ML Assignment 2 Write Up.
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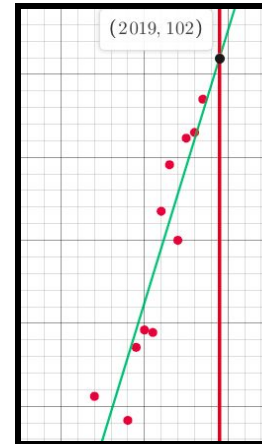
1)

   a) **Y** = 3.28**X** - 6520.32

A = sum(xi)	B = sum(yi)	C = sum(xi*xi)	D = sum(xi*yi)
22129	859.6	44517661	1729766.8

w0	w1
-6520.32	3.28

   b) H(2019) = 102
   c) RMSE = 5.247

2)   **X = ML, Y = HUR**

   a) **Y** = w1**X** + w0

A = sum(xi)	B = sum(yi)	C = sum(xi*xi)	D = sum(xi*yi)
798	819	64722	66045

w0	w1
29.12903226	0.6612903226
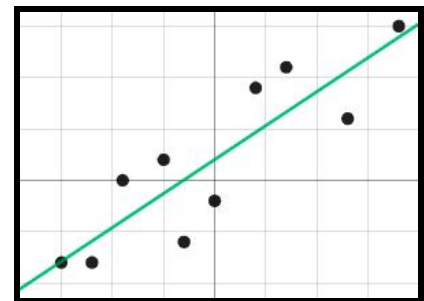
   b) **X** = w3**Y** + w2

A' = sum(yi)	B' = sum(xi)	C' = sum(yi*yi)	D' = sum(xi*yi)
819	798	67675	66045

| w2	w3
-14.3938888	1.150108532
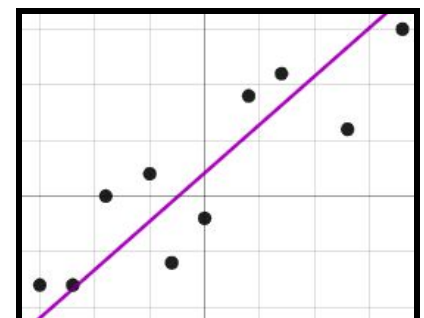
c) Plugging $X = 96$ into $Y = w1X + w0$
   => $Y = 92.613$

d) Plugging $Y = 95$ into $X = w3Y + w2$
   => $X = 94.866$

e) As we can see they are different lines and have different purposes. Like $Y = w1X + w0$ line should be used only to calculate the Y value for the corresponding X value and vice versa.

   The green line is for part (a) ie $Y = w1X + w0$
   The purple line is for part (b) ie $X = w3Y + w2$

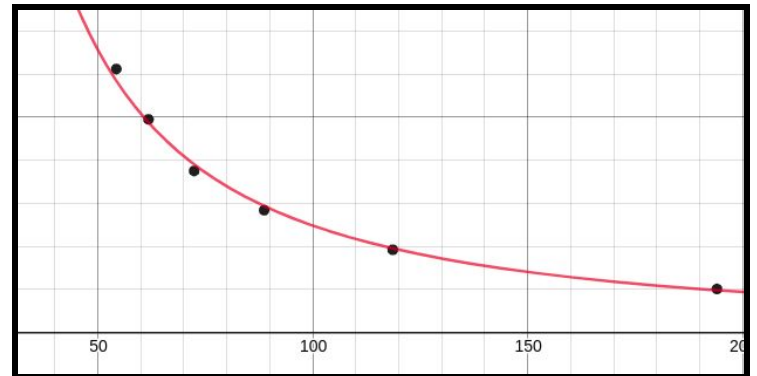   In (a) Y depends on X whereas in (b) it's the other way around.
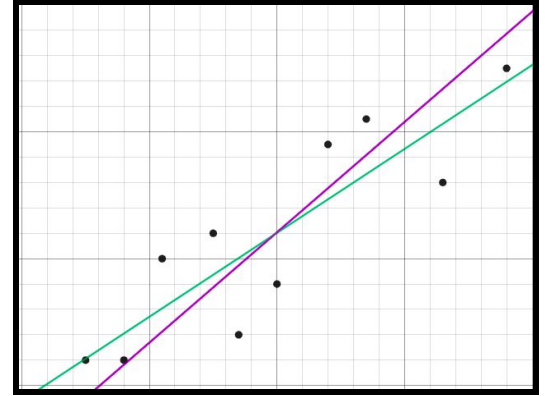
3)
$$PV^n = c$$

$\ln(PV^n) = \ln(c)$
$\ln(P) + n.\ln(V) = \ln(c)$
$\ln(P) = \ln(c) - n.\ln(V)$
$\ln(P) = \ln(c) + n.\ln(1/V)$

This equation is similar to the linear equation. $Y = b + n.X$

Where $X = \ln(1/V)$, $Y = \ln(P)$ and $b = \ln(c)$

A = sum(ln(1/V))	B = sum(ln(P))	C = sum(ln²(1/V))	D = sum(ln(1/V)*ln(P))
-26.92950843	20.25429564	121.9758294	-89.34905996

a) n and c are mentioned in the table

n	b = ln(c)	c
1.403709404	9.675916646	15929.3189

b) The Equation becomes :

$$\ln(P) = \ln(c) + n \cdot \ln(1/V)$$

c) **24.819** units

4)

A = sum(xi)	B = sum(xi^2)	C = sum(yi)	D = sum(xi^3)	E = sum(yi*xi)	F = sum(xi^4)	G = sum(xi^2*yi)
21	91	59.1	441	266.9	2275	1367.5

All the calculations are attached in the excel sheet attached. As we can see this curve completely covers all the points.

$$Y = 2.50952 - 1.2X + 0.733333X^2$$

$$\begin{bmatrix} n & A & B \\ A & B & D \\ B & D & F \end{bmatrix} \begin{bmatrix} w0 \\ w1 \\ w2 \end{bmatrix} = \begin{bmatrix} C \\ E \\ G \end{bmatrix}$$

Plugging all the values and solving for w0, w1 and w2.

w0	w1	w2
2.50952	-1.2	0.733333