Instructions

The assignment is at the bottom!

This cell automatically downloads Capital Bikeshare data

And here we read in the data

In [469]:
```
!pip install seaborn
```

```
Requirement already satisfied: seaborn in /opt/anaconda3/lib/python3.
9/site-packages (0.11.2)
Requirement already satisfied: numpy>=1.15 in /opt/anaconda3/lib/pyth
on3.9/site-packages (from seaborn) (1.21.5)
Requirement already satisfied: scipy>=1.0 in /opt/anaconda3/lib/pytho
n3.9/site-packages (from seaborn) (1.9.1)
Requirement already satisfied: pandas>=0.23 in /opt/anaconda3/lib/pyt
hon3.9/site-packages (from seaborn) (1.4.4)
Requirement already satisfied: matplotlib>=2.2 in /opt/anaconda3/lib/
python3.9/site-packages (from seaborn) (3.5.2)
Requirement already satisfied: pyparsing>=2.2.1 in /opt/anaconda3/lib
/python3.9/site-packages (from matplotlib>=2.2->seaborn) (3.0.9)
Requirement already satisfied: pillow>=6.2.0 in /opt/anaconda3/lib/py
thon3.9/site-packages (from matplotlib>=2.2->seaborn) (9.2.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /opt/anaconda3/li
b/python3.9/site-packages (from matplotlib>=2.2->seaborn) (1.4.2)
Requirement already satisfied: packaging>=20.0 in /opt/anaconda3/lib/
python3.9/site-packages (from matplotlib>=2.2->seaborn) (21.3)
Requirement already satisfied: fonttools>=4.22.0 in /opt/anaconda3/li
b/python3.9/site-packages (from matplotlib>=2.2->seaborn) (4.25.0)
Requirement already satisfied: cycler>=0.10 in /opt/anaconda3/lib/pyt
hon3.9/site-packages (from matplotlib>=2.2->seaborn) (0.11.0)
Requirement already satisfied: python-dateutil>=2.7 in /opt/anaconda3
/lib/python3.9/site-packages (from matplotlib>=2.2->seaborn) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /opt/anaconda3/lib/pyt
hon3.9/site-packages (from pandas>=0.23->seaborn) (2022.1)
Requirement already satisfied: six>=1.5 in /opt/anaconda3/lib/python
3.9/site-packages (from python-dateutil>=2.7->matplotlib>=2.2->seabor
n) (1.16.0)
```

In [470]:
```
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
plt.rcParams['figure.figsize'] = 20, 10
import pandas as pd
import numpy as np


day_hour_count = pd.read_csv("bikeshare_hour_count.csv")
day_hour_count
```

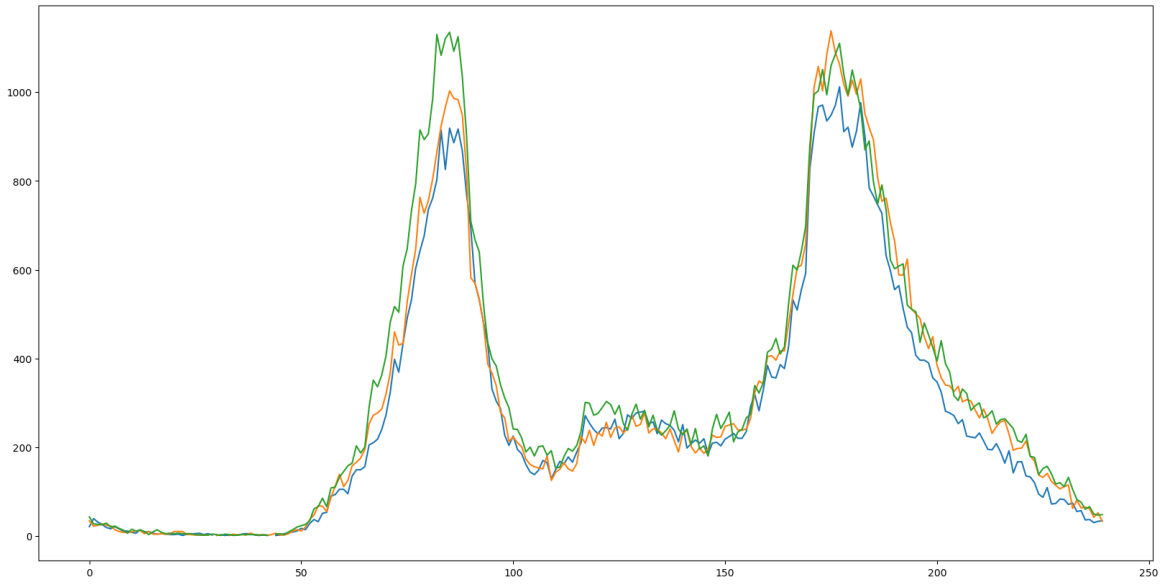
Out[470]:

	hour_of_day	0	1	2	3	4	5	6
0	0.0	21.0	34.0	43.0	47.0	51.0	89.0	106.0
1	0.1	39.0	22.0	27.0	37.0	56.0	87.0	100.0
2	0.2	31.0	24.0	26.0	42.0	50.0	98.0	77.0
3	0.3	26.0	27.0	25.0	29.0	52.0	99.0	87.0
4	0.4	19.0	24.0	29.0	29.0	50.0	98.0	69.0
...	...	...	...	...	...	...	...	...
235	23.5	36.0	65.0	60.0	94.0	80.0	93.0	28.0
236	23.6	37.0	61.0	66.0	100.0	81.0	95.0	28.0
237	23.7	30.0	42.0	49.0	80.0	101.0	105.0	27.0
238	23.8	33.0	52.0	47.0	79.0	91.0	93.0	24.0
239	23.9	34.0	33.0	48.0	65.0	105.0	111.0	23.0

240 rows × 8 columns

In [471]:
```
plt.figure(figsize=(20,10))
plt.plot(day_hour_count.index, day_hour_count["0"])
plt.plot(day_hour_count.index, day_hour_count["1"])
plt.plot(day_hour_count.index, day_hour_count["2"])
```

Out[471]:
```
[<matplotlib.lines.Line2D at 0x1300c66d0>]
```



Assignment 4

Explain the results in a **paragraph + charts** of to describe which model you'd recommend. This means show the data and the model's line on the same chart. The paragraph is a simple justification and comparison of the several models you tried.

1. Using the `day_hour_count` dataframe create two dataframes `monday` and `saturday` that represent the data for those days. (hint: Monday is day=0)

In [472]:
```
day_hour_count["hour_of_day"]
```

Out[472]:
```
0       0.0
1       0.1
2       0.2
3       0.3
4       0.4
       ...
235    23.5
236    23.6
237    23.7
238    23.8
239    23.9
Name: hour_of_day, Length: 240, dtype: float64
```

In [473]:
```
day_hour_count_drop = day_hour_count.dropna()

day_hour_count_fill = day_hour_count.fillna(0)

day_hour_count_drop, day_hour_count_fill
```

Out[473]:
```
(     hour_of_day     0     1     2     3     4     5     6
 0            0.0  21.0  34.0  43.0  47.0  51.0  89.0  106.0
 1            0.1  39.0  22.0  27.0  37.0  56.0  87.0  100.0
 2            0.2  31.0  24.0  26.0  42.0  50.0  98.0   77.0
 3            0.3  26.0  27.0  25.0  29.0  52.0  99.0   87.0
 4            0.4  19.0  24.0  29.0  29.0  50.0  98.0   69.0
 ..           ...   ...   ...   ...   ...   ...   ...    ...
 235         23.5  36.0  65.0  60.0  94.0  80.0  93.0   28.0
 236         23.6  37.0  61.0  66.0 100.0  81.0  95.0   28.0
 237         23.7  30.0  42.0  49.0  80.0 101.0 105.0   27.0
 238         23.8  33.0  52.0  47.0  79.0  91.0  93.0   24.0
 239         23.9  34.0  33.0  48.0  65.0 105.0 111.0   23.0

 [235 rows x 8 columns],
      hour_of_day     0     1     2     3     4     5     6
 0            0.0  21.0  34.0  43.0  47.0  51.0  89.0  106.0
 1            0.1  39.0  22.0  27.0  37.0  56.0  87.0  100.0
 2            0.2  31.0  24.0  26.0  42.0  50.0  98.0   77.0
 3            0.3  26.0  27.0  25.0  29.0  52.0  99.0   87.0
 4            0.4  19.0  24.0  29.0  29.0  50.0  98.0   69.0
 ..           ...   ...   ...   ...   ...   ...   ...    ...
 235         23.5  36.0  65.0  60.0  94.0  80.0  93.0   28.0
 236         23.6  37.0  61.0  66.0 100.0  81.0  95.0   28.0
 237         23.7  30.0  42.0  49.0  80.0 101.0 105.0   27.0
 238         23.8  33.0  52.0  47.0  79.0  91.0  93.0   24.0
 239         23.9  34.0  33.0  48.0  65.0 105.0 111.0   23.0

 [240 rows x 8 columns])
```

In [474]:
```
monday = day_hour_count_drop[["hour_of_day","0"]].copy()
```

In [475]:
```
saturday = day_hour_count_drop[["hour_of_day","5"]].copy()
```

In [476]:
```
monday["hour"] = monday.index
```

In [477]:
```
saturday["hour"] = saturday.index
```

In [478]:
```
monday
```

Out[478]:

	hour_of_day	0	hour
0	0.0	21.0	0
1	0.1	39.0	1
2	0.2	31.0	2
3	0.3	26.0	3
4	0.4	19.0	4
...	...	...	...
235	23.5	36.0	235
236	23.6	37.0	236
237	23.7	30.0	237
238	23.8	33.0	238
239	23.9	34.0	239

235 rows × 3 columns

In [479]:
```
saturday
```

Out[479]:

	hour_of_day	5	hour
0	0.0	89.0	0
1	0.1	87.0	1
2	0.2	98.0	2
3	0.3	99.0	3
4	0.4	98.0	4
...	...	...	...
235	23.5	93.0	235
236	23.6	95.0	236
237	23.7	105.0	237
238	23.8	93.0	238
239	23.9	111.0	239

235 rows × 3 columns

2a. Create 3 models fit to `monday.hour_of_day` with varying polynomial degrees (choose from `n=5,10,15`). (Repeat for `saturday` below)

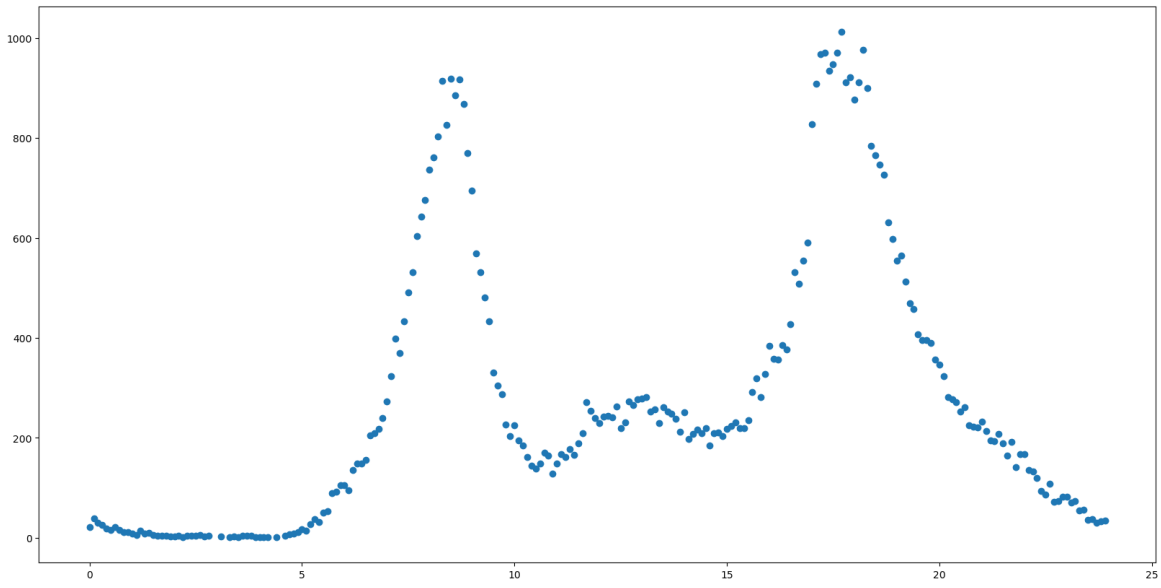
Plot all the results for each polynomial.

In [480]:
```
x_mon = monday["hour_of_day"].values.reshape(-1,1)
y_mon = monday["0"]
x_mon, y_mon
```

Out[480]:
```
(array([[ 0. ],
        [ 0.1],
        [ 0.2],
        [ 0.3],
        [ 0.4],
        [ 0.5],
        [ 0.6],
        [ 0.7],
        [ 0.8],
        [ 0.9],
        [ 1. ],
        [ 1.1],
        [ 1.2],
        [ 1.3],
        [ 1.4],
        [ 1.5],
        [ 1.6],
        [ 1.7],
        [ 1.8],
        [ 1.9],
```

In [481]:
```
plt.scatter(x_mon, y_mon)
```

Out[481]:
```
<matplotlib.collections.PathCollection at 0x13d95cee0>
```



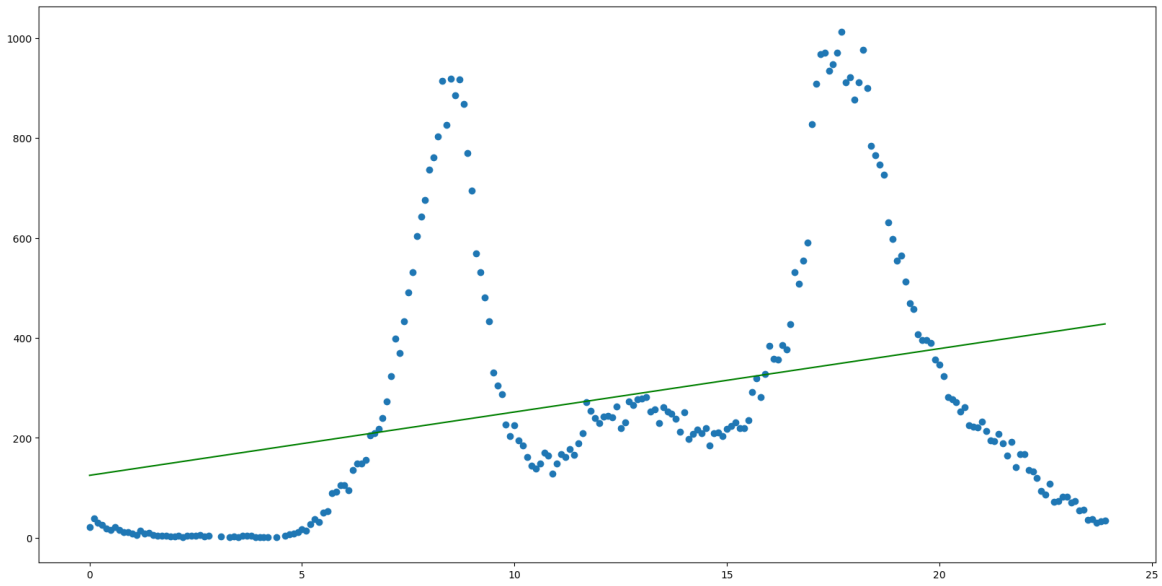
In [482]:
```
from sklearn import linear_model
```

In [483]:
```
linear_mon = linear_model.LinearRegression()

linear_mon.fit(x_mon, y_mon)

linear_mon.coef_, linear_mon.intercept_
```

Out[483]:
```
(array([12.67240265]), 125.09525619708384)
```

In [484]:
```
plt.scatter(x_mon,y_mon)
plt.plot(x_mon, x_mon*linear_mon.coef_ + linear_mon.intercept_, c='g')
```

Out[484]:
```
[<matplotlib.lines.Line2D at 0x12fd623a0>]
```



In [485]:
```
from sklearn.preprocessing import PolynomialFeatures

poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_mon)
```

In [486]:
```
#check what this looks like
x_15
```

Out[486]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
        0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, ...,
        1.00000000e-13, 1.00000000e-14, 1.00000000e-15],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, ...,
        8.19200000e-10, 1.63840000e-10, 3.27680000e-11],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, ...,
        7.44266546e+17, 1.76391171e+19, 4.18047076e+20],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, ...,
        7.86140991e+17, 1.87101556e+19, 4.45301703e+20],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, ...,
        8.30180852e+17, 1.98413224e+19, 4.74207605e+20]])
```

In [487]:
```
poly10 = PolynomialFeatures(degree=10)

x_10 = poly10.fit_transform(x_mon)
x_10
```

Out[487]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
        0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, ...,
        1.00000000e-08, 1.00000000e-09, 1.00000000e-10],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, ...,
        2.56000000e-06, 5.12000000e-07, 1.02400000e-07],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, ...,
        9.95375090e+10, 2.35903896e+12, 5.59092234e+13],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, ...,
        1.02947465e+11, 2.45014966e+12, 5.83135620e+13],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, ...,
        1.06459202e+11, 2.54437493e+12, 6.08105609e+13]])
```

In [488]:
```
poly5 = PolynomialFeatures(degree=5)

x_5 = poly5.fit_transform(x_mon)
x_5
```

Out[488]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, 0.00000000e+00,
        0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, 1.00000000e-03,
        1.00000000e-04, 1.00000000e-05],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, 8.00000000e-03,
        1.60000000e-03, 3.20000000e-04],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, 1.33120530e+04,
        3.15495656e+05, 7.47724705e+06],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, 1.34812720e+04,
        3.20854274e+05, 7.63633171e+06],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, 1.36519190e+04,
        3.26280864e+05, 7.79811265e+06]])
```

In [489]:
```
# troubleshooting errors that state mismatch
x_15.shape, x_10.shape, x_5.shape
```

Out[489]:
```
((235, 16), (235, 11), (235, 6))
```

In [490]:
```
x_mon.shape
```

Out[490]:
```
(235, 1)
```

In [491]:
```
linear_mon.fit(x_15, y_mon)

linear_mon.coef_, linear_mon.intercept_
```

Out[491]:
```
(array([ 0.00000000e+00,  1.54736655e-05,  7.42928578e-08,  9.14147263e-07,
         5.78926997e-06,  3.21956700e-05,  1.49223079e-04,  5.14125523e-04,
         9.56456144e-04, -3.93293881e-04,  6.34693567e-05, -5.53175693e-06,
         2.84572749e-07, -8.67949237e-09,  1.45668064e-10, -1.03934004e-12]),
 22.14972588863776)
```

In [492]:
```
# troubleshooting mismatches, trying to find what works
#y_mon_lin15 = np.dot(x_15.reshape(-1,1), linear_mon.coef_) + linear_m
#y_mon_lin15 = np.dot(x_15.T, linear_mon.coef_) + linear_mon.intercept
y_mon_lin15 = np.dot(x_15, linear_mon.coef_.T) + linear_mon.intercept_

y_mon_lin15.shape
```

Out[492]:
```
(235,)
```

In [493]:
```
linear_mon.fit(x_10, y_mon)
linear_mon.coef_, linear_mon.intercept_
y_mon_lin10 = np.dot(x_10, linear_mon.coef_.T) + linear_mon.intercept_
y_mon_lin10
```

Out[493]:
```
array([ 66.54747118,  39.22051635,  19.63117118,   6.41798012,
        -1.62402083,  -5.55554234,  -6.3046098 ,  -4.67748691,
        -1.36897964,   3.02785477,   8.01257039,  13.16874349,
        18.15590932,  22.70200301,  26.59628317,  29.68271771,
        31.85381176,  33.04485808,  33.22859111,  32.41022632,
        30.6228668 ,  27.92326002,  24.38788779,  20.10937319,
        15.19318872,   9.75465033,   3.91618256,  -2.19515949,
        -8.44992531, -26.7849425 , -37.41161877, -41.90076928,
       -45.70283459, -48.72472867, -50.88221931, -52.10039903,
       -52.31403704, -51.46782107, -49.51649777, -46.42491973,
       -36.73063081, -22.30254128, -13.32932846,  -3.20998527,
         8.02485033,  20.33654409,  33.67894354,  47.99888519,
        63.23672577,  79.32689309,  96.19845216, 113.77568244,
       131.97866248, 150.72385832, 169.92471221, 189.49222868,
       209.33555481, 229.36255219, 249.48035783, 269.59593198,
       289.61659038, 309.45051933, 329.00727155, 348.19824137,
       366.9371178 , 385.14031412, 402.72737301, 419.62134611,
       435.74914729, 451.04187886, 465.43513026, 478.86924865,
       491.28958125, 502.64668916, 512.89653256, 522.00062736,
       529.92617339, 536.64615442, 542.13941023, 546.3906812 ,
       549.39062586, 551.13581201, 551.62868205, 550.87749309,
       548.89623282, 545.70451177, 541.32743301, 535.79544005,
       529.14414413, 521.41413167, 512.65075324, 502.90389487,
       492.227733  , 480.68047426, 468.32408106, 455.22398446,
       441.44878533, 427.06994516, 412.16146772, 396.79957287,
       381.06236371, 365.02948836, 348.78179771, 332.40100025,
       315.9693154 , 299.56912633, 283.28263385, 267.19151219,
       251.37656819, 235.9174048 , 220.89209031, 206.37683415,
       192.44567055, 179.17015108, 166.61904703, 154.8580627 ,
       143.94956057, 133.95229917, 124.92118467, 116.9070369 ,
       109.95637071, 104.11119335,  99.40881853,  95.88169804,
        93.55727118,  92.4578329 ,  92.60042094,  93.99672254,
        96.65300101, 100.57004257, 105.74312381, 112.16199981,
       119.81091332, 128.66862489, 138.70846421, 149.89840247,
       162.20114584, 175.57424983, 189.97025432, 205.33683916,
       221.6169999 , 238.74924327, 256.66780208, 275.30286899,
       294.58084851, 314.42462679, 334.75385837, 355.48526921,
       376.53297524, 397.80881545, 419.22269877, 440.68296359,
       462.09674905, 483.37037688, 504.40974272, 525.12071565,
       545.40954482, 565.18327162, 584.35014629, 602.82004743,
       620.5049029 , 637.31911074, 653.17995846, 668.00803909,
       681.72766242, 694.26725966, 705.55977989, 715.54307643,
       724.16028142, 731.36016676, 737.09748944, 741.33331957,
       744.03534901, 745.17817865, 744.7435826 , 742.72074689,
       739.10648118, 733.90540094, 727.13007842, 718.80116028,
       708.94744967, 697.60595096, 684.82187476, 670.64860151,
       655.14760119, 638.38830752, 620.44794424, 601.41130172,
       581.37046174, 560.42446855, 538.67894409, 516.24564576,
       493.24196442, 469.79036116, 446.01774072, 422.05475995,
       398.03506959, 374.09448739, 350.37010158, 326.9993024 ,
       304.11874062, 281.8632117 , 260.36446381, 239.74992889,
```

```
220.14137525, 201.65348083, 184.39232567, 168.45380365,
153.92195106, 140.86719327, 129.34450704, 119.39149945,
111.02640209, 104.2459808 ,  99.02336076,  95.30576688,
 93.01217971,  92.03090735,  92.21707356,  93.39002292,
 95.33064393,  97.77861068, 100.42954483, 102.93209845,
104.88496052, 105.83378679, 105.26805748, 102.6178629 ,
 97.25062035,  88.4677244 ,  75.50113444,  57.50990053,
 33.576633  ,   2.70391791, -36.18931688])
```

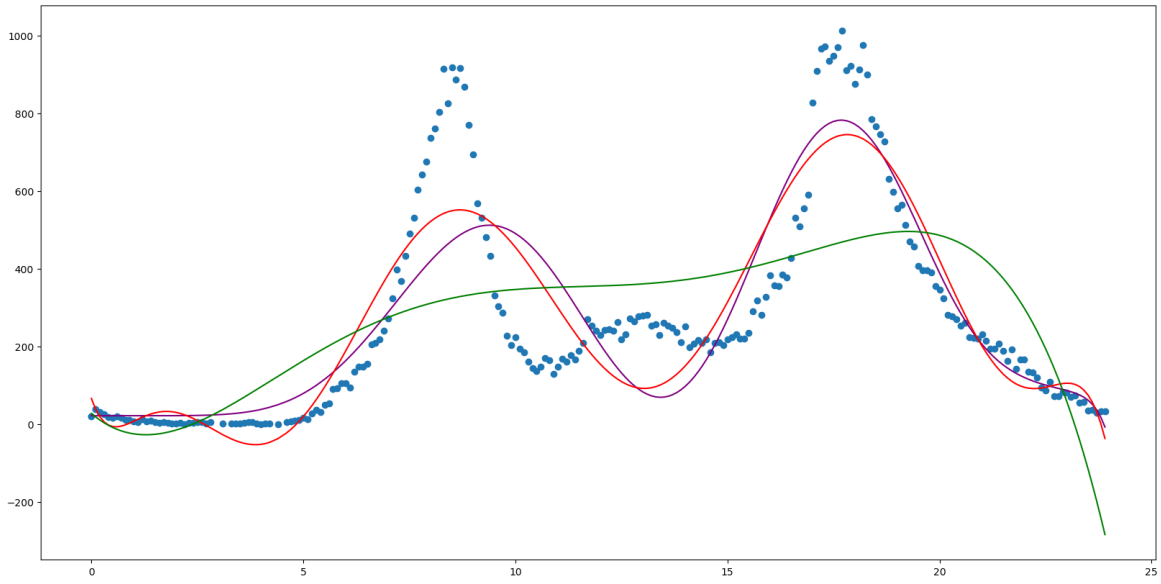
In [494]:
```
# 5 polynomials for monday
linear_mon.fit(x_5, y_mon)
linear_mon.coef_, linear_mon.intercept_
y_mon_lin5 = np.dot(x_5, linear_mon.coef_.T) + linear_mon.intercept_
y_mon_lin5
```

Out[494]:
```
array([  28.01526488,   19.09310504,   11.07611465,    3.92961279,
         -2.38035452,   -7.88702121,  -12.62290785,  -16.61982856,
        -19.90889773,  -22.52053685,  -24.4844813 ,  -25.82978717,
        -26.58483802,  -26.77735172,  -26.43438721,  -25.58235135,
        -24.24700567,  -22.45347317,  -20.22624518,  -17.58918806,
        -14.56555011,  -11.17796828,   -7.448475  ,   -3.398505  ,
          0.95109792,    5.58007408,   10.46874112,   15.59798721,
         20.94926424,   38.15811291,   50.42553354,   56.75019772,
         63.18226921,   69.70746494,   76.31200435,   82.98260263,
         89.7064639 ,   96.47127441,  103.26519576,  110.07685808,
        123.71022805,  137.2895378 ,  144.03527986,  150.74000225,
        157.3954245 ,  163.99368027,  170.52731061,  176.98925706,
        183.37285497,  189.67182659,  195.88027437,  201.99267406,
        208.00386801,  213.90905829,  219.70379995,  225.38399419,
        230.94588157,  236.38603519,  241.70135394,  246.88905565,
        251.94667031,  256.8720333 ,  261.66327853,  266.31883169,
        270.83740344,  275.2179826 ,  279.45982937,  283.5624685 ,
        287.52568253,  291.34950496,  295.03421347,  298.58032309,
        301.98857945,  305.25995196,  308.39562698,  311.39700106,
        314.26567414,  317.00344272,  319.6122931 ,  322.09439454,
        324.4520925 ,  326.68790182,  328.80449992,  330.80472   ,
        332.69154426,  334.46809708,  336.13763824,  337.70355609,
        339.16936078,  340.53867746,  341.81523947,  343.00288152,
        344.10553296,  345.1272109 ,  346.07201345,  346.94411293,
        347.74774906,  348.48722215,  349.16688632,  349.79114268,
        350.36443255,  350.89123067,  351.37603836,  351.82337675,
        352.23778   ,  352.62378844,  352.98594185,  353.3287726 ,
        353.65679887,  353.97451784,  354.28639894,  354.59687699,
        354.91034542,  355.23114949,  355.56357947,  355.91186385,
        356.28016254,  356.67256008,  357.09305882,  357.54557213,
        358.03391761,  358.56181029,  359.13285581,  359.75054366,
        360.41824033,  361.13918256,  361.91647052,  362.75306099,
        363.6517606 ,  364.61521902,  365.64592213,  366.74618526,
        367.91814637,  369.16375927,  370.48478679,  371.88279402,
        373.35914147,  374.9149783 ,  376.5512355 ,  378.26861914,
        380.06760349,  381.94842428,  383.91107191,  385.95528459,
        388.08054161,  390.28605648,  392.57077019,  394.93334436,
        397.37215448,  399.88528307,  402.47051292,  405.12532027,
        407.84686804,  410.63199897,  413.47722888,  416.37873984,
        419.3323734 ,  422.33362375,  425.37763096,  428.45917414,
        431.57266469,  434.71213946,  437.87125398,  441.04327563,
        444.22107688,  447.39712845,  450.56349255,  453.71181605,
        456.83332368,  459.91881128,  462.95863893,  465.94272421,
        468.86053537,  471.70108452,  474.45292088,  477.10412393,
        479.64229663,  482.05455864,  484.32753949,  486.44737179,
        488.39968445,  490.16959585,  491.74170708,  493.10009508,
        494.22830593,  495.10934795,  495.725685  ,  496.05922959,
        496.09133615,  495.80279419,  495.17382153,  494.18405747,
        492.81255603,  491.0377791 ,  488.8375897 ,  486.18924512,
        483.06939018,  479.45405039,  475.31862516,  470.637881  ,
```

```
       465.38594476,  459.53629675,  453.06176401,  445.93451351,
       438.12604529,  429.60718573,  420.3480807 ,  410.31818881,
       399.48627457,  387.82040159,  375.28792583,  361.85548873,
       347.48901048,  332.15368317,  315.81396402,  298.43356857,
       279.97546387,  260.40186171,  239.6742118 ,  217.75319497,
       194.59871637,  170.16989871,  144.42507539,  117.32178376,
        88.81675829,   58.8659238 ,   27.42438862,   -5.55356217,
       -40.11447356,  -76.30572742, -114.17554925, -153.77301503,
      -195.14805802, -238.35147551, -283.43493566])
```

In [495]:
```
plt.scatter(x_mon,y_mon)
plt.plot(x_mon, y_mon_lin15, c='purple')
plt.plot(x_mon, y_mon_lin10, c='red')
plt.plot(x_mon, y_mon_lin5, c='green')
```

Out[495]: [<matplotlib.lines.Line2D at 0x12fdad9d0>]



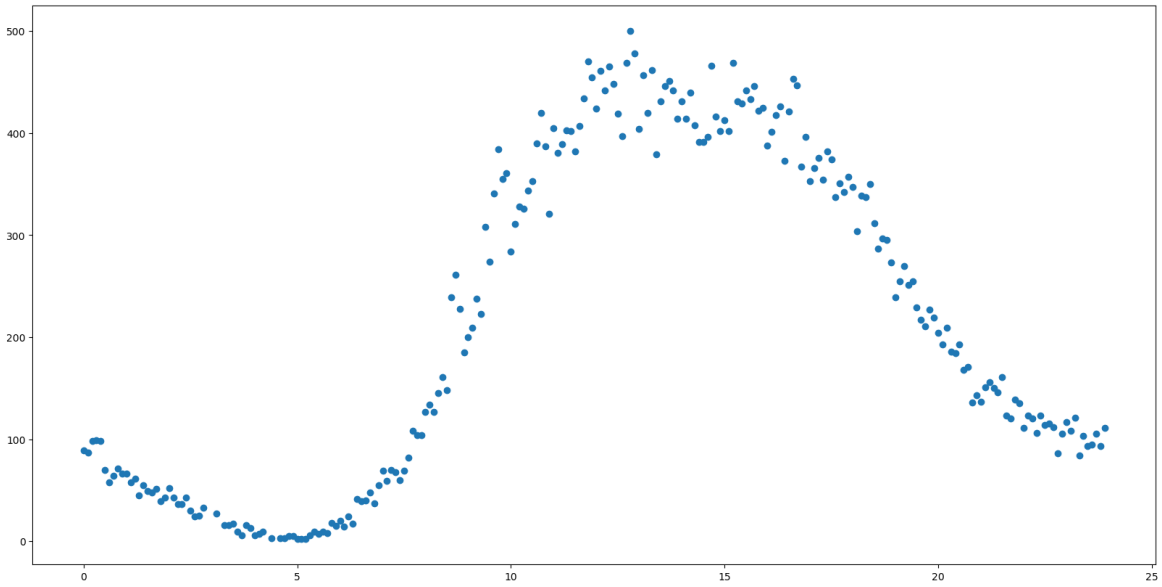
2b. Repeat 2a for `saturday.hour_of_day`

In [496]:
```
x_sat = saturday["hour_of_day"].values.reshape(-1,1)
y_sat = saturday["5"]
x_sat, y_sat
```

Out[496]:
```
(array([[ 0. ],
        [ 0.1],
        [ 0.2],
        [ 0.3],
        [ 0.4],
        [ 0.5],
        [ 0.6],
        [ 0.7],
        [ 0.8],
        [ 0.9],
        [ 1. ],
        [ 1.1],
        [ 1.2],
        [ 1.3],
        [ 1.4],
        [ 1.5],
        [ 1.6],
        [ 1.7],
        [ 1.8],
```

In [497]:
```
plt.scatter(x_sat, y_sat)
```

Out[497]:
```
<matplotlib.collections.PathCollection at 0x12fdf2430>
```



In [498]:
```
linear_sat = linear_model.LinearRegression()

linear_sat.fit(x_sat, y_sat)

linear_sat.coef_, linear_sat.intercept_
```

Out[498]:
```
(array([9.71309939]), 99.50083162432375)
```

In [499]:
```
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_sat)
x_15
```

Out[499]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
        0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, ...,
        1.00000000e-13, 1.00000000e-14, 1.00000000e-15],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, ...,
        8.19200000e-10, 1.63840000e-10, 3.27680000e-11],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, ...,
        7.44266546e+17, 1.76391171e+19, 4.18047076e+20],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, ...,
        7.86140991e+17, 1.87101556e+19, 4.45301703e+20],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, ...,
        8.30180852e+17, 1.98413224e+19, 4.74207605e+20]])
```

In [500]:
```
poly10 = PolynomialFeatures(degree=10)

x_10 = poly10.fit_transform(x_sat)
x_10
```

Out[500]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, ...,
        0.00000000e+00, 0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, ...,
        1.00000000e-08, 1.00000000e-09, 1.00000000e-10],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, ...,
        2.56000000e-06, 5.12000000e-07, 1.02400000e-07],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, ...,
        9.95375090e+10, 2.35903896e+12, 5.59092234e+13],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, ...,
        1.02947465e+11, 2.45014966e+12, 5.83135620e+13],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, ...,
        1.06459202e+11, 2.54437493e+12, 6.08105609e+13]])
```

In [501]:
```
poly5 = PolynomialFeatures(degree=5)

x_5 = poly5.fit_transform(x_sat)
x_5
```

Out[501]:
```
array([[1.00000000e+00, 0.00000000e+00, 0.00000000e+00, 0.00000000e+0
0,
        0.00000000e+00, 0.00000000e+00],
       [1.00000000e+00, 1.00000000e-01, 1.00000000e-02, 1.00000000e-0
3,
        1.00000000e-04, 1.00000000e-05],
       [1.00000000e+00, 2.00000000e-01, 4.00000000e-02, 8.00000000e-0
3,
        1.60000000e-03, 3.20000000e-04],
       ...,
       [1.00000000e+00, 2.37000000e+01, 5.61690000e+02, 1.33120530e+0
4,
        3.15495656e+05, 7.47724705e+06],
       [1.00000000e+00, 2.38000000e+01, 5.66440000e+02, 1.34812720e+0
4,
        3.20854274e+05, 7.63633171e+06],
       [1.00000000e+00, 2.39000000e+01, 5.71210000e+02, 1.36519190e+0
4,
        3.26280864e+05, 7.79811265e+06]])
```

In [502]:
```
# 15 polynomials for saturday
linear_sat.fit(x_15, y_sat)
linear_sat.coef_, linear_sat.intercept_
y_sat_lin15 = np.dot(x_15, linear_sat.coef_.T) + linear_sat.intercept_
y_sat_lin15
```

Out[502]:
```
array([ 24.15367675,  24.15367683,  24.15367691,  24.15367702,
        24.15367721,  24.15367777,  24.15367941,  24.15368374,
        24.15369408,  24.15371652,  24.15376155,  24.15384618,
        24.1539967 ,  24.15425222,  24.15466885,  24.1553249 ,
        24.15632686,  24.15781633,  24.15997796,  24.1630483 ,
        24.16732559,  24.17318055,  24.18106793,  24.19153899,
        24.20525465,  24.22299928,  24.24569505,  24.27441665,
        24.31040631,  24.47723523,  24.65647148,  24.77341822,
        24.91225815,  25.07608985,  25.26829797,  25.49256112,
        25.75285801,  26.05347173,  26.39899188,  26.79431447,
        27.75546569,  28.9820637 ,  29.71024558,  30.52371982,
        31.42931019,  32.43405158,  33.54516546,  34.77003228,
        36.11616124,  37.59115728,  39.20268547,  40.95843295,
        42.86606857,  44.93320036,  47.1673311 ,  49.57581211,
        52.16579567,  54.94418612,  57.91759011,  61.09226613,
        64.4740738 ,  68.06842308,  71.8802238 ,  75.91383596,
        80.17302091,  84.66089402,  89.37987897,  94.33166422,
        99.51716187, 104.93646927, 110.58883387, 116.4726214 ,
       122.58528791, 128.92335586, 135.48239459, 142.25700547,
       149.24081182, 156.42645408, 163.80559015, 171.36890133,
       179.10610376, 187.00596564, 195.05633019, 203.2441445 ,
       211.55549412, 219.97564357, 228.4890824 , 237.07957703,
       245.73022795, 254.42353219, 263.1414509 , 271.8654816 ,
       280.57673503, 289.25601598, 297.88390801, 306.44086138,
       314.90728395, 323.26363441, 331.49051751, 339.56878049,
       347.47961049, 355.20463197, 362.72600391, 370.02651588,
       377.0896825 , 383.89983565, 390.44221363, 396.70304685,
       402.66963926, 408.33044485, 413.67513875, 418.69468215,
       423.38138054, 427.72893475, 431.7324841 , 435.38864135,
       438.69551882, 441.65274538, 444.26147388, 446.52437873,
       448.44564337, 450.03093738, 451.28738317, 452.22351213,
       452.84921027, 453.1756534 , 453.21523203, 452.98146619,
       452.48891057, 451.75305025, 450.79018758, 449.61732076,
       448.25201479, 446.71226548, 445.01635731, 443.18271611,
       441.22975754, 439.1757322 , 437.03856884, 434.83571654,
       432.58398722, 430.29939984, 427.99702747, 425.69084877,
       423.39360524, 421.11666557, 418.86989874, 416.66155718,
       414.49817139, 412.38445766, 410.32323999, 408.31538779,
       406.3597705 , 404.45323038, 402.5905746 , 400.76458758,
       398.96606455, 397.18386698, 395.40500059, 393.61471626,
       391.79663415, 389.93289105, 388.00431074, 385.99059708,
       383.87054894, 381.62229637, 379.22355648, 376.65190784,
       373.88508138, 370.90126598, 367.67942611, 364.19962899,
       360.44337811, 356.39394997, 352.0367302 , 347.35954516,
       342.35298487, 337.01071261, 331.32975648, 325.31077787,
       318.95831167, 312.28097271, 305.2916231 , 298.00749468,
       290.4502611 , 282.646054  , 274.62541773, 266.42319749,
       258.07835596, 249.63371396, 241.1356109 , 232.63348204,
       224.17934999, 215.82722836, 207.63243802, 199.65083594,
       191.93795961, 184.5480909 , 177.53324556, 170.94209672,
```

```
164.81884334, 159.20203726, 154.12338592, 149.60655111,
145.665968  , 142.30571344, 139.51845661, 137.28453098,
135.57117185, 134.33197008, 133.50659971, 133.02088422,
132.78727488, 132.70582268, 132.66573507, 132.54762036,
132.22653091, 131.57593162, 130.47273025, 128.80352241,
126.47221699, 123.40922508, 119.58241296, 115.01003686,
109.77589768, 104.04697526,  98.0938237 ,  92.31403419,
 87.25909582,  83.66501275,  82.48706761,  84.93914729,
 92.53808373, 107.15349543, 131.06365389])
```

In [503]:
```
# 10 polynomials for saturday
linear_sat.fit(x_10, y_sat)
linear_sat.coef_, linear_sat.intercept_
y_sat_lin10 = np.dot(x_10, linear_sat.coef_.T) + linear_sat.intercept_
y_sat_lin10
```

Out[503]:
```
array([ 1.09876032e+02,  9.97305024e+01,  9.10290251e+01,  8.36118919
e+01,
        7.73299938e+01,  7.20445265e+01,  6.76266847e+01,  6.39573459
e+01,
        6.09267467e+01,  5.84341515e+01,  5.63875154e+01,  5.47031433
e+01,
        5.33053449e+01,  5.21260880e+01,  5.11046506e+01,  5.01872726
e+01,
        4.93268082e+01,  4.84823808e+01,  4.76190392e+01,  4.67074177
e+01,
        4.57234003e+01,  4.46477891e+01,  4.34659784e+01,  4.21676346
e+01,
        4.07463820e+01,  3.91994965e+01,  3.75276054e+01,  3.57343963
e+01,
        3.38263331e+01,  2.75135882e+01,  2.29498713e+01,  2.06103652
e+01,
        1.82570173e+01,  1.59093647e+01,  1.35875787e+01,  1.13122755
e+01,
        9.10433698e+00,  6.98474161e+00,  4.97440485e+00,  3.09403003
e+00,
       -1.95907836e-01, -2.72874166e+00, -3.66539481e+00, -4.35944832
e+00,
       -4.79504681e+00, -4.95739503e+00, -4.83282273e+00, -4.40884112
e+00,
       -3.67419102e+00, -2.61888303e+00, -1.23422984e+00,  4.87128906
e-01,
        2.55120906e+00,  4.96267134e+00,  7.72481749e+00,  1.08395928
e+01,
        1.43075947e+01,  1.81280875e+01,  2.22990221e+01,  2.68170616
e+01,
        3.16776111e+01,  3.68748531e+01,  4.24017861e+01,  4.82502681
e+01,
        5.44110635e+01,  6.08738930e+01,  6.76274876e+01,  7.46596440
e+01,
        8.19572839e+01,  8.95065146e+01,  9.72926917e+01,  1.05300484
e+02,
        1.13513937e+02,  1.21916544e+02,  1.30491309e+02,  1.39220818
e+02,
        1.48087304e+02,  1.57072720e+02,  1.66158802e+02,  1.75327140
e+02,
        1.84559243e+02,  1.93836605e+02,  2.03140769e+02,  2.12453394
e+02,
        2.21756311e+02,  2.31031588e+02,  2.40261582e+02,  2.49429002
e+02,
        2.58516958e+02,  2.67509011e+02,  2.76389225e+02,  2.85142212
e+02,
        2.93753172e+02,  3.02207938e+02,  3.10493007e+02,  3.18595579
e+02,
        3.26503587e+02,  3.34205720e+02,  3.41691452e+02,  3.48951062
e+02,
```

```
        3.55975648e+02,  3.62757145e+02,  3.69288334e+02,  3.75562846
e+02,
        3.81575173e+02,  3.87320660e+02,  3.92795507e+02,  3.97996763
e+02,
        4.02922311e+02,  4.07570863e+02,  4.11941937e+02,  4.16035841
e+02,
        4.19853652e+02,  4.23397189e+02,  4.26668989e+02,  4.29672271
e+02,
        4.32410910e+02,  4.34889396e+02,  4.37112801e+02,  4.39086739
e+02,
        4.40817325e+02,  4.42311130e+02,  4.43575139e+02,  4.44616706
e+02,
        4.45443503e+02,  4.46063480e+02,  4.46484806e+02,  4.46715828
e+02,
        4.46765021e+02,  4.46640932e+02,  4.46352138e+02,  4.45907190
e+02,
        4.45314572e+02,  4.44582643e+02,  4.43719599e+02,  4.42733420
e+02,
        4.41631830e+02,  4.40422252e+02,  4.39111766e+02,  4.37707070
e+02,
        4.36214444e+02,  4.34639714e+02,  4.32988220e+02,  4.31264789
e+02,
        4.29473705e+02,  4.27618690e+02,  4.25702879e+02,  4.23728811
e+02,
        4.21698410e+02,  4.19612981e+02,  4.17473204e+02,  4.15279132
e+02,
        4.13030196e+02,  4.10725215e+02,  4.08362405e+02,  4.05939400
e+02,
        4.03453269e+02,  4.00900546e+02,  3.98277259e+02,  3.95578966
e+02,
        3.92800794e+02,  3.89937484e+02,  3.86983442e+02,  3.83932786
e+02,
        3.80779412e+02,  3.77517048e+02,  3.74139324e+02,  3.70639841
e+02,
        3.67012241e+02,  3.63250287e+02,  3.59347940e+02,  3.55299438
e+02,
        3.51099387e+02,  3.46742839e+02,  3.42225386e+02,  3.37543245
e+02,
        3.32693346e+02,  3.27673425e+02,  3.22482109e+02,  3.17119004
e+02,
        3.11584778e+02,  3.05881250e+02,  3.00011461e+02,  2.93979754
e+02,
        2.87791842e+02,  2.81454874e+02,  2.74977488e+02,  2.68369861
e+02,
        2.61643751e+02,  2.54812524e+02,  2.47891173e+02,  2.40896323
e+02,
        2.33846222e+02,  2.26760717e+02,  2.19661213e+02,  2.12570612
e+02,
        2.05513238e+02,  1.98514730e+02,  1.91601922e+02,  1.84802690
e+02,
        1.78145780e+02,  1.71660595e+02,  1.65376964e+02,  1.59324871
e+02,
        1.53534147e+02,  1.48034129e+02,  1.42853275e+02,  1.38018741
e+02,
        1.33555906e+02,  1.29487856e+02,  1.25834815e+02,  1.22613520
e+02,
```

```
        1.19836548e+02,  1.17511569e+02,  1.15640552e+02,  1.14218900
e+02,
        1.13234509e+02,  1.12666765e+02,  1.12485457e+02,  1.12649617
e+02,
        1.13106272e+02,  1.13789109e+02,  1.14617048e+02,  1.15492724
e+02,
        1.16300864e+02,  1.16906562e+02,  1.17153446e+02,  1.16861726
e+02,
        1.15826137e+02,  1.13813742e+02,  1.10561621e+02,  1.05774415
e+02,
        9.91217463e+01,  9.02354768e+01,  7.87068311e+01])
```

In [504]:
```
# 5 polynomials for saturday
linear_sat.fit(x_5, y_sat)
linear_sat.coef_, linear_sat.intercept_
y_sat_lin5 = np.dot(x_5, linear_sat.coef_.T) + linear_sat.intercept_
y_sat_lin5
```

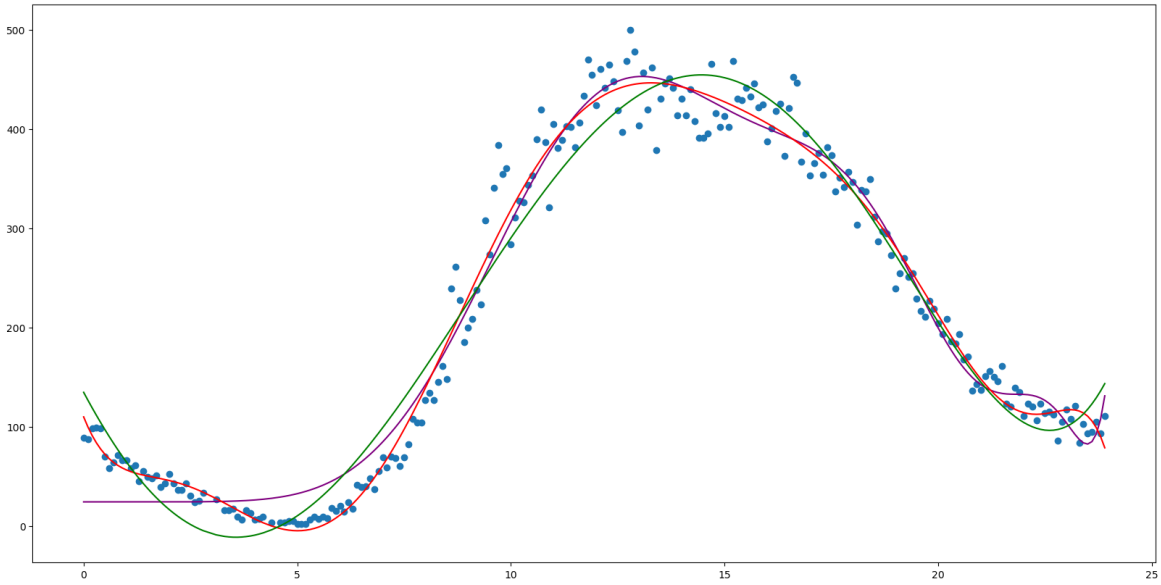
Out[504]:
```
array([ 1.34641512e+02,  1.26682084e+02,  1.18921759e+02,  1.11364223
e+02,
        1.04012959e+02,  9.68712391e+01,  8.99421332e+01,  8.32285092
e+01,
        7.67330360e+01,  7.04581861e+01,  6.44062381e+01,  5.85792788
e+01,
        5.29792062e+01,  4.76077321e+01,  4.24663841e+01,  3.75565083
e+01,
        3.28792723e+01,  2.84356670e+01,  2.42265096e+01,  2.02524458
e+01,
        1.65139526e+01,  1.30113407e+01,  9.74475703e+00,  6.71418706
e+00,
        3.91945767e+00,  1.36023944e+00, -9.63950786e-01, -3.05374736
e+00,
       -4.90993335e+00, -9.08683603e+00, -1.07242034e+01, -1.12031803
e+01,
       -1.14579801e+01, -1.14904850e+01, -1.13027032e+01, -1.08967663
e+01,
       -1.02749269e+01, -9.43955630e+00, -8.39314160e+00, -7.13828349
e+00,
       -4.01419185e+00, -9.02604498e-02,  2.16400960e+00,  4.60887713
e+00,
        7.24101763e+00,  1.00570132e+01,  1.30533553e+01,  1.62264467
e+01,
        1.95726048e+01,  2.30880635e+01,  2.67689758e+01,  3.06114167
e+01,
        3.46113855e+01,  3.87648080e+01,  4.30675394e+01,  4.75153670
e+01,
        5.21040120e+01,  5.68291328e+01,  6.16863269e+01,  6.66711339
e+01,
        7.17790376e+01,  7.70054688e+01,  8.23458078e+01,  8.77953868
e+01,
        9.33494923e+01,  9.90033681e+01,  1.04752217e+02,  1.10591204
e+02,
        1.16515460e+02,  1.22520080e+02,  1.28600131e+02,  1.34750652
e+02,
        1.40966654e+02,  1.47243129e+02,  1.53575045e+02,  1.59957355
e+02,
        1.66384995e+02,  1.72852888e+02,  1.79355948e+02,  1.85889080
e+02,
        1.92447185e+02,  1.99025159e+02,  2.05617900e+02,  2.12220308
e+02,
        2.18827286e+02,  2.25433746e+02,  2.32034610e+02,  2.38624811
e+02,
        2.45199297e+02,  2.51753034e+02,  2.58281009e+02,  2.64778228
e+02,
        2.71239726e+02,  2.77660563e+02,  2.84035829e+02,  2.90360646
e+02,
        2.96630173e+02,  3.02839606e+02,  3.08984178e+02,  3.15059169
e+02,
```

```
        3.21059901e+02,  3.26981745e+02,  3.32820120e+02,  3.38570501
e+02,
        3.44228415e+02,  3.49789448e+02,  3.55249246e+02,  3.60603518
e+02,
        3.65848037e+02,  3.70978645e+02,  3.75991253e+02,  3.80881847
e+02,
        3.85646484e+02,  3.90281304e+02,  3.94782522e+02,  3.99146441
e+02,
        4.03369445e+02,  4.07448007e+02,  4.11378692e+02,  4.15158157
e+02,
        4.18783153e+02,  4.22250529e+02,  4.25557238e+02,  4.28700331
e+02,
        4.31676967e+02,  4.34484413e+02,  4.37120045e+02,  4.39581354
e+02,
        4.41865946e+02,  4.43971542e+02,  4.45895989e+02,  4.47637252
e+02,
        4.49193424e+02,  4.50562726e+02,  4.51743508e+02,  4.52734256
e+02,
        4.53533589e+02,  4.54140266e+02,  4.54553184e+02,  4.54771386
e+02,
        4.54794059e+02,  4.54620539e+02,  4.54250313e+02,  4.53683020
e+02,
        4.52918456e+02,  4.51956574e+02,  4.50797489e+02,  4.49441478
e+02,
        4.47888985e+02,  4.46140622e+02,  4.44197172e+02,  4.42059591
e+02,
        4.39729010e+02,  4.37206740e+02,  4.34494273e+02,  4.31593282
e+02,
        4.28505629e+02,  4.25233363e+02,  4.21778723e+02,  4.18144143
e+02,
        4.14332253e+02,  4.10345881e+02,  4.06188055e+02,  4.01862008
e+02,
        3.97371180e+02,  3.92719217e+02,  3.87909977e+02,  3.82947532
e+02,
        3.77836172e+02,  3.72580401e+02,  3.67184949e+02,  3.61654767
e+02,
        3.55995032e+02,  3.50211151e+02,  3.44308762e+02,  3.38293737
e+02,
        3.32172182e+02,  3.25950444e+02,  3.19635111e+02,  3.13233015
e+02,
        3.06751234e+02,  3.00197094e+02,  2.93578173e+02,  2.86902304
e+02,
        2.80177574e+02,  2.73412331e+02,  2.66615183e+02,  2.59795004
e+02,
        2.52960931e+02,  2.46122374e+02,  2.39289012e+02,  2.32470797
e+02,
        2.25677961e+02,  2.18921012e+02,  2.12210740e+02,  2.05558221
e+02,
        1.98974815e+02,  1.92472173e+02,  1.86062237e+02,  1.79757243
e+02,
        1.73569723e+02,  1.67512510e+02,  1.61598736e+02,  1.55841840
e+02,
        1.50255566e+02,  1.44853968e+02,  1.39651410e+02,  1.34662574
e+02,
        1.29902454e+02,  1.25386367e+02,  1.21129950e+02,  1.17149165
e+02,
```

```
        1.13460301e+02,  1.10079976e+02,  1.07025139e+02,  1.04313075
e+02,
        1.01961405e+02,  9.99880897e+01,  9.84114312e+01,  9.72500767
e+01,
        9.65230200e+01,  9.62496046e+01,  9.64495258e+01,  9.71428335
e+01,
        9.83499347e+01,  1.00091596e+02,  1.02388945e+02,  1.05263476
e+02,
        1.08737049e+02,  1.12831893e+02,  1.17570611e+02,  1.22976179
e+02,
        1.29071950e+02,  1.35881659e+02,  1.43429420e+02])
```

In [505]:
```
plt.scatter(x_sat,y_sat)
plt.plot(x_sat, y_sat_lin15, c='purple')
plt.plot(x_sat, y_sat_lin10, c='red')
plt.plot(x_sat, y_sat_lin5, c='green')
```

Out[505]: [<matplotlib.lines.Line2D at 0x12fe40a90>]



3. Using the n=15 polynomial, create 3 new models fit to `hour_of_day` with different Ridge Regression α (alpha) Ridge Coefficient values using the `monday` and `saturday` datasets.

In [506]:
```
#Monday alpha .5
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_mon)

ridge_mon = linear_model.Ridge(alpha=.5)
ridge_mon.fit(x_15, y_mon)

(ridge_mon.coef_, ridge_mon.intercept_)
```

Out[506]:
```
(array([ 0.00000000e+00,  7.76323967e-03, -4.70822269e+00, -2.1879739
4e+02,
         3.92306495e+02, -2.61871056e+02,  9.30220460e+01, -2.0294259
6e+01,
         2.92637975e+00, -2.90050641e-01,  2.01090605e-02, -9.7493301
4e-04,
         3.24154585e-05, -7.04683223e-07,  9.02506540e-09, -5.1648396
5e-11]),
 94.21876785602973)
```

In [507]:
```
y_mon_ridge0_5 = np.dot(x_15, ridge_mon.coef_) + ridge_mon.intercept_
y_mon_ridge0_5
```

Out[507]:
```
array([  94.21876786,   93.99036752,   92.83120509,   90.4947242
3,
         87.17662305,   83.33740946,   79.5663313 ,   76.4799638
5,
         74.64955249,   74.55194743,   76.53963543,   80.8259766
5,
         87.48229661,   96.44396992,  107.52306719,  120.4255240
5,
        134.77113503,  150.11497925,  165.96915225,  181.8239127
3,
        197.16755662,  211.50450742,  224.37126317,  235.3499691
,
        244.07949391,  250.26397758,  253.67889324,  254.1747249
1,
        251.6784099 ,  226.62731993,  196.88612332,  178.8947437
1,
        159.28661435,  138.45309475,  116.80982488,   94.7878536
3,
         72.82489805,   51.35689073,   30.8099535 ,   11.5929163
,
        -21.34289255,  -44.7669303 ,  -52.24362432,  -56.6297215
6,
        -57.78492558,  -55.61836709,  -50.08883928,  -41.2042522
3,
        -29.02035465,  -13.63877916,    4.79552644,   26.0974143
6,
         50.04512687,   76.3842874 ,  104.83221715,  135.0825015
1,
        166.80973128,  199.67434514,  233.32750263,  267.4159195
7,
        301.58660235,  335.49142152,  368.79147024,  401.1611585
,
        432.29199961,  461.89605141,  489.70898067,  515.4927252
5,
        539.03773465,  560.16477583,  578.72629687,  594.6073468
7,
        607.72605601,  618.03368511,  625.51425823,  630.1837973
4,
        632.08918155,  631.30665707,  627.94002801,  622.1185600
1,
        613.99463179,  603.74117128,  591.54891396,  577.6235234
8,
        562.18261238,  545.45270384,  527.66617266,  509.0582040
3,
        489.86380613,  470.31491375,  450.63761372,  431.0495255
3,
        411.75736386,  392.95471001,  374.82001397,  357.5148469
,
        341.18242053,  325.94638524,  311.9099162 ,  299.155094
,
        287.74258027,  277.71158836,  269.08014188,  261.8456152
4,
        255.98554334,  251.4586849 ,  248.20632503,  246.1537928
```

```
3,
        245.21217534,   245.2802001 ,   246.2462636 ,   247.9905748
1,
        250.38738296,   253.30726764,   256.61944935,   260.1940996
4,
        263.90461514,   267.62982247,   271.25609777,   274.6793527
3,
        277.80687806,   280.55901167,   282.87060282,   284.6922657
2,
        285.99139807,   286.75293705,   286.97986004,   286.6934072
7,
        285.93303273,   284.75605604,   283.23705838,   281.4669768
6,
        279.55193779,   277.61184952,   275.77872155,   274.1947772
2,
        273.01036713,   272.38169358,   272.46837876,   273.4309241
5,
        275.42805359,   278.61403916,   283.13596794,   289.1310317
3,
        296.72387955,   306.02404854,   317.12353966,   330.0945117
2,
        344.98724243,   361.82827637,   380.61886475,   401.3336798
9,
        423.91989777,   448.29661057,   474.35459397,   501.9565188
6,
        530.93747971,   561.1060817 ,   592.24576447,   624.1166446
,
        656.45781586,   688.98984787,   721.41786454,   753.4348094
2,
        784.72518418,   814.96879837,   843.84511063,   871.0373866
3,
        896.2372081 ,   919.14908097,   939.49475357,   957.0178706
4,
        971.48816941,   982.70560715,   990.50425217,   994.7556636
1,
        995.37210343,   992.30876419,   985.56614945,   975.1909968
6,
        961.2771785 ,   943.96554825,   923.44288895,   899.9402644
4,
        873.73045609,   845.12431595,   814.46654007,   782.1303736
9,
        748.51173661,   714.02223465,   679.08156082,   644.1095759
6,
        609.51738236,   575.69859574,   543.01954911,   511.8102290
4,
        482.35481522,   454.88252518,   429.55937455,   406.4799678
1,
        385.66093705,   367.03529618,   350.44832108,   335.6544368
,
        322.31801102,   310.01375077,   298.23115799,   286.3813044
8,
        273.80519364,   259.78627274,   243.56447098,   224.3534724
5,
        201.35927079,   173.80177567,   140.93745682,   102.0831477
4,
         56.63795731,    4.10670731,   -55.88071945,  -123.5563786
```

```
3,
       -199.00217941,  -282.15330246,  -372.80747726,  -470.6534245
3,
       -575.3143132 ,  -686.41990402,  -803.70078781,  -927.1225407
4,
      -1057.05833175, -1194.50974777, -1341.38767746, -1500.8576481
6,
      -1677.765363  , -1879.14890793, -2114.859113  ])
```

In [508]:
```
#Monday alpha 10
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_mon)

ridge_mon = linear_model.Ridge(alpha=10)
ridge_mon.fit(x_15, y_mon)

(ridge_mon.coef_, ridge_mon.intercept_)
```

Out[508]:
```
(array([ 0.00000000e+00,  1.97969992e-02, -8.46375100e+00,  6.2018727
9e+01,
         5.84533029e+01, -8.75331348e+01,  4.02991039e+01, -9.9913927
9e+00,
         1.55150024e+00, -1.61133709e-01,  1.15223214e-02, -5.7047229
5e-04,
         1.92400647e-05, -4.22247025e-07,  5.43997687e-09, -3.1231023
7e-11]),
 9.957689975170354)
```

In [509]:
```
y_mon_ridge10 = np.dot(x_15, ridge_mon.coef_) + ridge_mon.intercept_
y_mon_ridge10
```

Out[509]:
```
array([   9.95768998,    9.94206021,   10.18721898,   11.16445499,
         13.33034342,   17.07928523,   22.7126375 ,   30.42124576,
         40.27861326,   52.2423241 ,   66.16168027,   81.7898204 ,
         98.79886239,  116.7968563 ,  135.34555025,  153.97816303,
        172.21652436,  189.58709016,  205.63546678,  219.93918753,
        232.11857785,  241.84562463,  248.85083072,  252.92809044,
        253.93766544,  251.80737538,  246.53214425,  238.17206293,
        226.84914138,  177.15388916,  133.77243705,  110.04700277,
         85.48264231,   60.48226247,   35.45191088,   10.79387826,
        -13.0998134 ,  -35.85345264,  -57.1131407 ,  -76.55169837,
       -108.81525219, -130.70651098, -137.32803972, -140.91824295,
       -141.4186059 , -138.81261542, -133.12479405, -124.41919859,
       -112.7974307 ,  -98.39621111,  -81.38457147,  -61.96072001,
        -40.3486382 ,  -16.79446578,    8.43726858,   35.06751523,
         62.80661574,   91.35820738,  120.42307055,  149.70287312,
        178.90376915,  207.73981304,  235.9361546 ,  263.23198456,
        289.38320432,  314.16479858,  337.37289336,  358.82648704,
        378.36884585,  395.86855996,  411.22025995,  424.344998  ,
        435.19030118,  443.72990825,  449.96320422,  453.91437007,
        455.6312675 ,  455.18408099,  452.66374132,  448.18015648,
        441.86027699,  433.84602402,  424.29210877,  413.36377247,
        401.23447584,  388.0835671 ,  374.09395631,  359.44982368,
        344.3343876 ,  328.92775776,  313.40489564,  297.93370434,
        282.67326689,  267.77225027,  253.36748937,  239.58276505,
        226.52778417,  214.29737109,  202.97087405,  192.61179015,
        183.26760808,  174.9698658 ,  167.73441926,  161.56191305,
        156.43844566,  152.33641503,  149.21553335,  147.02399388,
        145.69977341,  145.17205212,  145.36273119,  146.18802628,
        147.56011853,  149.38883803,  151.58335767,  154.05387888,
        156.7132828 ,  159.4787266 ,  162.27316651,  165.02678201,
        167.67828724,  170.17611167,  172.47942636,  174.55901501,
        176.39796183,  177.99215696,  179.3506057 ,  180.49553463,
        181.46229813,  182.29906723,  183.06632397,  183.83614752,
        184.69130251,  185.72414658,  187.0353472 ,  188.73245213,
        190.9282963 ,  193.73928997,  197.28358672,  201.67916367,
        207.04184506,  213.48326752,  221.10884735,  230.01574013,
        240.29085896,  252.00893948,  265.23070214,  280.0011594 ,
        296.34802601,  314.2803447 ,  333.78729699,  354.83722946,
        377.37691758,  401.33112595,  426.60241387,  453.07124398,
        480.5964019 ,  509.01572296,  538.1471431 ,  567.79003403,
        597.72691223,  627.72535584,  657.54032395,  686.91665528,
        715.5918834 ,  743.29924271,  769.77086136,  794.74116013,
        817.9503505 ,  839.14803955,  858.09678147,  874.57574723,
        888.38427994,  899.34527848,  907.30846665,  912.15349076,
        913.79255173,  912.17294571,  907.27900193,  899.13368485,
        887.79960129,  873.37965653,  856.01682541,  835.89365647,
        813.23078415,  788.28497574,  761.34649918,  732.73564408,
        702.79864762,  671.90312455,  640.43248246,  608.78018448,
        577.34305069,  546.51455948,  516.67726395,  488.19555924,
        461.40764115,  436.61792252,  414.08952591,  394.03657791,
        376.61809037,  361.93074295,  350.00447342,  340.79735062,
        334.19301102,  329.99855301,  327.94481156,  327.68757889,
        328.81181595,  330.83693192,  333.22508499,  335.39128373,
```

```
 336.71574662,  336.55900833,  334.27849076,  329.2474849 ,
 320.87523148,  308.6292598 ,  292.05650589,  270.80589554,
 244.64958451,  213.50114701,  177.43126175,  136.67692826,
  91.6459224 ,   42.90880082,   -8.81794479,  -62.70722702,
-117.87128952, -173.43696335, -228.64777877, -282.99689987,
-336.39936569, -389.40839889, -443.48347213])
```

In [510]:
```
#Monday alpha 15
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_mon)

ridge_mon = linear_model.Ridge(alpha=15)
ridge_mon.fit(x_15, y_mon)

(ridge_mon.coef_, ridge_mon.intercept_)
```

Out[510]:
```
(array([ 0.00000000e+00,  1.80096514e-02, -7.44022843e+00,  6.0739898
7e+01,
         4.71785060e+01, -7.67787993e+01,  3.59489547e+01, -8.9775523
5e+00,
         1.39911158e+00, -1.45561424e-01,  1.04152442e-02, -5.1558893
3e-04,
         1.73769583e-05, -3.80928418e-07,  4.90035657e-09, -2.8082547
9e-11]),
 17.151186679271916)
```

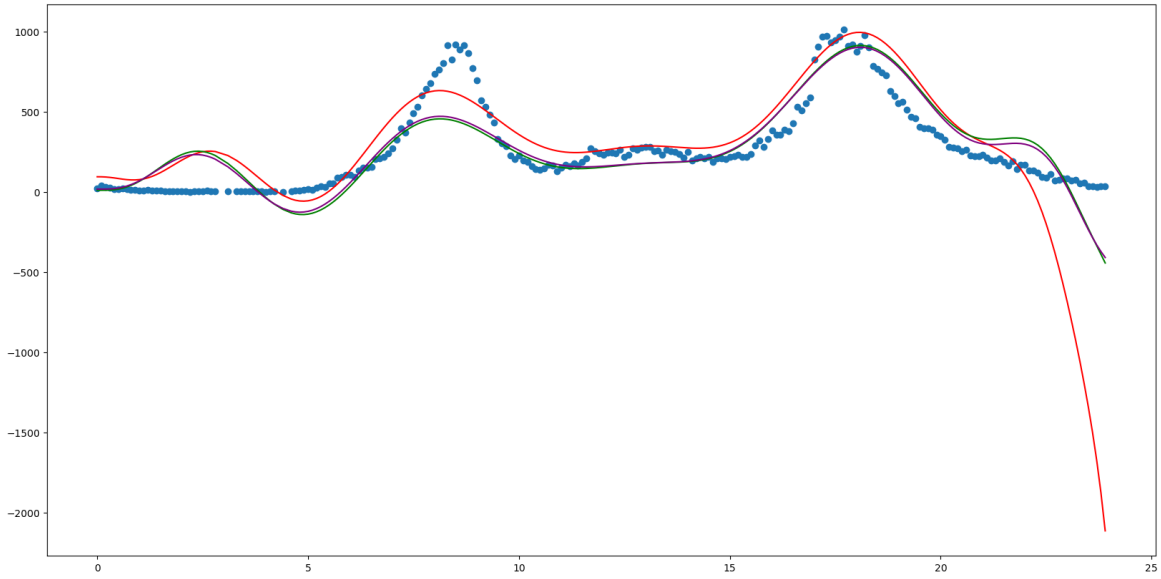
In [511]:
```
y_mon_ridge15 = np.dot(x_15, ridge_mon.coef_) + ridge_mon.intercept_
y_mon_ridge15
```

Out[511]:
```
array([  17.15118668,   17.14331039,   17.39620438,   18.34685208,
         20.41028029,   23.93869707,   29.19535763,   36.34029808,
         45.42545926,   56.39706676,   69.10344238,   83.30669924,
         98.69701982,  114.90843579,  131.53522311,  148.14819758,
        164.31034613,  179.59136057,  193.58075438,  205.89934059,
        216.20893266,  224.22020059,  229.69867331,  232.46892695,
        232.41703747,  229.49140699,  223.70209672,  215.11881619,
        203.86773004,  156.12200266,  115.36773668,   93.2981605 ,
         70.58563147,   47.6060801 ,   24.7369956 ,    2.35108575,
        -19.18969405,  -39.53966661,  -58.37445109,  -75.39542361,
       -102.95279691, -120.46922306, -125.07882003, -126.79629981,
       -125.5763945 , -121.41302724, -114.33833668, -104.42120968,
        -91.76536659,  -76.50704703,  -58.81234639,  -38.87425517,
        -16.90945402,    6.84508227,   32.13561912,   58.69528317,
         86.24771989,  114.51073979,  143.19990786,  172.03203376,
        200.72852347,  229.01855693,  256.64205955,  283.35243982,
        308.91906891,  333.12948258,  355.79128962,  376.7337753 ,
        395.8091922 ,  412.89373483,  427.88819831,  440.71832471,
        451.33484449,  459.71322338,  465.85312804,  469.77762671,
        471.53214332,  471.18318556,  468.81686957,  464.53726511,
        458.46458638,  450.73325465,  441.48985925,  430.89104414,
        419.10134677,  406.29101605,  392.63383569,  378.30497785,
        363.47891193,  348.32739105,  333.01753797,  317.7100501 ,
        302.55754188,  287.70304038,  273.27864784,  259.40438363,
        246.18721408,  233.72027803,  222.08231244,  211.33728132,
        201.53420654,  192.70719961,  184.87568948,  178.04483971,
        172.20614592,  167.33820388,  163.40763447,  160.37015191,
        158.17176053,  156.75006071,  156.03564916,  155.95359126,
        156.42494795,  157.36833629,  158.70150194,  160.34288416,
        162.21315417,  164.23670218,  166.34305892,  168.46822939,
        170.55592081,  172.55865166,  174.43872092,  176.16903255,
        177.73374936,  179.12878225,  180.36209485,  181.45382116,
        182.43619463,  183.35328004,  184.2605221 ,  185.22409413,
        186.3200681 ,  187.63341544,  189.25682423,  191.2893779 ,
        193.83509037,  197.00130818,  200.89701054,  205.63103554,
        211.31022236,  218.0375211 ,  225.91007969,  235.01735184,
        245.43920872,  257.24413845,  270.48750756,  285.20993874,
        301.4358289 ,  319.1720216 ,  338.40666268,  359.10825322,
        381.22494957,  404.68408272,  429.39195893,  455.23391411,
        482.07466385,  509.75896714,  538.11253426,  566.94328568,
        596.04288361,  625.18854019,  654.14512703,  682.66753647,
        710.50326035,  737.39530442,  763.08508561,  787.31568787,
        809.83520386,  830.40004608,  848.77848694,  864.75408432,
        878.12905762,  888.72763321,  896.399245  ,  901.0214412 ,
        902.50261948,  900.78452561,  895.8441417 ,  887.69554398,
        876.39083359,  862.02109024,  844.7162883 ,  824.64496109,
        802.01315567,  777.0626323 ,  750.06853745,  721.3364589 ,
        691.19873307,  660.00993607,  628.14221451,  595.97951004,
        563.91157791,  532.32742569,  501.60837052,  472.12062332,
        444.20810196,  418.18460343,  394.3263881 ,  372.86494706,
        353.97990677,  337.79266617,  324.36068985,  313.67264054,
        305.64471695,  300.11804459,  296.85772965,  295.55374405,
        295.82306168,  297.21454117,  299.21548722,  301.26013443,
```

```
       302.7416713 ,  303.02484391,  301.46264908,  297.41345475,
       290.26159928,  279.43860123,  264.44598648,  244.87958023,
       220.45190689,  191.0158107 ,  156.58471939,  117.35028336,
        73.6953151 ,   26.19916031,  -24.36419418,  -77.04070785,
      -130.72448471, -184.20300033, -236.22515609, -285.59246566,
      -331.28301742, -372.6116307 , -409.42937973])
```

In [512]:
```
plt.scatter(x_mon,y_mon)
plt.plot(x_mon, y_mon_ridge0_5, c='r')
plt.plot(x_mon, y_mon_ridge10, c='g')
plt.plot(x_mon, y_mon_ridge15, c='purple')
```

Out[512]:
```
[<matplotlib.lines.Line2D at 0x12fe8e4c0>]
```



In [513]:
```
#Saturday alpha .5
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_sat)

ridge_sat = linear_model.Ridge(alpha=.5)
ridge_sat.fit(x_15, y_sat)

(ridge_sat.coef_, ridge_sat.intercept_)
```

Out[513]:
```
(array([ 0.00000000e+00,  3.07109227e-03, -1.11287502e+00,  3.0841355
4e+00,
        -8.77186822e+00,  5.99738153e+00, -2.10807188e+00,  4.5439111
7e-01,
        -6.43933086e-02,  6.21671496e-03, -4.15775258e-04,  1.9274374
2e-05,
        -6.08206562e-07,  1.24728884e-08, -1.49986535e-10,  8.0304583
6e-13]),
 78.07622891689869)
```

In [514]:
```
y_sat_ridge0_5 = np.dot(x_15, ridge_sat.coef_) + ridge_sat.intercept_
y_sat_ridge0_5
```

Out[514]:
```
array([ 7.80762289e+01,  7.80676721e+01,  7.80447561e+01,  7.80023431
e+01,
        7.79257046e+01,  7.77946106e+01,  7.75864766e+01,  7.72787186
e+01,
        7.68504502e+01,  7.62836382e+01,  7.55638194e+01,  7.46804658
e+01,
        7.36270765e+01,  7.24010588e+01,  7.10034574e+01,  6.94385755
e+01,
        6.77135289e+01,  6.58377634e+01,  6.38225639e+01,  6.16805725
e+01,
        5.94253348e+01,  5.70708842e+01,  5.46313727e+01,  5.21207554
e+01,
        4.95525286e+01,  4.69395252e+01,  4.42937643e+01,  4.16263535
e+01,
        3.89474412e+01,  3.09289783e+01,  2.56710608e+01,  2.30866187
e+01,
        2.05388719e+01,  1.80328184e+01,  1.55734377e+01,  1.31658501
e+01,
        1.08154703e+01,  8.52814966e+00,  6.31030562e+00,  4.16903536
e+00,
        1.48553223e-01, -3.45982384e+00, -5.08247761e+00, -6.56783642
e+00,
       -7.90256734e+00, -9.07249780e+00, -1.00626924e+01, -1.08575490
e+01,
       -1.14409113e+01, -1.17961986e+01, -1.19065476e+01, -1.17549670
e+01,
       -1.13245011e+01, -1.05984003e+01, -9.56029694e+00, -8.19438380
e+00,
       -6.48559236e+00, -4.41976960e+00, -1.98385058e+00,  8.33975258
e-01,
        4.04410578e+00,  7.65537796e+00,  1.16749312e+01,  1.61080842
e+01,
        2.09582258e+01,  2.62267222e+01,  3.19128408e+01,  3.80136914
e+01,
        4.45241857e+01,  5.14370157e+01,  5.87426508e+01,  6.64293535
e+01,
        7.44832150e+01,  8.28882075e+01,  9.16262564e+01,  1.00677329
e+02,
        1.10019538e+02,  1.19629265e+02,  1.29481295e+02,  1.39548963
e+02,
        1.49804317e+02,  1.60218289e+02,  1.70760874e+02,  1.81401319
e+02,
        1.92108318e+02,  2.02850206e+02,  2.13595168e+02,  2.24311431
e+02,
        2.34967474e+02,  2.45532222e+02,  2.55975244e+02,  2.66266942
e+02,
        2.76378732e+02,  2.86283222e+02,  2.95954376e+02,  3.05367665
e+02,
        3.14500214e+02,  3.23330925e+02,  3.31840596e+02,  3.40012018
e+02,
        3.47830059e+02,  3.55281735e+02,  3.62356254e+02,  3.69045059
e+02,
        3.75341837e+02,  3.81242523e+02,  3.86745284e+02,  3.91850479
```

```
e+02,
        3.96560616e+02,  4.00880281e+02,  4.04816056e+02,  4.08376426
e+02,
        4.11571667e+02,  4.14413724e+02,  4.16916074e+02,  4.19093587
e+02,
        4.20962366e+02,  4.22539588e+02,  4.23843333e+02,  4.24892411
e+02,
        4.25706186e+02,  4.26304391e+02,  4.26706949e+02,  4.26933792
e+02,
        4.27004684e+02,  4.26939043e+02,  4.26755771e+02,  4.26473093
e+02,
        4.26108396e+02,  4.25678086e+02,  4.25197450e+02,  4.24680527
e+02,
        4.24139999e+02,  4.23587087e+02,  4.23031469e+02,  4.22481204
e+02,
        4.21942682e+02,  4.21420577e+02,  4.20917831e+02,  4.20435642
e+02,
        4.19973475e+02,  4.19529090e+02,  4.19098580e+02,  4.18676435
e+02,
        4.18255614e+02,  4.17827631e+02,  4.17382663e+02,  4.16909666
e+02,
        4.16396499e+02,  4.15830074e+02,  4.15196496e+02,  4.14481230
e+02,
        4.13669267e+02,  4.12745291e+02,  4.11693865e+02,  4.10499604
e+02,
        4.09147361e+02,  4.07622404e+02,  4.05910598e+02,  4.03998578
e+02,
        4.01873921e+02,  3.99525302e+02,  3.96942657e+02,  3.94117315
e+02,
        3.91042140e+02,  3.87711638e+02,  3.84122070e+02,  3.80271533
e+02,
        3.76160031e+02,  3.71789531e+02,  3.67163993e+02,  3.62289388
e+02,
        3.57173690e+02,  3.51826853e+02,  3.46260764e+02,  3.40489178
e+02,
        3.34527634e+02,  3.28393352e+02,  3.22105104e+02,  3.15683081
e+02,
        3.09148736e+02,  3.02524603e+02,  2.95834125e+02,  2.89101449
e+02,
        2.82351215e+02,  2.75608352e+02,  2.68897851e+02,  2.62244537
e+02,
        2.55672852e+02,  2.49206632e+02,  2.42868880e+02,  2.36681558
e+02,
        2.30665397e+02,  2.24839690e+02,  2.19222128e+02,  2.13828643
e+02,
        2.08673279e+02,  2.03768060e+02,  1.99122927e+02,  1.94745669
e+02,
        1.90641885e+02,  1.86814989e+02,  1.83266249e+02,  1.79994844
e+02,
        1.76997966e+02,  1.74270956e+02,  1.71807465e+02,  1.69599669
e+02,
        1.67638483e+02,  1.65913844e+02,  1.64415001e+02,  1.63130842
e+02,
        1.62050237e+02,  1.61162416e+02,  1.60457365e+02,  1.59926235
e+02,
        1.59561754e+02,  1.59358688e+02,  1.59314253e+02,  1.59428589
```

```
e+02,
        1.59705177e+02,  1.60151327e+02,  1.60778587e+02,  1.61603212
e+02,
        1.62646581e+02,  1.63935673e+02,  1.65503502e+02,  1.67389549
e+02,
        1.69640320e+02,  1.72309810e+02,  1.75460052e+02,  1.79161835
e+02,
        1.83495369e+02,  1.88551174e+02,  1.94431148e+02])
```

In [515]:
```
#Saturday alpha 10
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_sat)

ridge_sat = linear_model.Ridge(alpha=10)
ridge_sat.fit(x_15, y_sat)

(ridge_sat.coef_, ridge_sat.intercept_)
```

Out[515]:
```
(array([ 0.00000000e+00,  2.86969597e-03, -1.06428632e+00, -2.3723679
1e+00,
        -1.93046969e+00,  2.29012935e+00, -9.56533563e-01,  2.2482497
5e-01,
        -3.32845456e-02,  3.26418021e-03, -2.17179595e-04,  9.8440866
3e-06,
        -2.98928214e-07,  5.80480876e-09, -6.49267933e-11,  3.1654304
7e-13]),
 79.43505936886402)
```

In [516]:
```
y_sat_ridge10 = np.dot(x_15, ridge_sat.coef_) + ridge_sat.intercept_
y_sat_ridge10
```

Out[516]:
```
array([ 7.94350594e+01,  7.94221600e+01,  7.93716686e+01,  7.92653585
e+01,
        7.90845502e+01,  7.88114756e+01,  7.84302364e+01,  7.79274290
e+01,
        7.72924998e+01,  7.65178872e+01,  7.55989979e+01,  7.45340584
e+01,
        7.33238771e+01,  7.19715462e+01,  7.04821079e+01,  6.88622050
e+01,
        6.71197323e+01,  6.52635012e+01,  6.33029279e+01,  6.12477521
e+01,
        5.91077907e+01,  5.68927311e+01,  5.46119633e+01,  5.22744530
e+01,
        4.98886531e+01,  4.74624528e+01,  4.50031605e+01,  4.25175181
e+01,
        4.00117430e+01,  3.24294302e+01,  2.73714921e+01,  2.48564671
e+01,
        2.23575898e+01,  1.98803740e+01,  1.74307719e+01,  1.50152792
e+01,
        1.26410300e+01,  1.03158779e+01,  8.04846258e+00,  5.84826083
e+00,
        1.69177458e+00, -2.06018721e+00, -3.75150537e+00, -5.30052373
e+00,
       -6.69195246e+00, -7.90988517e+00, -8.93789943e+00, -9.75917029
e+00,
       -1.03565954e+01, -1.07129298e+01, -1.08109292e+01, -1.06334997
e+01,
       -1.01638522e+01, -9.38565984e+00, -8.28321606e+00, -6.84159277
e+00,
       -5.04679548e+00, -2.88591439e+00, -3.47269799e-01,  2.57944997
e+00,
        5.90305936e+00,  9.63075658e+00,  1.37680160e+01,  1.83184928
e+01,
        2.32839419e+01,  2.86641496e+01,  3.44568821e+01,  4.06578480
e+01,
        4.72606776e+01,  5.42569178e+01,  6.16360436e+01,  6.93854855
e+01,
        7.74906732e+01,  8.59350945e+01,  9.47003698e+01,  1.03766341
e+02,
        1.13111174e+02,  1.22711475e+02,  1.32542418e+02,  1.42577884
e+02,
        1.52790610e+02,  1.63152348e+02,  1.73634028e+02,  1.84205932
e+02,
        1.94837869e+02,  2.05499358e+02,  2.16159806e+02,  2.26788697
e+02,
        2.37355770e+02,  2.47831201e+02,  2.58185782e+02,  2.68391092
e+02,
        2.78419666e+02,  2.88245151e+02,  2.97842461e+02,  3.07187918
e+02,
        3.16259380e+02,  3.25036366e+02,  3.33500162e+02,  3.41633913
e+02,
        3.49422709e+02,  3.56853644e+02,  3.63915878e+02,  3.70600665
e+02,
        3.76901379e+02,  3.82813521e+02,  3.88334705e+02,  3.93464640
```

```
e+02,
        3.98205087e+02,  4.02559803e+02,  4.06534477e+02,  4.10136645
e+02,
        4.13375596e+02,  4.16262264e+02,  4.18809110e+02,  4.21029990
e+02,
        4.22940020e+02,  4.24555427e+02,  4.25893393e+02,  4.26971897
e+02,
        4.27809547e+02,  4.28425413e+02,  4.28838856e+02,  4.29069353
e+02,
        4.29136331e+02,  4.29058991e+02,  4.28856146e+02,  4.28546057
e+02,
        4.28146278e+02,  4.27673506e+02,  4.27143441e+02,  4.26570655
e+02,
        4.25968471e+02,  4.25348853e+02,  4.24722311e+02,  4.24097816
e+02,
        4.23482736e+02,  4.22882773e+02,  4.22301935e+02,  4.21742503
e+02,
        4.21205031e+02,  4.20688352e+02,  4.20189604e+02,  4.19704273
e+02,
        4.19226251e+02,  4.18747906e+02,  4.18260176e+02,  4.17752668
e+02,
        4.17213777e+02,  4.16630816e+02,  4.15990158e+02,  4.15277386
e+02,
        4.14477461e+02,  4.13574886e+02,  4.12553890e+02,  4.11398604
e+02,
        4.10093255e+02,  4.08622348e+02,  4.06970856e+02,  4.05124412
e+02,
        4.03069487e+02,  4.00793573e+02,  3.98285352e+02,  3.95534863
e+02,
        3.92533652e+02,  3.89274912e+02,  3.85753612e+02,  3.81966608
e+02,
        3.77912736e+02,  3.73592885e+02,  3.69010062e+02,  3.64169415
e+02,
        3.59078260e+02,  3.53746061e+02,  3.48184403e+02,  3.42406942
e+02,
        3.36429317e+02,  3.30269054e+02,  3.23945441e+02,  3.17479379
e+02,
        3.10893218e+02,  3.04210560e+02,  2.97456062e+02,  2.90655201
e+02,
        2.83834043e+02,  2.77018986e+02,  2.70236500e+02,  2.63512852
e+02,
        2.56873840e+02,  2.50344513e+02,  2.43948900e+02,  2.37709742
e+02,
        2.31648241e+02,  2.25783815e+02,  2.20133874e+02,  2.14713628
e+02,
        2.09535900e+02,  2.04610994e+02,  1.99946583e+02,  1.95547640
e+02,
        1.91416408e+02,  1.87552424e+02,  1.83952576e+02,  1.80611225
e+02,
        1.77520373e+02,  1.74669876e+02,  1.72047723e+02,  1.69640356
e+02,
        1.67433043e+02,  1.65410298e+02,  1.63556333e+02,  1.61855562
e+02,
        1.60293104e+02,  1.58855329e+02,  1.57530390e+02,  1.56308736
e+02,
        1.55183621e+02,  1.54151536e+02,  1.53212586e+02,  1.52370749
```

```
e+02,
        1.51634014e+02,  1.51014364e+02,  1.50527531e+02,  1.50192512
e+02,
        1.50030814e+02,  1.50065305e+02,  1.50318705e+02,  1.50811580
e+02,
        1.51559794e+02,  1.52571355e+02,  1.53842564e+02,  1.55353350
e+02,
        1.57061719e+02,  1.58897233e+02,  1.60753327e+02])
```

In [518]:
```
#Saturday alpha 15
poly15 = PolynomialFeatures(degree=15)

x_15 = poly15.fit_transform(x_sat)

ridge_sat = linear_model.Ridge(alpha=15)
ridge_sat.fit(x_15, y_sat)

(ridge_sat.coef_, ridge_sat.intercept_)
```

Out[518]:
```
(array([ 0.00000000e+00,  2.91919865e-03, -1.09472723e+00, -2.2654280
2e+00,
        -1.66524296e+00,  2.00242221e+00, -8.35854051e-01,  1.9621728
5e-01,
        -2.89421619e-02,  2.81760744e-03, -1.85289966e-04,  8.2579740
6e-06,
        -2.44950034e-07,  4.60535744e-09, -4.92370543e-11,  2.2487979
7e-13]),
 79.14680308128925)
```

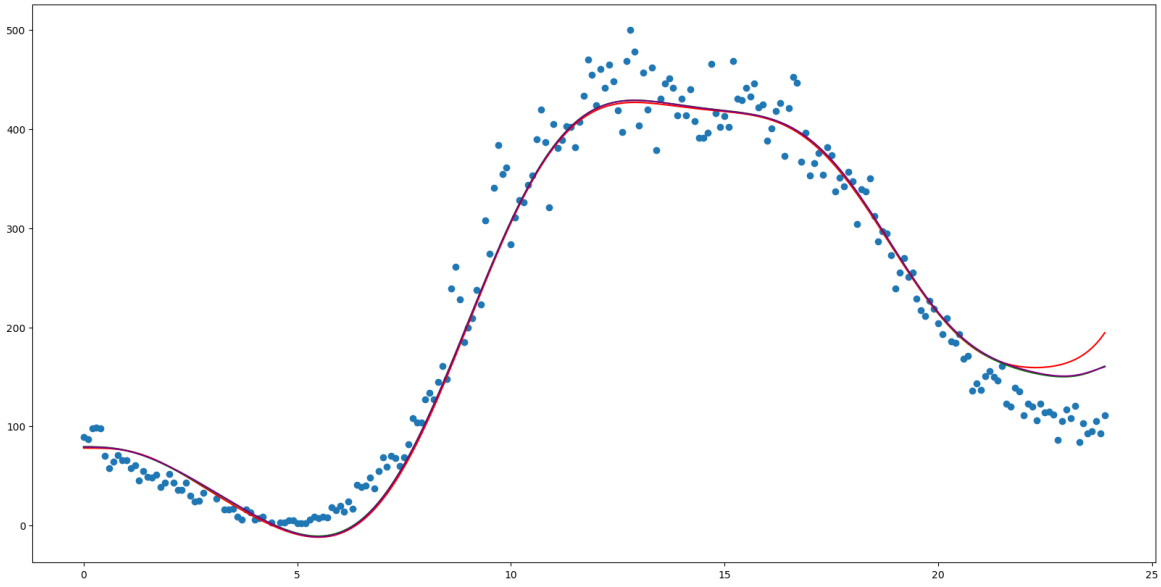
In [519]:
```
y_sat_ridge15 = np.dot(x_15, ridge_sat.coef_) + ridge_sat.intercept_
y_sat_ridge15
```

Out[519]:
```
array([ 79.14680308,  79.13373498,  79.08339974,  78.97879598,
        78.80258117,  78.53826538,  78.17104962,  77.68837275,
        77.08022297,  76.33926254,  75.46080769,  74.44269977,
        73.28509811,  71.99022053,  70.56205274,  69.00604446,
        67.32880623,  65.5378183 ,  63.64116007,  61.64726651,
        59.56471574,  57.40205052,  55.16763485,  52.86954566,
        50.51549858,  48.11280619,  45.66836605,  43.18867589,
        40.67987254,  33.03609742,  27.89743248,  25.33189047,
        22.77672461,  20.23827608,  17.72336748,  15.23939163,
        12.79438998,  10.39711877,   8.05710148,   5.78466652,
         1.48799776,  -2.39373085,  -4.14452447,  -5.74876704,
        -7.19078744,  -8.45438236,  -9.52291684, -10.37943652,
       -11.00679015, -11.38776098, -11.50520543, -11.34219742,
       -10.88217677, -10.10909984,  -9.00759091,  -7.56309247,
        -5.76201293,  -3.59187   ,  -1.04142837,   1.89916988,
         5.23828337,   8.98265941,  13.13733297,  17.70553762,
        22.68862941,  28.08602447,  33.89515091,  40.11141564,
        46.7281863 ,  53.73678871,  61.12651985,  68.88467628,
        76.9965979 ,  85.44572669,  94.21368003, 103.280338  ,
       112.62394398, 122.22121792, 132.04748114, 142.07679202,
       152.2820912 , 162.63535551, 173.10775914, 183.66984106,
       194.29167729, 204.94305671, 215.59365922, 226.21323468,
       236.77178156, 247.23972369, 257.5880841 , 267.78865432,
       277.81415828, 287.63840922, 297.23645879, 306.58473707,
       315.66118252, 324.44536099, 332.91857291, 341.06394785,
       348.86652585, 356.31332489, 363.39339415, 370.09785252,
       376.41991221, 382.35488743, 387.90018786, 393.05529718,
       397.82173676, 402.20301495, 406.20456205, 409.83365192,
       413.09931043, 416.01221173, 418.58456297, 420.82997845,
       422.76334415, 424.40067365, 425.75895652, 426.85600042,
       427.71026811, 428.34071053, 428.76659741, 429.00734655,
       429.08235323, 429.01082109, 428.8115957 , 428.50300229,
       428.10268884, 427.62747593, 427.09321427, 426.51465175,
       425.90531013, 425.27737348, 424.64158861, 424.00717863,
       423.38177057, 422.77133743, 422.18015572, 421.61077824,
       421.06402347, 420.53898069, 420.03303182, 419.54188959,
       419.05965172, 418.57887118, 418.09064195, 417.58469936,
       417.04953516, 416.4725256 , 415.84007183, 415.13775209,
       414.35048366, 413.46269381, 412.45849782, 411.3218835 ,
       410.03689933, 408.58784565, 406.95946637, 405.13714001,
       403.10706785, 400.85645705, 398.373698  , 395.64853239,
       392.67221189, 389.43764406, 385.93952429, 382.1744535 ,
       378.14103687, 373.8399654 , 369.27407724, 364.4483971 ,
       359.37015438, 354.048778  , 348.49586743, 342.72513825,
       336.75234777, 330.5951888 , 324.27316839, 317.80745441,
       311.22070748, 304.53688413, 297.7810263 , 290.97902912,
       284.15739185, 277.34295934, 270.56264728, 263.84316319,
       257.21072072, 250.69075173, 244.30762476, 238.08436435,
       232.042386  , 226.20124263, 220.57839078, 215.18898481,
       210.04569119, 205.15854496, 200.53483576, 196.17904013,
       192.09279698, 188.27492827, 184.72152108, 181.42605323,
       178.37957734, 175.57096785, 172.98721713, 170.61378878,
       168.43502158, 166.434591  , 164.59599751, 162.90310496,
```

```
       161.34069556, 159.89503688, 158.55445308, 157.30986899,
       156.15531844, 155.08838862, 154.11056155, 153.22744292,
       152.44881743, 151.78850573, 151.26397723, 150.89564055,
       150.70577639, 150.71707362, 150.95060843, 151.42330188,
       152.14465731, 153.11277407, 154.30947131, 155.69440478,
       157.19812793, 158.71383685, 160.08775729])
```

In [520]:
```
plt.scatter(x_sat,y_sat)
plt.plot(x_sat, y_sat_ridge0_5, c='r')
plt.plot(x_sat, y_sat_ridge10, c='g')
plt.plot(x_sat, y_sat_ridge15, c='purple')
```

Out[520]:
```
[<matplotlib.lines.Line2D at 0x12ff15e20>]
```



4. Describe your results and which n and α you find fits the data best to your models

In looking at both days, it's a bit difficult to discern which is a better fit and the number of polynomials. There are cases where using 10 polynomials provides a better pattern but 15 polynomials provides better curve tracking. For the ridge model, using 15 polynomials and an alpha above 10, shows a better fit to the data, however going over 10, there isn't that much of a difference in fit. Overall, it looks like the ridge model provides a better fit than the regualr linear regression model.