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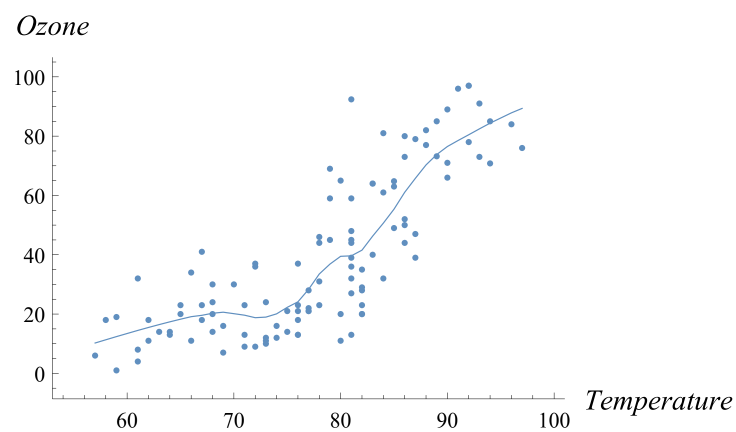
Final Problem 7: Ozone Study

Part (a) - NY Temperature/Ozone

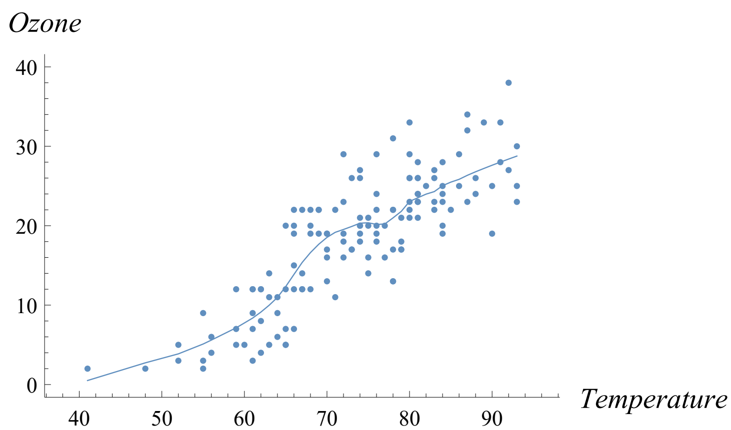
```
smoothNY = LowessSmooth[pairsNY, 0.35];
SmoothPlot[{pairsNY, smoothNY},
 AxesLabel → {"Temperature", "Ozone"}]
```



From the graph of the ozone and temperature, there appears to be a clear positive relationship between ozone and temperature levels, but the rate of ozone increases with respect to temperature increases varies greatly. In particular, it appears that ozone levels only really start to increase once the temperature reaches the mid-70’s. Then, going from the 70s to the 90s almost quintuples the amount of ozone in the air.

Part (b) - CA Temperature/Ozone

```
smoothCA = LowessSmooth[pairsCA, 0.30];
SmoothPlot[{pairsCA, smoothCA},
 AxesLabel → {"Temperature", "Ozone"}]
```



From this graph, we can see that the relationship between ozone and temperature in California seems much more stable. Whereas the relationship between ozone and temperature almost quadratic, the relationship in California seems more linear. Furthermore, ozone levels don't go nearly as high in California. While ozone levels reached close to 100 parts per billion in New York at high temperatures, ozone levels only rise to about 40 parts per billion at similarly high temperatures in California.

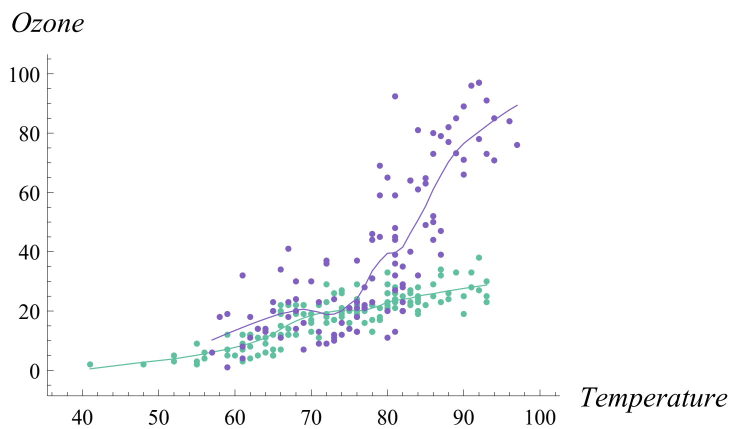
Part (c) - Summary Statistics

	Sample Size	Mean Temp	Mean Ozone		Predicted Ozone @78º	~95 % CI for Mean Ozone @78º
NY	111	77.79	39.01		33.51	[27.74, 40.16]
CA	138	73.38	18.38		20.99	[19.06, 23.24]

Part (d) - Discussion

As we can see from the summary statistics in part c, it appears that ozone and temperature levels have dif ferent relationships in New York and California. While the two states have relatively similar mean temperatures over the sample, New York's mean ozone density is roughly twice as high as California. Furthermore, our predictions indicate that we would expect New York to have a higher ozone level than California at a temperature of 78 degrees fahrenheit. Although the estimate for New York has a wider band, there is no overlap between the confidence intervals, which indicates that we can be confident that New York would have a higher ozone level at the given temperature. This difference in ozone becomes more apparent once we overlay the two graphs from earlier:

```
SmoothPlot[{pairsCA, smoothCA}, {pairsNY, smoothNY},
 AxesLabel → {"Temperature", "Ozone"}]
```



Note that in the graph above, the purple (darker) points correspond to datapoints from New York and the green (lighter) points correspond to the data points in California. As I mentioned earlier, California's pattern seems to be roughly linear whereas New York's pattern seems to be quadratic. Until about 75 degrees, there is a fairly large overlap in the data points. At points higher than 75 degrees, however, New York experienced far higher levels of ozone than we see for California at the same temperature levels. All of this seems to make a compelling argument that the New York and Los Angeles metropolitan areas have different ozone-temperature relationships. I don't have much expertise on subject, but it would be interesting to see if other metropolitan areas on the east and west coast had similar divergences in behavior. It may be that existing on the different seaboards changes the ozone-temperature dynamics in the areas. Furthermore, it would be interesting to see if this ozone-temperature tradeoff persists at all temperature for New York. Although both samples came from the summer time, New York experiences a greater variability in temperature over the course of a year, so it would be interesting to see the ozone-temperature relationship during the winter. Finally, it would be nice to have multiple years of data to see whether this divergence in behavior persists over multiple years. It may be that yearly weather patterns, e.g. El Nino/Nina, are affecting the ozone-temperature dynamics in these two areas differently. Having multiple years of data would help to test this idea.