
0   2020      1        31           0               0           0
```

1	2020	2	29	0	0	0
2	2020	3	31	77	2387	2387
3	2020	4	30	1844	55320	57707
4	2020	5	31	1448	44888	102595
5	2020	6	30	785	23550	126145
6	2020	7	31	769	23839	149984
7	2020	8	31	1020	31620	181604
8	2020	9	30	739	22170	203774
9	2020	10	31	751	23281	227055
10	2020	11	30	1225	36750	263805
11	2020	12	15	2247	33705	297510

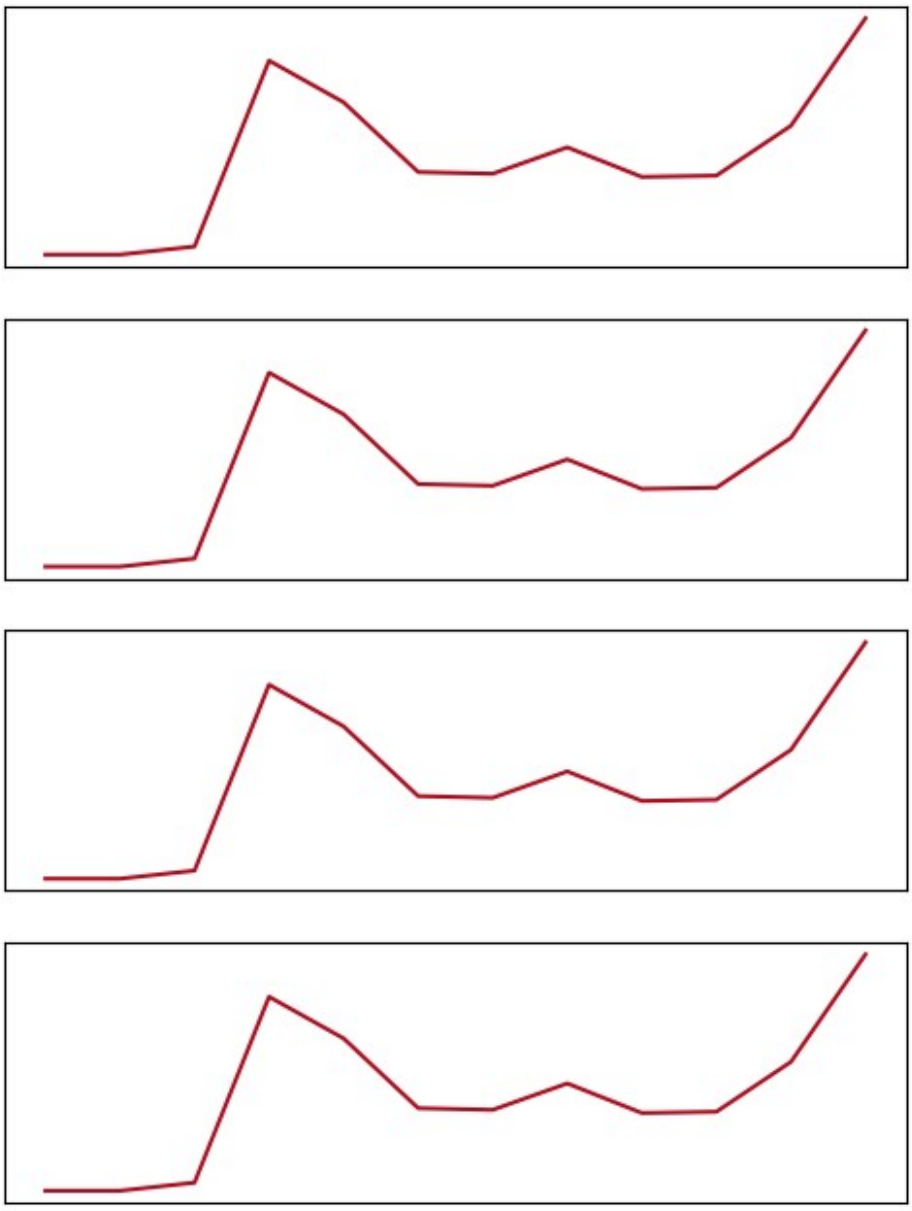
```
# Jan - March -> 1-3
# March - Jun 3 - 6
# Jun - Oct 6 -10
# Oct - Dec 10 -12

fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e")
plt.show()
```




```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e")
    ax.set_xticklabels([])
    ax.set_yticklabels([])
plt.show()
```

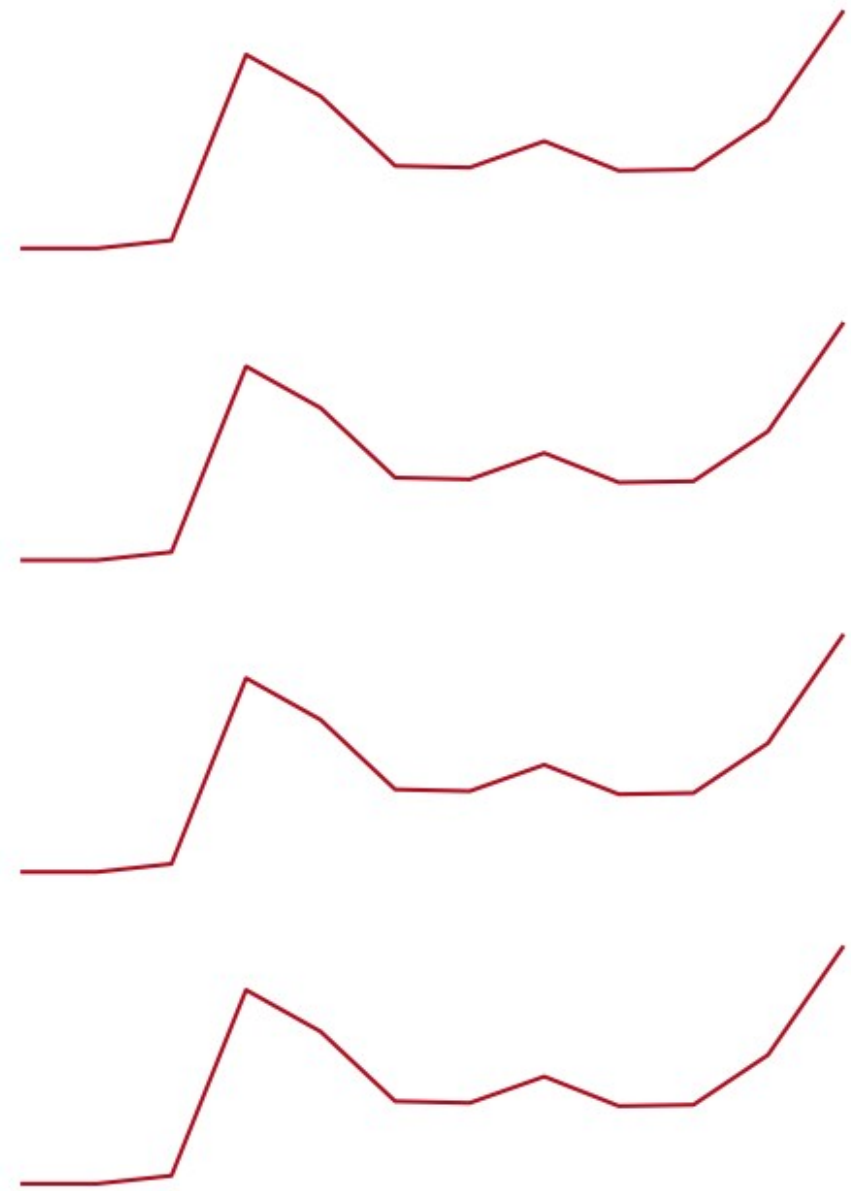


```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e")
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
plt.show()
```



```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e")
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
```

```
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)

plt.show()
```



```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
```

```
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)

plt.show()
```

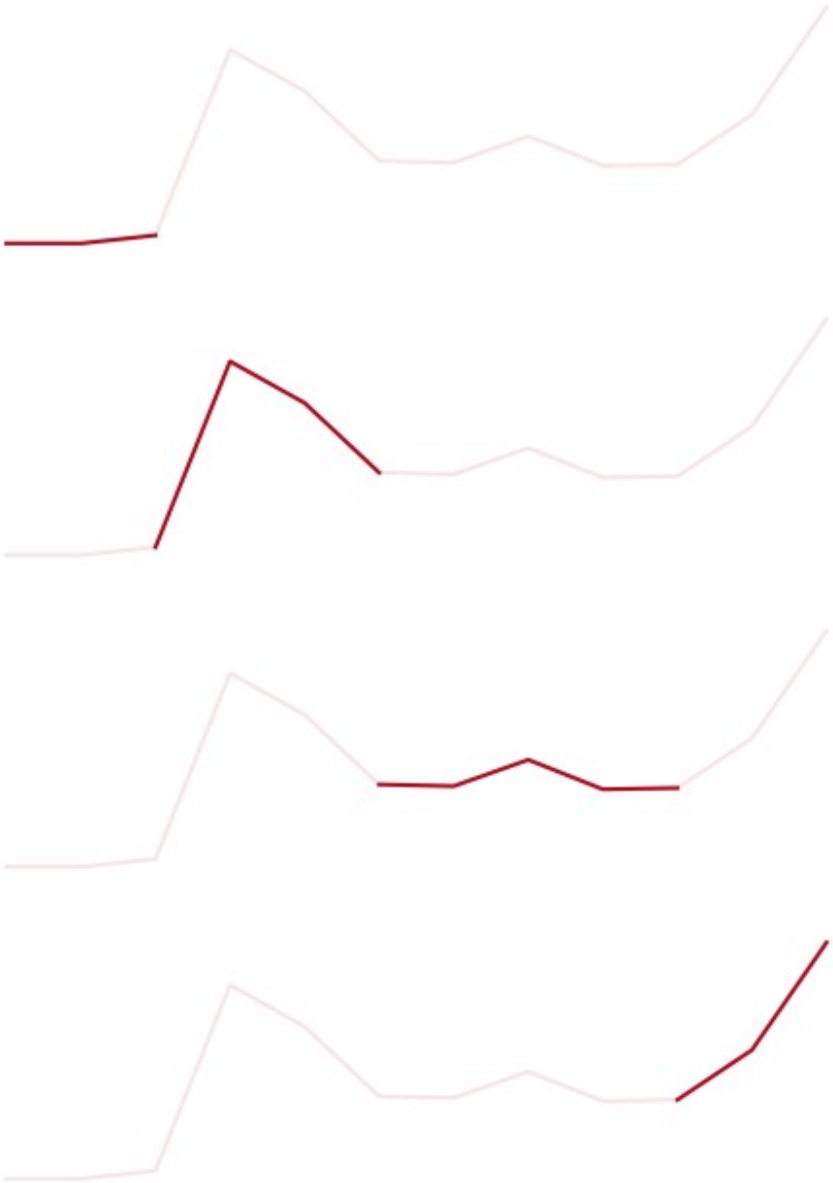
```
deaths[:3]
```

	Year	Month	Num_days	Avg_deaths	Monthly_deaths	Cum_deaths
0	2020	1	31	0	0	0
1	2020	2	29	0	0	0
2	2020	3	31	77	2387	2387

```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)
ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e")
plt.show()
```

```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
```

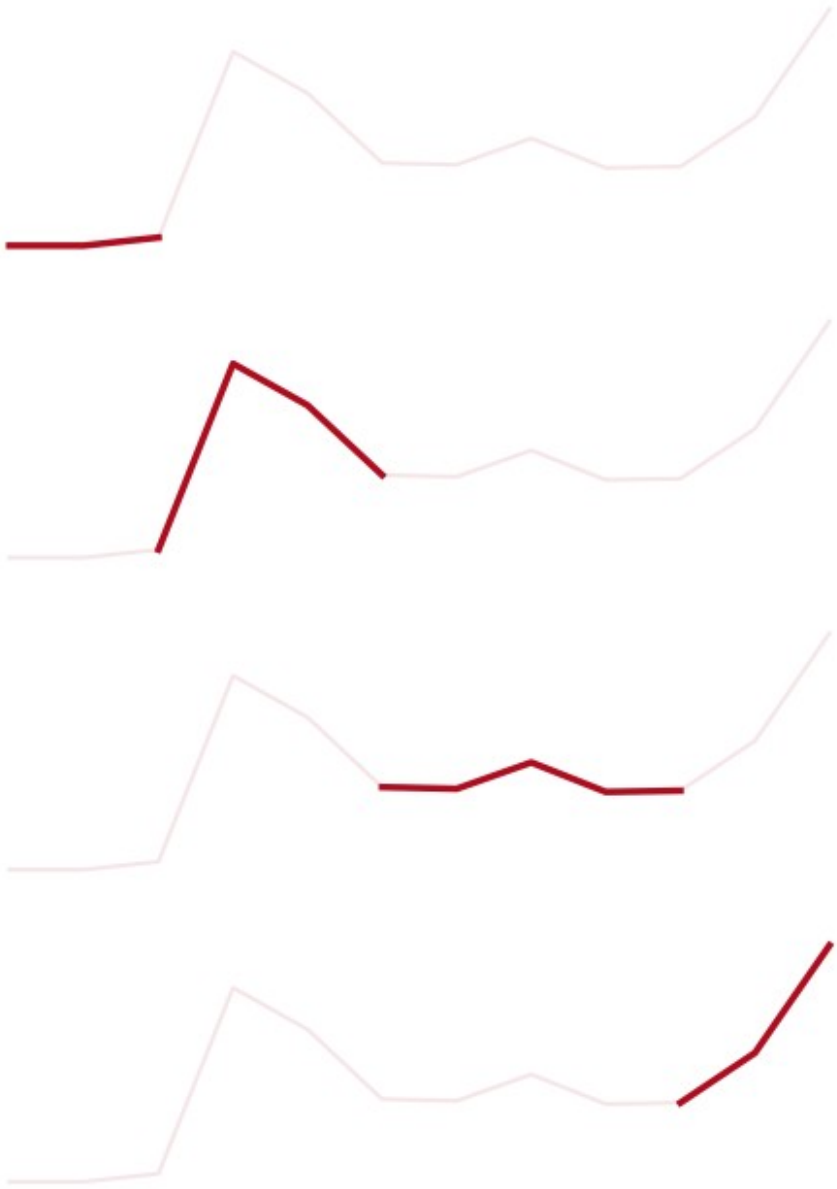
```
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)
ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e")
ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e")
ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e")
ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e")
plt.show()
```



```
deaths[5:10]
```

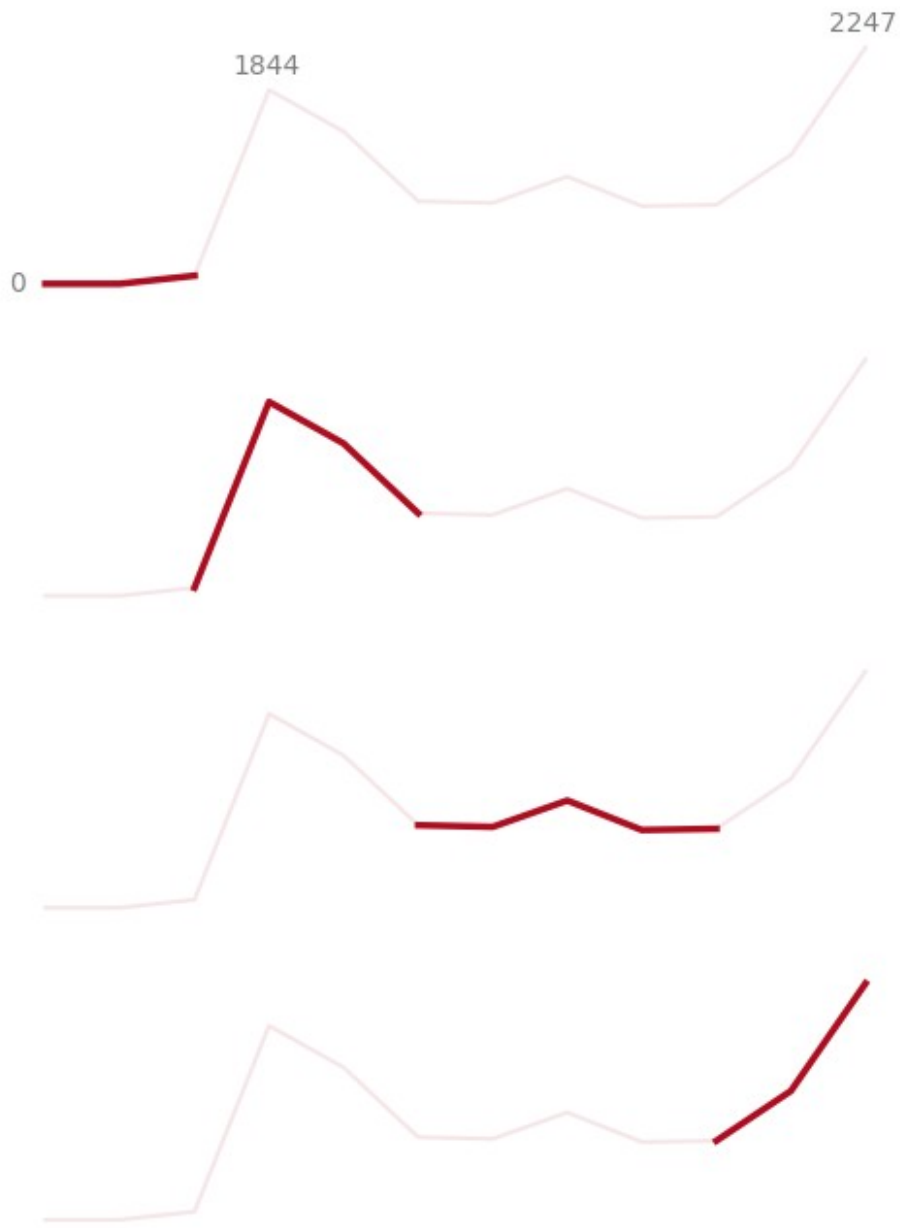
	Year	Month	Num_days	Avg_deaths	Monthly_deaths	Cum_deaths
5	2020	6	30	785	23550	126145
6	2020	7	31	769	23839	149984
7	2020	8	31	1020	31620	181604
8	2020	9	30	739	22170	203774
9	2020	10	31	751	23281	227055

```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)
ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e", linewidth = 2.5)
ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e", linewidth = 2.5)
ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e", linewidth = 2.5)
ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e", linewidth = 2.5)
plt.show()
```



```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
```

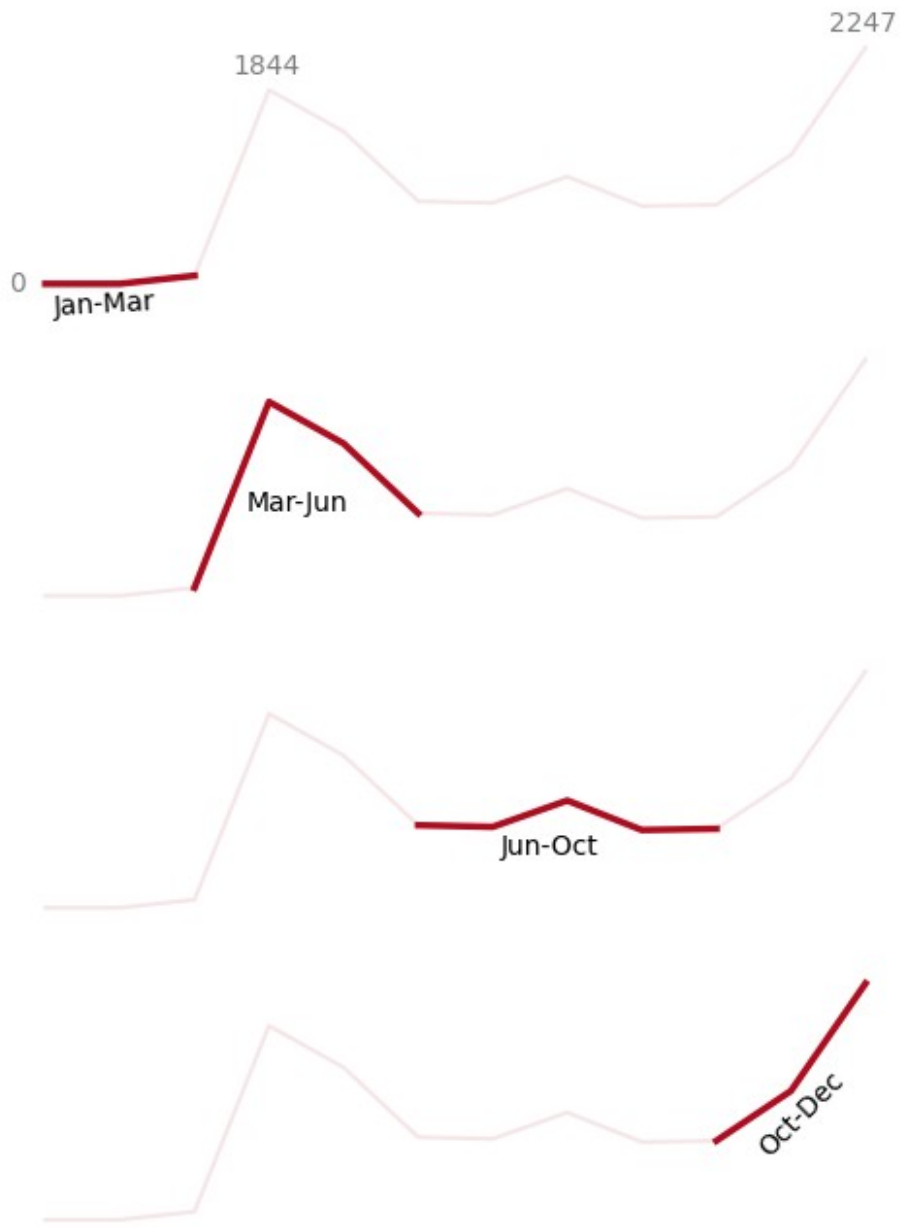
```
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)
ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e", linewidth = 2.5)
ax1.text(x = 0.5, y= -80, s = "0", alpha = 0.5)
ax1.text(x = 3.5, y= 2000, s = "1844", alpha = 0.5)
ax1.text(x = 11.5, y= 2400, s = "2247", alpha = 0.5)


ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e", linewidth = 2.5)
ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e", linewidth = 2.5)
ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e", linewidth = 2.5)



plt.show()
```



deaths

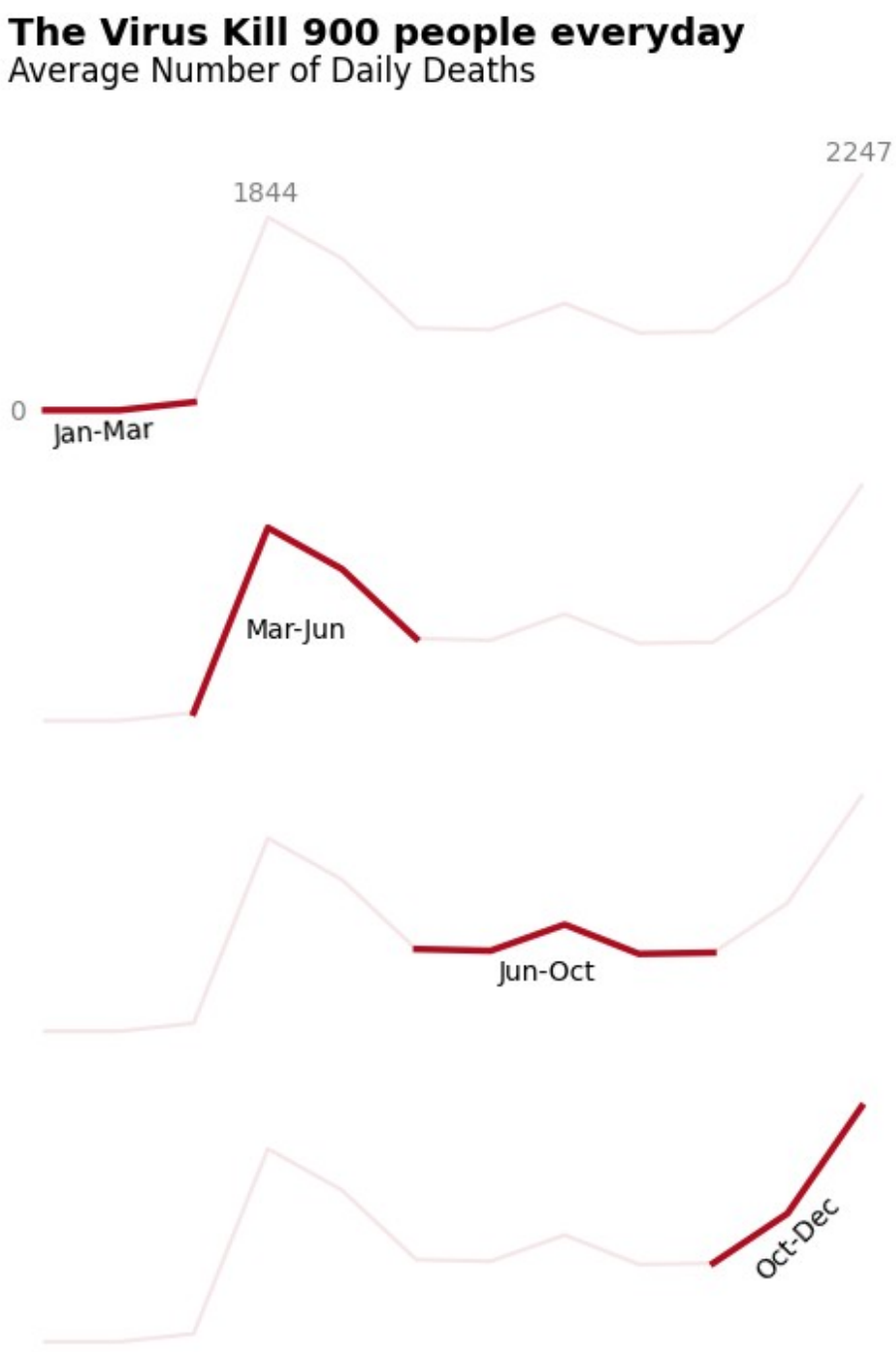
	Year	Month	Num_days	Avg_deaths	Monthly_deaths	Cum_deaths
0	2020	1	31	0	0	0
1	2020	2	29	0	0	0
2	2020	3	31	77	2387	2387
3	2020	4	30	1844	55320	57707
4	2020	5	31	1448	44888	102595
5	2020	6	30	785	23550	126145
6	2020	7	31	769	23839	149984
7	2020	8	31	1020	31620	181604
8	2020	9	30	739	22170	203774

```
9   2020     10        31         751           23281      227055
10  2020     11        30        1225           36750      263805
11  2020     12        15        2247           33705      297510

fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)
ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e", linewidth = 2.5)
ax1.text(x = 0.5, y= -80, s = "0", alpha = 0.5)
ax1.text(x = 3.5, y= 2000, s = "1844", alpha = 0.5)
ax1.text(x = 11.5, y= 2400, s = "2247", alpha = 0.5)
ax1.text(x = 1.1, y= -300, s = "Jan-Mar", rotation = 3)


ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e", linewidth = 2.5)
ax2.text(x = 3.7, y= 800, s = "Mar-Jun")



ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e", linewidth = 2.5)
ax3.text(x = 7.1, y= 500, s = "Jun-Oct")

ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e", linewidth = 2.5)
ax4.text(x = 10.5, y= 600, s = "Oct-Dec", rotation = 45)



plt.show()
```




```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
```

```
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)

ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e", linewidth = 2.5)
ax1.text(x = 0.5, y= -80, s = "0", alpha = 0.5)
ax1.text(x = 3.5, y= 2000, s = "1844", alpha = 0.5)
ax1.text(x = 11.5, y= 2400, s = "2247", alpha = 0.5)
ax1.text(x = 1.1, y= -300, s = "Jan-Mar", rotation = 3)
ax1.text(0.5, 3500, "The Virus Kill 900 people everyday", size = 14,
weight = "bold")
ax1.text(0.5, 3150, "Average Number of Daily Deaths", size = 12,)



ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e", linewidth = 2.5)
ax2.text(x = 3.7, y= 800, s = "Mar-Jun")



ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e", linewidth = 2.5)
ax3.text(x = 7.1, y= 500, s = "Jun-Oct")

ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e", linewidth = 2.5)
ax4.text(x = 10.5, y= 600, s = "Oct-Dec", rotation = 45)



plt.show()
```




```
deaths["Avg_deaths"].mean()
```

```
908.75
```

```
deaths
```

	Year	Month	Num_days	Avg_deaths	Monthly_deaths	Cum_deaths
0	2020	1	31	0	0	0
1	2020	2	29	0	0	0

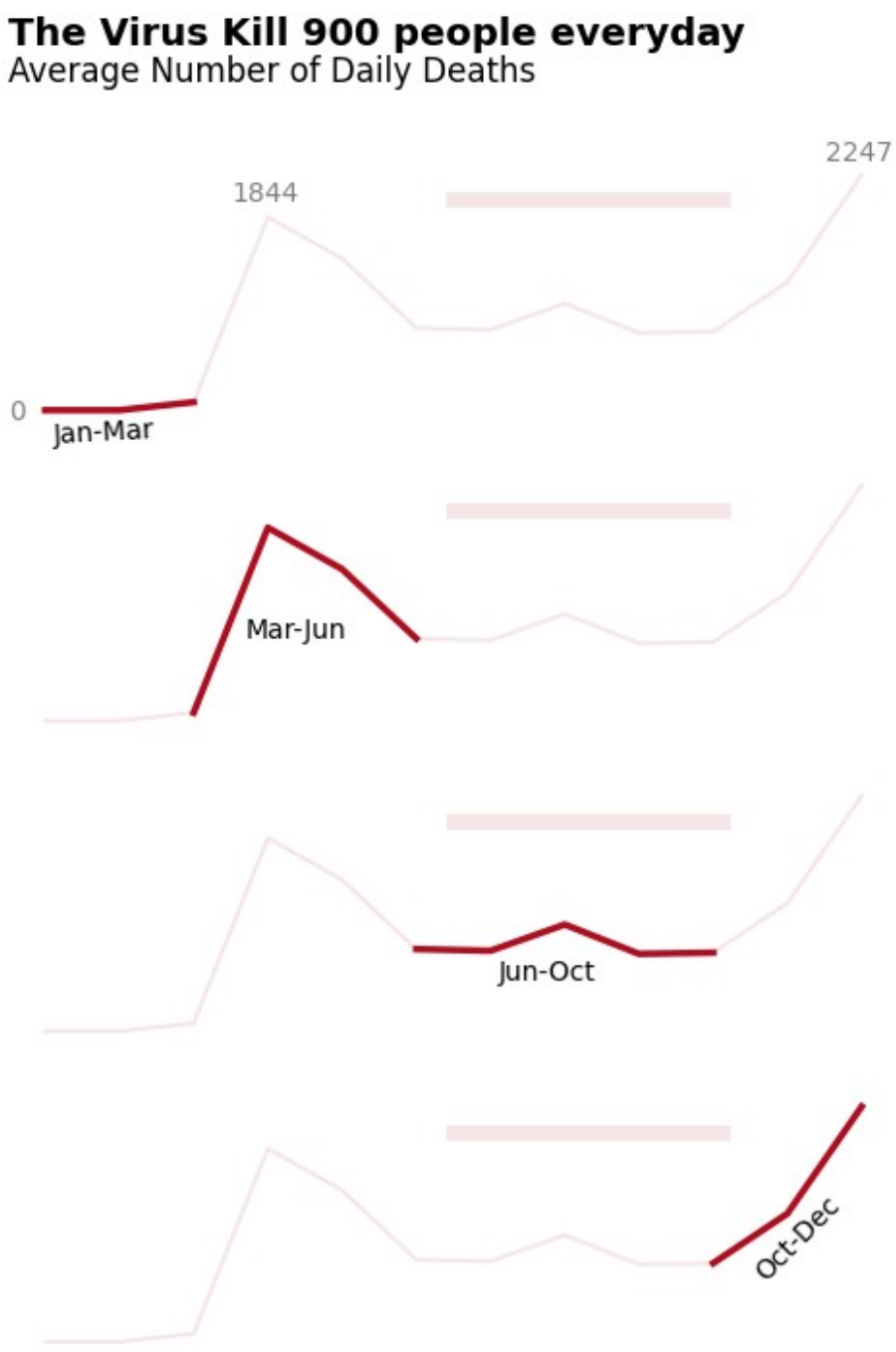
```
2   2020      3        31          77            2387         2387
3   2020      4        30        1844           55320        57707
4   2020      5        31        1448           44888       102595
5   2020      6        30         785           23550       126145
6   2020      7        31         769           23839       149984
7   2020      8        31        1020           31620       181604
8   2020      9        30         739           22170       203774
9   2020     10        31         751           23281       227055
10  2020     11        30        1225           36750       263805
11  2020     12        15        2247           33705       297510
```

```
cum_cases =
[deaths.loc[2,"Cum_deaths" ],deaths.loc[5,"Cum_deaths"],deaths.loc[9,"
Cum_deaths" ],
            deaths.loc[11,"Cum_deaths" ]]

cum_cases
```

```
[2387, 126145, 227055, 297510]
```

```
fig,(ax1, ax2, ax3, ax4) = plt.subplots(nrows = 4, ncols = 1, figsize
= (6,8))

axes = [ax1, ax2, ax3, ax4]


for ax in axes:
    ax.plot(deaths["Month"], deaths["Avg_deaths"], color = "#b00b1e",
alpha = 0.1)
    ax.set_xticklabels([]) # Data Ink, Data Element
    ax.set_yticklabels([])
    ax.tick_params(bottom = False, left = False) # Non Data Ink ->
removing Structural element
    # ax.spines["left"].set_visible(False)
    for spine in ax.spines:
        ax.spines[spine].set_visible(False)

ax1.plot(deaths["Month"][:3], deaths["Avg_deaths"][:3], color =
"#b00b1e", linewidth = 2.5)
ax1.text(x = 0.5, y= -80, s = "0", alpha = 0.5)
ax1.text(x = 3.5, y= 2000, s = "1844", alpha = 0.5)
ax1.text(x = 11.5, y= 2400, s = "2247", alpha = 0.5)
ax1.text(x = 1.1, y= -300, s = "Jan-Mar", rotation = 3)
ax1.text(0.5, 3500, "The Virus Kill 900 people everyday", size = 14,
weight = "bold")
ax1.text(0.5, 3150, "Average Number of Daily Deaths", size = 12,)



ax2.plot(deaths["Month"][2:6], deaths["Avg_deaths"][2:6], color =
"#b00b1e", linewidth = 2.5)
```

```
ax2.text(x = 3.7, y= 800, s = "Mar-Jun")



ax3.plot(deaths["Month"][5:10], deaths["Avg_deaths"][5:10], color =
"#b00b1e", linewidth = 2.5)
ax3.text(x = 7.1, y= 500, s = "Jun-Oct")

ax4.plot(deaths["Month"][9:], deaths["Avg_deaths"][9:], color =
"#b00b1e", linewidth = 2.5)
ax4.text(x = 10.5, y= 600, s = "Oct-Dec", rotation = 45)

for ax in axes:
    ax.axhline(y = 2000, xmin = 0.5, xmax = 0.8, c = "#b00b1e",
linewidth = 6, alpha = 0.1)

plt.show()
```




```
proportions = [round(i/cum_cases[-1], 2) for i in cum_cases]
propotions
```

```
[0.01, 0.42, 0.76, 1.0]
```

```
proportions = []

for i in cum_cases:
    v = i/297510
```

```
    final = round(v,2)
    # print(final)
    proportions.append(final)

proportions
```

```
[0.01, 0.42, 0.76, 1.0]
```

```
xmaxs = [0.5 + i*(0.8-0.5) for i in proportions]

xmaxs
```

```
[0.503, 0.626, 0.728, 0.8]
```