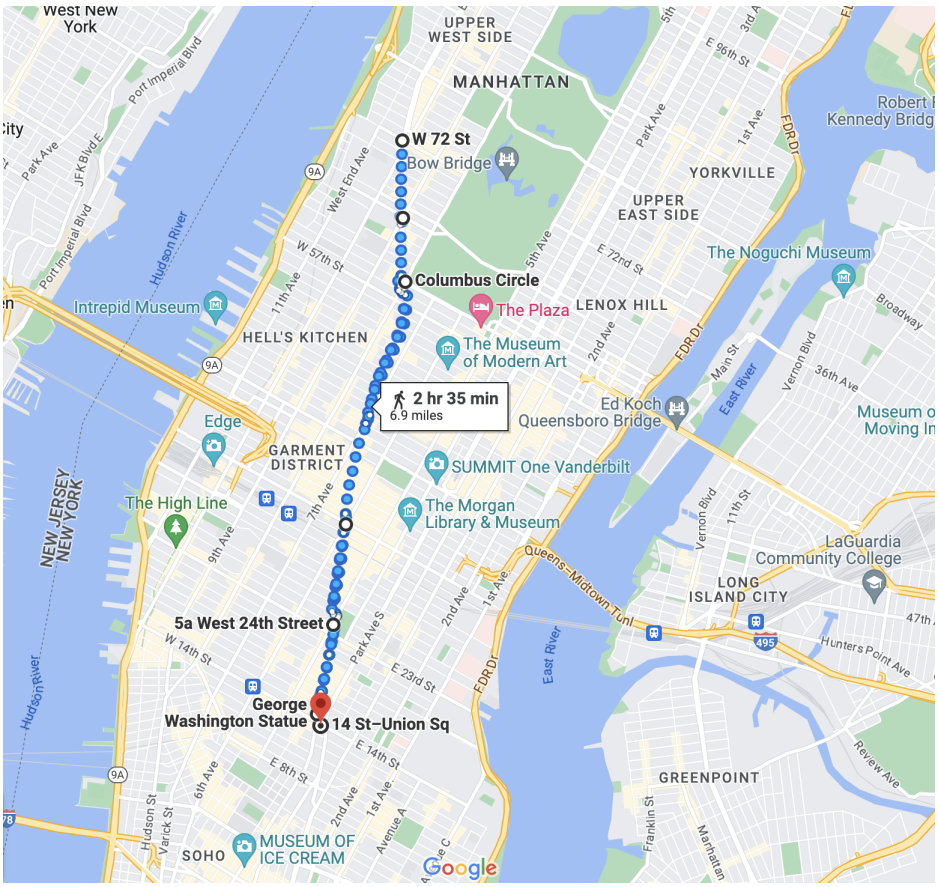
Class Activity

Let's do some New York mathematics!

Part of New York City is set up on a grid where streets run horizontally and avenues run vertically. But Broadway is the only road in Manhattan that runs diagonally cutting the streets and avenue from 14th street to 72nd street. We will use this fact to develop a linear regression line for Broadway in New York City.

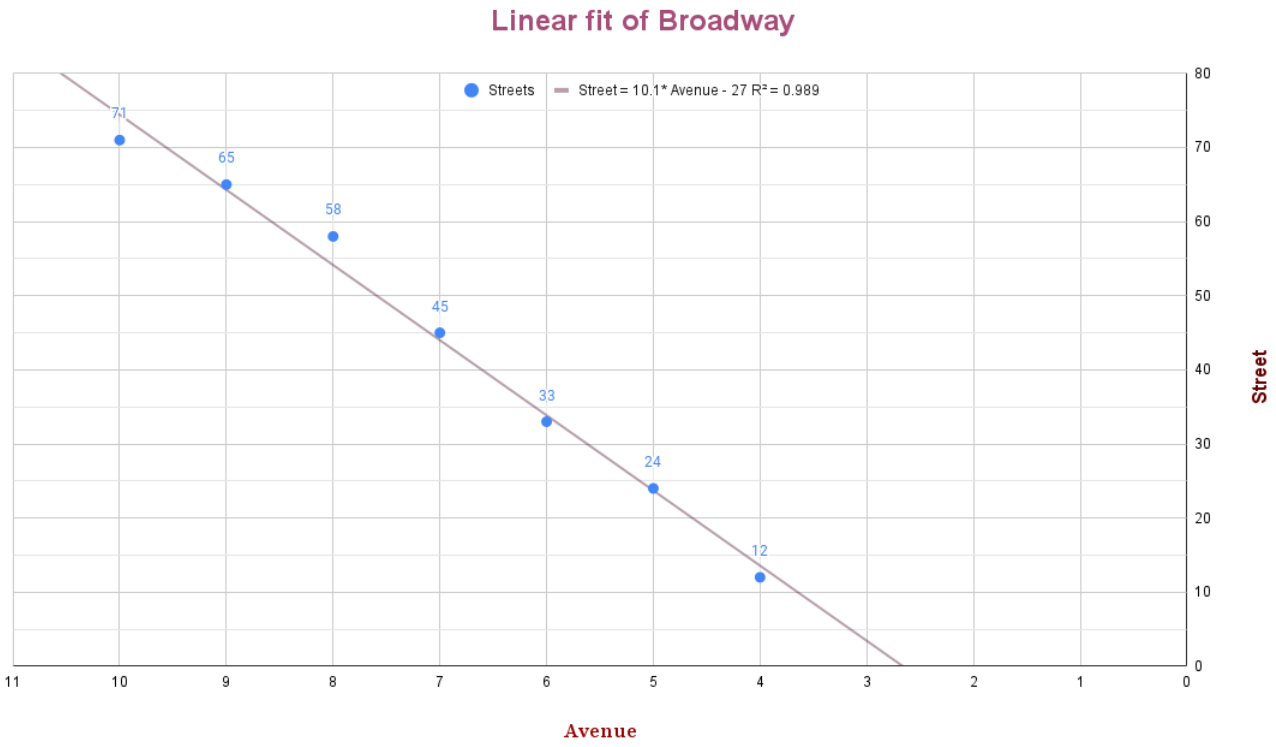
First of all, we need a grid. Since there is no 0th avenue and 0th street, the corner of Avenue A and East 1st street is the origin of the grid. Also, the avenues decrease as we move from left to right which is unconventional, but it does the job.

Broadway runs parallel to avenues up to 4th avenue, so we will start our data collection from 4th avenue and 14th street. On our $x-$axis we will plot the avenues and on $y-$axis we will plot the streets. Broadway meets avenue and street on 4th avenue and 14th street, so first data point is $(4, 14)$. Similarly, Broadway meets the intersection of 5th avenue and 24th street. Hence, our second data point is $(5, 24)$. Broadway meets the intersection of 6th avenue and 33rd street. Thus, our third data point is $(6, 33)$. Using similar methodology, we have the rest of our observations as $(7, 45)$, $(8, 58)$, $(9, 65)$, and $(10, 71)$.



You can verify this result yourself via Google Maps or Apple Maps before proceeding to the next part.

Now we will plot this information on a scatterplot and create a line of best fit for Broadway. The linear equation is calculated as Streets $= -27 + 10.1\times$ Avenue. The r^2 value is 0.989



Now let's answer the following questions.

1. Interpret the slope of the regression line.

2. Interpret the $y-$intercept of the the regression line. Does it make sense in real life?

3. Suppose you do not have street number, but you partial information that that you need to reach Broadway in between 8th and 9th avenue (8.5th avenue for mathematical sense). Using the regression line, predict in which street you would expect to see the Broadway in between 8th and 9th avenue. Verify your prediction using maps. How close was the prediction?

4. Was the prediction in question 3 a good prediction or bad prediction. Explain in mathematical terms.

5. Now let's re-arrange the regression equation. Let's write the regression equation in terms of avenue as response variable which would be Avenue $= 2.67 + 0.1\times$ Streets. Now interpret the slope and $y-$intercept of this new regression line where avenue is response variable and street is explanatory variable.

6. Suppose you are on 50th street in Manhattan. Using the regression line, predict in which avenue you would expect to see the Broadway cross 50th street. Verify your prediction using maps. How close was the prediction?

7. Was the prediction in question 7 a good prediction or bad prediction? Explain in mathematical terms.

8. Suppose you are on 110th street in Manhattan. Using the regression line, predict in which avenue you would expect to see the Broadway cross 110th street. Verify your prediction using maps. How close was the prediction?

9. Was the prediction in question 9 a good prediction or bad prediction? Explain in mathematical terms.

10. How well the does the data fit the regression model in our least square regression model? Write in terms of percentage.