## The result of standard procter test are given in the table below.

Volume of Proctor mold (cm^3)	Mass of Wet soil in the mold (kg)	Moisture Content (%)	Moist unit weight (kg/m^3)	Dry unit weight
943.3	1.68	9.9	1780.98	1620.55
943.3	1.71	10.6	1812.78	1639.04
943.3	1.77	12.1	1876.39	1673.85
943.3	1.83	13.8	1939.99	1704.74
943.3	1.86	15.1	1971.80	1713.12
943.3	1.88	17.4	1993.00	1697.61
943.3	1.87	19.4	1982.40	1660.30
943.3	1.85	21.2	1961.20	1618.15

Perform the following analysis for above provided data.

1. Make a Scatter Plot of moisture content vs dry unit weight.
2. Considering moisture content as cause (x variable) and dry unit weight as effect (y variable), make following curve fittings:
   - one degree least square fit.
   - two degree least square fit.
   - quadratic spline curve.
3. Visulize three lines of fitting in graph along with scatter points. Then observe and determine whether least square fit of degree one or degree two is best suited for the data provided.

   - Graph should be somewhat similar to this:
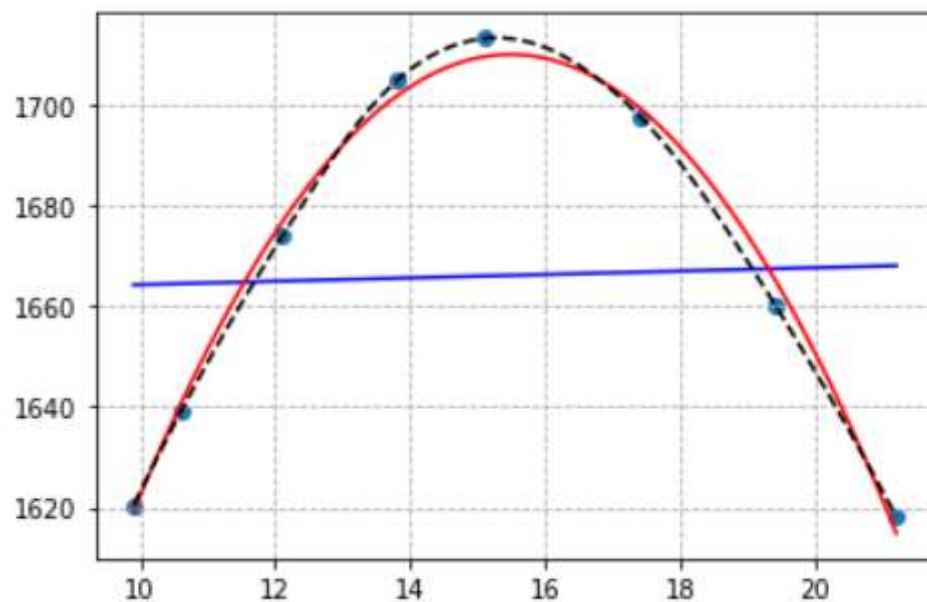
4. Considering Equation of Quadratic line of fit, Find it's derivative when moisture content is 15%.

5. Use Secant's method to determine two root of Quadratic line of fit.
   (Different initial guess can be used to determine different lines of fit.)

Following References are recommended for Learning Further Applications of Python Language in civil Engineering:

1. Dynamics and Control Theory:
   Dynamics and Control Theory is mostly used in Water Resources Engineering Sector of Civil Engineering to model various phenomenon and machinary.
   http://www.bristol.ac.uk/engineering/research/dynamicscontrol/

2. Sympy Documentation:
   All the capabilites of sympy library can be explored through this link.
   https://docs.sympy.org/latest/index.html

3. Matplotlib Official Website:
   One of the most easy to comprehend official documentation/tutorial site.
   https://matplotlib.org/

4. Numpy and Scipy Documentation:
   This website is best to refer when you want to know the exacty syntax of numpy and scipy functions.
   https://docs.scipy.org/doc/

In [ ]: