# Covid19 Data Analysis Notebook

## Let's Import the modules

In [2]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
print('Modules are imported.')
```

```
Modules are imported.
```

# Task 2

## Task 2.1: importing covid19 dataset

importing "Covid19_Confirmed_dataset.csv" from "./Dataset" folder.

In [5]:
```
corona_dataset_csv = pd.read_csv("Datasets/covid19_Confirmed_dataset.csv")
corona_dataset_csv.head()
```

Out[5]:

| | Province/State | Country/Region | Lat | Long | 1/22/20 | 1/23/20 | 1/24/20 | 1/25/20 | 1/26/20 |
|---|---|---|---|---|---|---|---|---|---|
| **0** | NaN | Afghanistan | 33.0000 | 65.0000 | 0 | 0 | 0 | 0 | 0 |
| **1** | NaN | Albania | 41.1533 | 20.1683 | 0 | 0 | 0 | 0 | 0 |
| **2** | NaN | Algeria | 28.0339 | 1.6596 | 0 | 0 | 0 | 0 | 0 |
| **3** | NaN | Andorra | 42.5063 | 1.5218 | 0 | 0 | 0 | 0 | 0 |
| **4** | NaN | Angola | -11.2027 | 17.8739 | 0 | 0 | 0 | 0 | 0 |

5 rows × 104 columns

## Let's check the shape of the dataframe

In [6]:
```
corona_dataset_csv.shape
```

Out[6]:
```
(266, 104)
```

## Task 2.2: Delete the useless columns

In [9]:
```
df = corona_dataset_csv.drop(["Lat","Long"],axis=1, inplace = True)
```

In [11]:
```
corona_dataset_csv.head(10)
```

Out[11]:

| | Province/State | Country/Region | 1/22/20 | 1/23/20 | 1/24/20 | 1/25/20 | 1/26/20 | 1/27/20 | 1/28/20 |
|---|---|---|---|---|---|---|---|---|---|
| **0** | NaN | Afghanistan | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | NaN | Albania | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | NaN | Algeria | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | NaN | Andorra | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | NaN | Angola | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5** | NaN | Antigua and Barbuda | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **6** | NaN | Argentina | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7** | NaN | Armenia | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8** | Australian Capital Territory | Australia | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **9** | New South Wales | Australia | 0 | 0 | 0 | 0 | 3 | 4 | 4 |

10 rows × 102 columns

## Task 2.3: Aggregating the rows by the country

In [12]:
```
corona_dataset_aggregated = corona_dataset_csv.groupby("Country/Region").sum()
```

In [13]:
```
corona_dataset_aggregated.head()
```

Out[13]:

| Country/Region | 1/22/20 | 1/23/20 | 1/24/20 | 1/25/20 | 1/26/20 | 1/27/20 | 1/28/20 | 1/29/20 | 1/30/20 |
|---|---|---|---|---|---|---|---|---|---|
| **Afghanistan** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Albania** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Algeria** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Andorra** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Angola** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

5 rows × 100 columns

In [15]:
```
corona_dataset_aggregated.shape
```

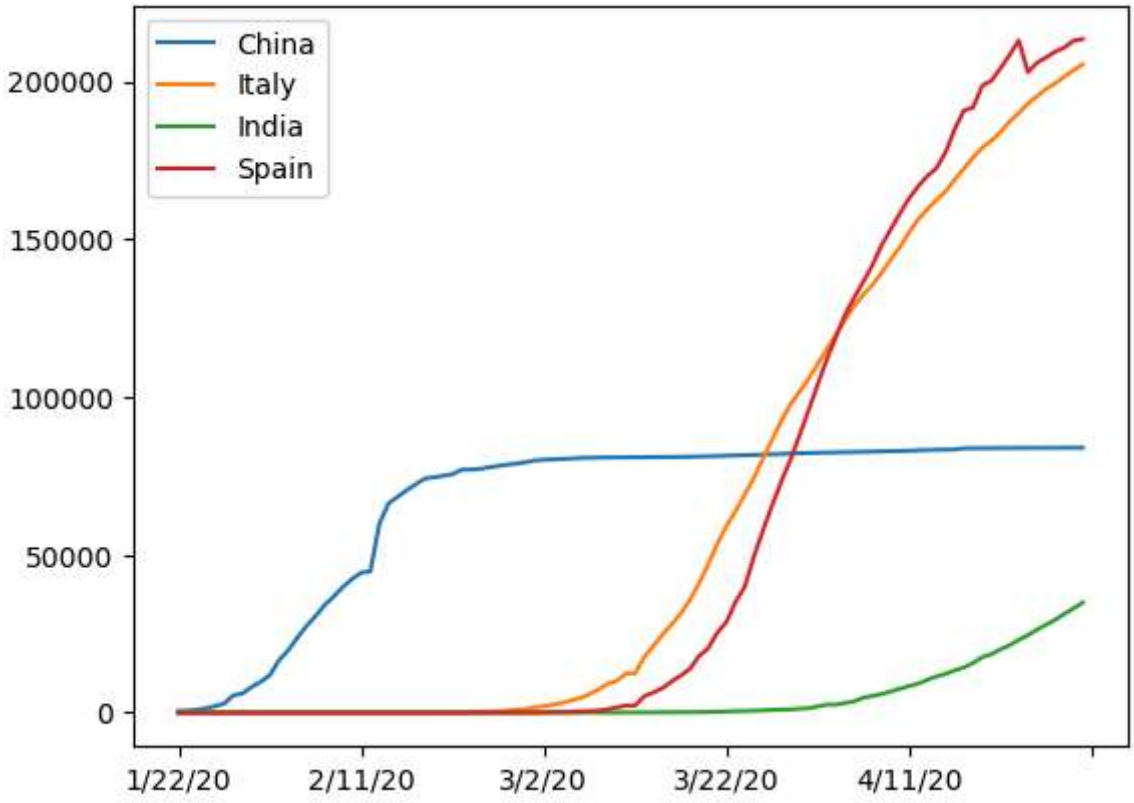
Out[15]:
```
(187, 100)
```

## Task 2.4: Visualizing data related to a country for example China

visualization always helps for better understanding of our data.

In [17]:
```
corona_dataset_aggregated.loc["China"].plot()
corona_dataset_aggregated.loc["Italy"].plot()
corona_dataset_aggregated.loc["India"].plot()
corona_dataset_aggregated.loc["Spain"].plot()
plt.legend()
```

Out[17]:
```
<matplotlib.legend.Legend at 0x7846dc058100>
```

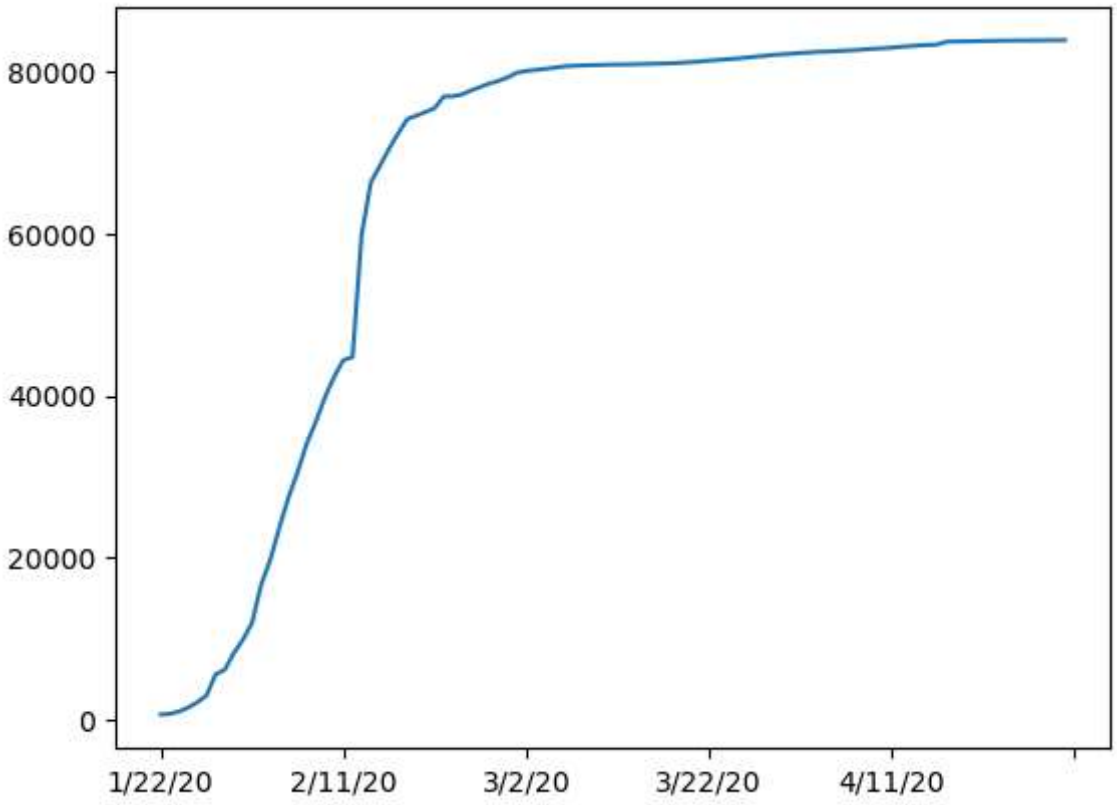



## Task3: Calculating a good measure

we need to find a good measure reperestend as a number, describing the spread of the virus in a country.

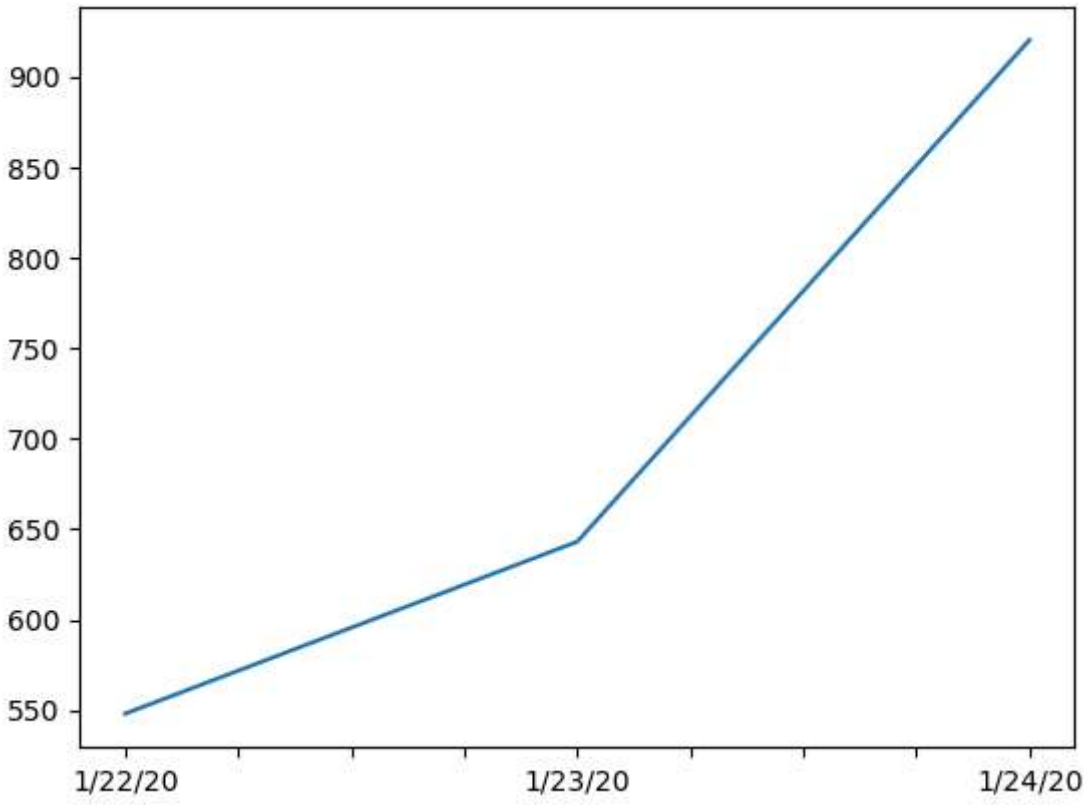
In [18]:
```
corona_dataset_aggregated.loc['China'].plot()
```

Out[18]:
```
<AxesSubplot: >
```




In [19]:
```
corona_dataset_aggregated.loc["China"][:3].plot()
```

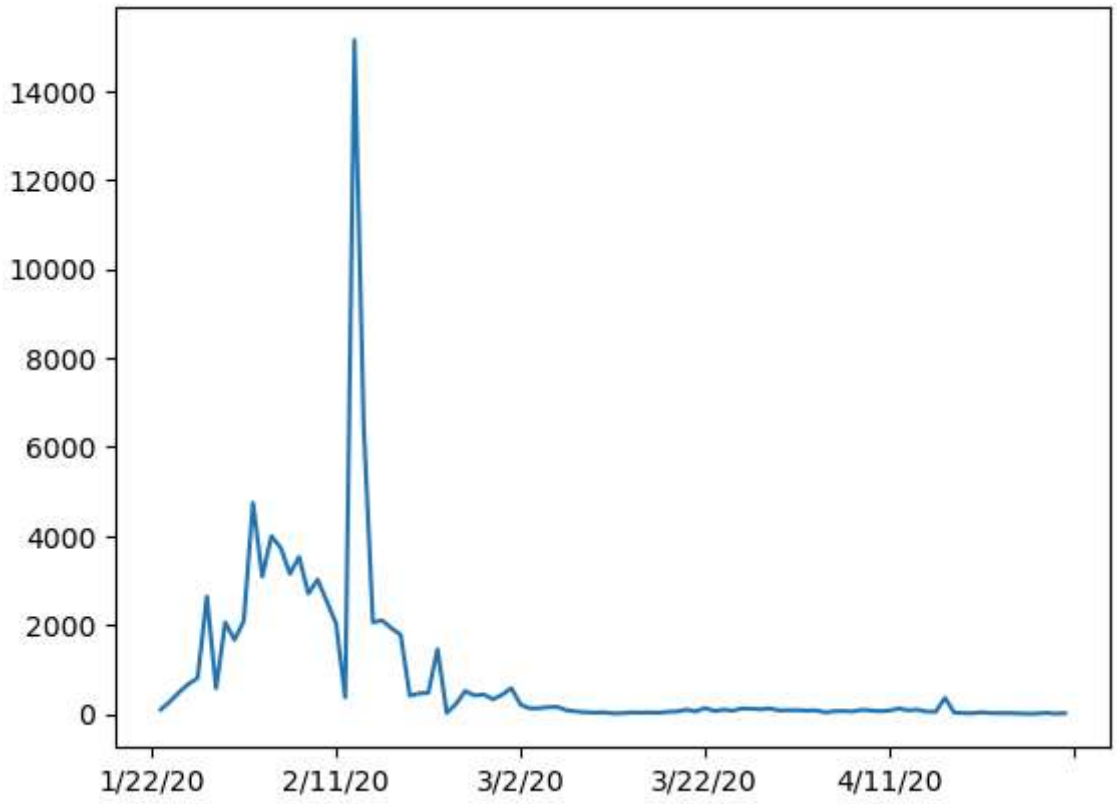
Out[19]: <AxesSubplot: >




## task 3.1: caculating the first derivative of the curve

In [20]:
```
corona_dataset_aggregated.loc["China"].diff().plot()
```

Out[20]:
```
<AxesSubplot: >
```




## task 3.2: find maxmimum infection rate for China

In [21]:
```
corona_dataset_aggregated.loc["China"].diff().max()
```

Out[21]:
```
15136.0
```

In [23]:
```
corona_dataset_aggregated.loc["India"].diff().max()
```

Out[23]:
```
1893.0
```

In [22]:
```
corona_dataset_aggregated.loc["Spain"].diff().max()
```

Out[22]:
```
9630.0
```

## Task 3.3: find maximum infection rate for all of the countries.

In [37]:
```
countries = list(corona_dataset_aggregated.index)
max_infection_rates = []
for c in countries:
    max_infection_rates.append(corona_dataset_aggregated.loc[c].diff().max())
corona_dataset_aggregated["max_infection_rate"] = max_infection_rates
```

In [38]:
```
corona_dataset_aggregated.head()
```

Out[38]:

| Country/Region | 1/22/20 | 1/23/20 | 1/24/20 | 1/25/20 | 1/26/20 | 1/27/20 | 1/28/20 | 1/29/20 | 1/30/20 |
|---|---|---|---|---|---|---|---|---|---|
| **Afghanistan** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Albania** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Algeria** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Andorra** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Angola** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

5 rows × 101 columns

## Task 3.4: create a new dataframe with only needed column

In [39]:
```
corona_data = pd.DataFrame(corona_dataset_aggregated["max_infection_rate"])
```

In [40]:
```
corona_data.head()
```

Out[40]:

| Country/Region | max_infection_rate |
|---|---|
| **Afghanistan** | 232.0 |
| **Albania** | 34.0 |
| **Algeria** | 199.0 |
| **Andorra** | 43.0 |
| **Angola** | 5.0 |

## Task4:

- Importing the WorldHappinessReport.csv dataset
- selecting needed columns for our analysis
- join the datasets
- calculate the correlations as the result of our analysis

## Task 4.1 : importing the dataset

In [57]:
```
happiness_report_csv = pd.read_csv("Datasets/worldwide_happiness_report.csv")
```

In [58]:
```
happiness_report_csv.head()
```

Out[58]:

| | Overall rank | Country or region | Score | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices | Generosity | Perceptions of corruption |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | Finland | 7.769 | 1.340 | 1.587 | 0.986 | 0.596 | 0.153 | 0.393 |
| **1** | 2 | Denmark | 7.600 | 1.383 | 1.573 | 0.996 | 0.592 | 0.252 | 0.410 |
| **2** | 3 | Norway | 7.554 | 1.488 | 1.582 | 1.028 | 0.603 | 0.271 | 0.341 |
| **3** | 4 | Iceland | 7.494 | 1.380 | 1.624 | 1.026 | 0.591 | 0.354 | 0.118 |
| **4** | 5 | Netherlands | 7.488 | 1.396 | 1.522 | 0.999 | 0.557 | 0.322 | 0.298 |

## Task 4.2: let's drop the useless columns

In [66]:
```
useless_cols = ["Overall rank","Score", "Generosity", "Perceptions of corruption" ]
```

In [68]:
```
happiness_report_csv.drop(useless_cols,axis=1,inplace=True)
happiness_report_csv.head()
```

Out[68]:

| | Country or region | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|---|
| **0** | Finland | 1.340 | 1.587 | 0.986 | 0.596 |
| **1** | Denmark | 1.383 | 1.573 | 0.996 | 0.592 |
| **2** | Norway | 1.488 | 1.582 | 1.028 | 0.603 |
| **3** | Iceland | 1.380 | 1.624 | 1.026 | 0.591 |
| **4** | Netherlands | 1.396 | 1.522 | 0.999 | 0.557 |

## Task 4.3: changing the indices of the dataframe

In [69]:
```
happiness_report_csv.set_index("Country or region", inplace=True)
```

In [70]:
```
happiness_report_csv.head()
```

Out[70]:

| Country or region | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|
| **Finland** | 1.340 | 1.587 | 0.986 | 0.596 |
| **Denmark** | 1.383 | 1.573 | 0.996 | 0.592 |
| **Norway** | 1.488 | 1.582 | 1.028 | 0.603 |
| **Iceland** | 1.380 | 1.624 | 1.026 | 0.591 |
| **Netherlands** | 1.396 | 1.522 | 0.999 | 0.557 |

# Task4.4: now let's join two dataset we have prepared

## Corona Dataset :

In [72]:
```
corona_data.head()
```

Out[72]:

| Country/Region | max_infection_rate |
|---|---|
| **Afghanistan** | 232.0 |
| **Albania** | 34.0 |
| **Algeria** | 199.0 |
| **Andorra** | 43.0 |
| **Angola** | 5.0 |

In [74]:
```
corona_data.shape
```

Out[74]:
```
(187, 1)
```

## wolrd happiness report Dataset :

In [75]:
```
happiness_report_csv.head()
```

Out[75]:

| Country or region | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|
| **Finland** | 1.340 | 1.587 | 0.986 | 0.596 |
| **Denmark** | 1.383 | 1.573 | 0.996 | 0.592 |
| **Norway** | 1.488 | 1.582 | 1.028 | 0.603 |
| **Iceland** | 1.380 | 1.624 | 1.026 | 0.591 |
| **Netherlands** | 1.396 | 1.522 | 0.999 | 0.557 |

In [77]:
```
happiness_report_csv.shape
```

Out[77]:
```
(156, 4)
```

In [78]:
```
data = corona_data.join(happiness_report_csv,how="inner")
data.head()
```

Out[78]:

| | max_infection_rate | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|---|
| **Afghanistan** | 232.0 | 0.350 | 0.517 | 0.361 | 0.000 |
| **Albania** | 34.0 | 0.947 | 0.848 | 0.874 | 0.383 |
| **Algeria** | 199.0 | 1.002 | 1.160 | 0.785 | 0.086 |
| **Argentina** | 291.0 | 1.092 | 1.432 | 0.881 | 0.471 |
| **Armenia** | 134.0 | 0.850 | 1.055 | 0.815 | 0.283 |

## Task 4.5: correlation matrix

In [79]:
```
data.corr()
```

Out[79]:

| | max_infection_rate | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|---|
| **max_infection_rate** | 1.000000 | 0.250118 | 0.191958 | 0.289263 | 0.078196 |
| **GDP per capita** | 0.250118 | 1.000000 | 0.759468 | 0.863062 | 0.394603 |
| **Social support** | 0.191958 | 0.759468 | 1.000000 | 0.765286 | 0.456246 |
| **Healthy life expectancy** | 0.289263 | 0.863062 | 0.765286 | 1.000000 | 0.427892 |
| **Freedom to make life choices** | 0.078196 | 0.394603 | 0.456246 | 0.427892 | 1.000000 |

## Task 5: Visualization of the results

our Analysis is not finished unless we visualize the results in terms figures and graphs so that everyone can understand what you get out of our analysis

In [80]:
```
data.head()
```

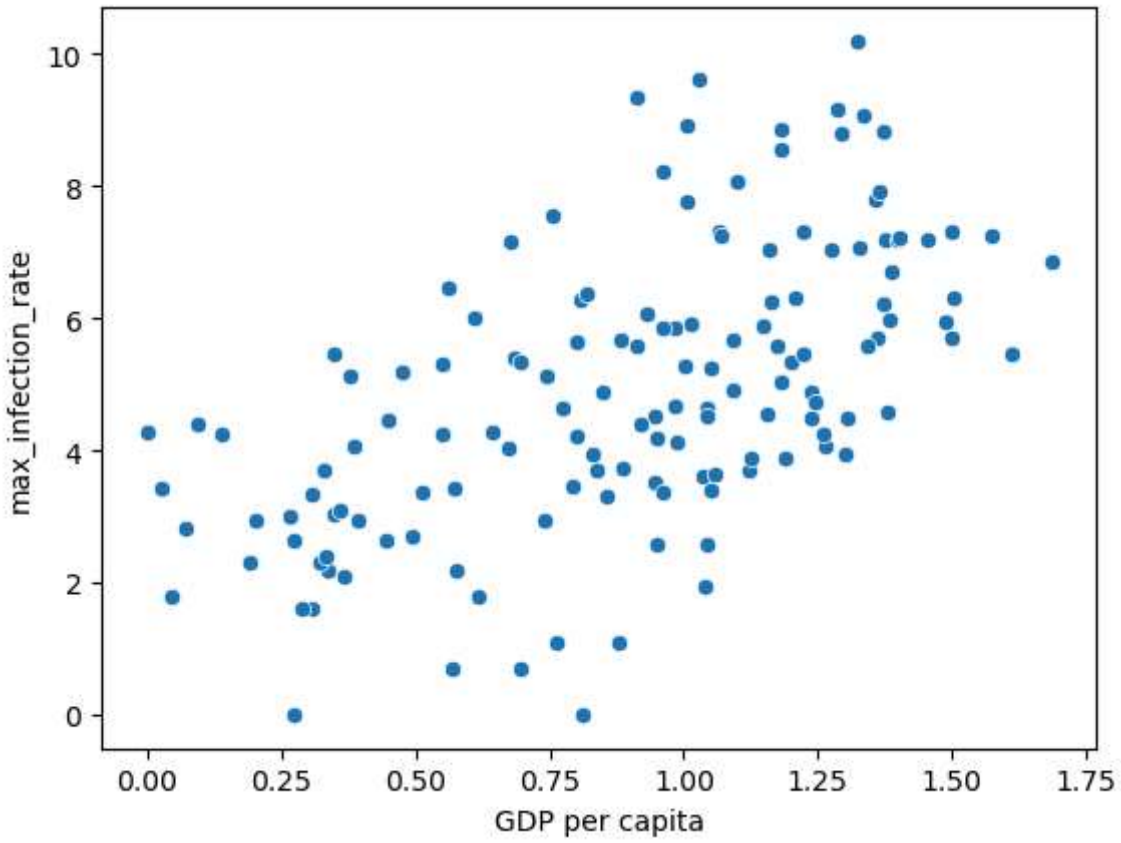
Out[80]:

| | max_infection_rate | GDP per capita | Social support | Healthy life expectancy | Freedom to make life choices |
|---|---|---|---|---|---|
| **Afghanistan** | 232.0 | 0.350 | 0.517 | 0.361 | 0.000 |
| **Albania** | 34.0 | 0.947 | 0.848 | 0.874 | 0.383 |
| **Algeria** | 199.0 | 1.002 | 1.160 | 0.785 | 0.086 |
| **Argentina** | 291.0 | 1.092 | 1.432 | 0.881 | 0.471 |
| **Armenia** | 134.0 | 0.850 | 1.055 | 0.815 | 0.283 |

## Task 5.1: Plotting GDP vs maximum Infection rate

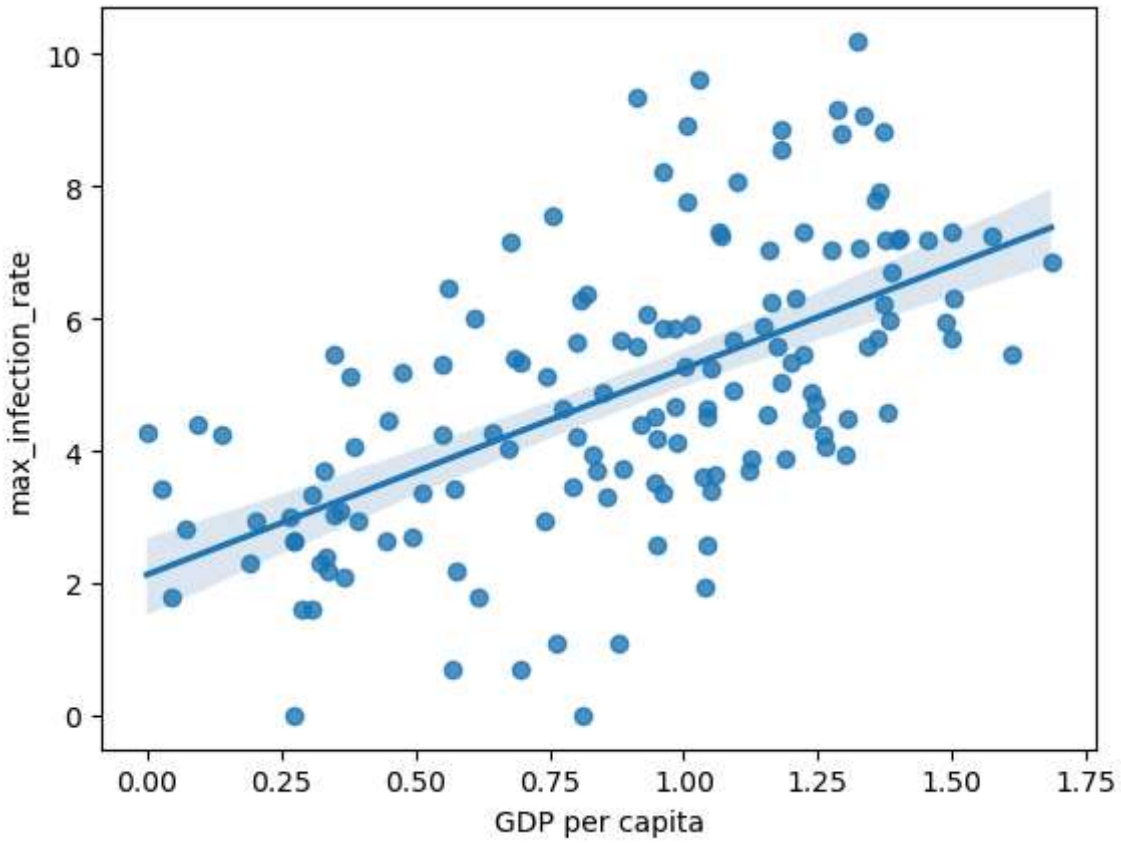
In [85]:
```
x = data["GDP per capita"]
y = data["max_infection_rate"]
sns.scatterplot(x=x, y=np.log(y))
```

Out[85]:
```
<AxesSubplot: xlabel='GDP per capita', ylabel='max_infection_rate'>
```




In [87]:
```
sns.regplot(x=x,y=np.log(y))
```

Out[87]:
```
<AxesSubplot: xlabel='GDP per capita', ylabel='max_infection_rate'>
```


max_infection_rate
GDP per capita
0
2
4
6
8
10
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75