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Q.1.

$$h(\theta) = \theta x$$

$$J(\theta) = \frac{1}{2m} \sum_{i=1}^{5} (y - h(\theta))^2$$

$\leftarrow h(\theta) \rightarrow$

x	y	$\theta=0$	$\theta=1$	$\theta=2$	$\theta=3$	$\theta=4$
1	2	0	1	2	3	4
2	5	0	2	4	6	8
4	7	0	4	8	12	16
3	7	0	3	6	9	12
5	10	0	5	10	15	20

$$J(\theta=0) = \frac{1}{2\times5}\left(2^2+5^2+7^2+7^2+10^2\right)$$

$$J(\theta=0) = 22.7$$

$$J(\theta=1) = \frac{1}{10}\left(0^2+0^2+0^2+0^2+0^2\right) = 0$$

$$J(\theta=2) = \frac{1}{10}\left(1^2+1^2+1^2+0^2\right) = \frac{3}{10} = 0.3$$

$$J(\theta=3) = \frac{1}{10}\left(1^2+1^2+5^2+2^2+5^2\right) = 5.6$$

$$J(\theta=4) = \frac{1}{10}\left(4+9+81+25+100\right) = \frac{219}{10} = 21.9.$$

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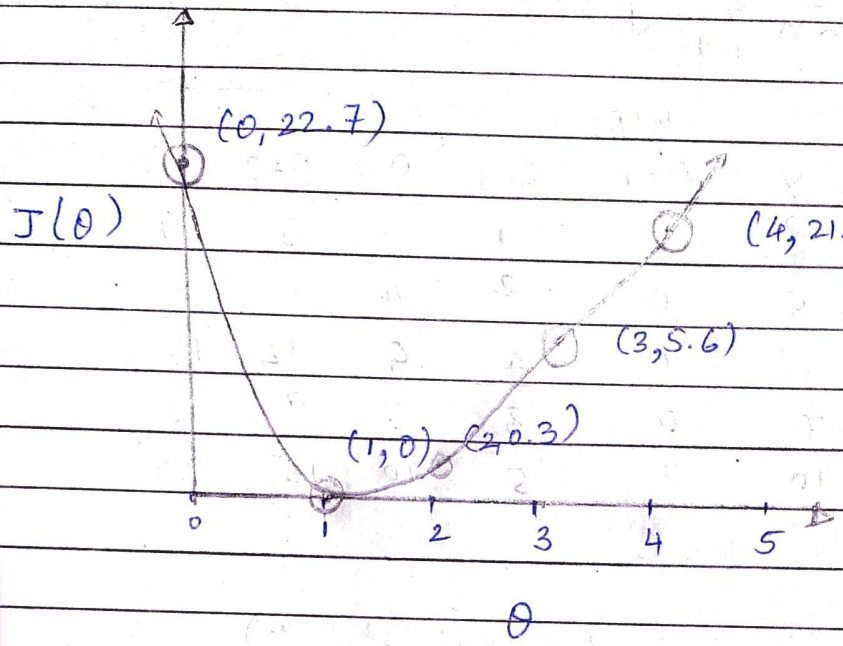
Plotting graph.



Q.2.

X_1	X_2	Y
85	85	No
71	80	NO
75	50	YES
60	80	YES
72	3	YES

Here K=3 we need to predict for (72, 75)

① cosine similarity with 1st tuple.

$$\cos\theta = \frac{(72)(85) + (75)(85)}{\sqrt{72^2+75^2}\ \sqrt{85^2+85^2}}$$

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$$\frac{12495}{103.96 \times 120.20} = 0.999 \simeq 1.0$$

(2) $\cos\theta = \frac{(72\times71)+(75\times80)}{103.96 \times 106.96} = 0.999 \simeq 1.0.$

(3) $\cos\theta = \frac{(72\times75)+(75\times50)}{103.96 \times 90.13} = 0.976$

(4) $\cos\theta = \frac{(72\times60)+(75\times80)}{103.96 \times 100} = 0.9926$

(5) $\cos\theta = \frac{(72\times72)+(75\times3)}{103.96 \times 72.06} = 0.722.$

Now as $K=3$ and $\cos 0^\circ = 1$ i.e. the angle blw them is much smaller which results into smaller distance blw them.

$\therefore$ $m = \{1, 2, 4\}$ → has much smaller angle thus $\{$ "NO", "NO", "YES" $\}$

the value of (72, 75) will be "NO"

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Q.3. (i) As we know eq. of linear function can be determined as

$$y = mx + c$$

here $y = a + bx$

$$\boxed{y = -4.930 + 0.030x}$$

(ii) slope we can say is $\frac{dy}{dx}$

so here slope = $\frac{d(\text{sales})}{d(\text{no. of shopping centres})}$

so positive slope indicates that increasing a single unit of x their is 0.03 increase in y.

∴ increasing 1 shopping centre leads to 0.03 growth in sales.

(iii) $y = -4.930 + 0.03x$

when $x = 0$ $y = -4.930$.

i.e. when the no. of shops are null then their is negative growth in sales or no sales takes place.

But in Real-life cases it make no sense to predicts sales when you have not opened a single shop.

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(iv) $y = -4.930 + 0.03x$

$\therefore \quad x = 500$

$y = -4.930 + 0.03(500)$

$y = 10.07$

$\therefore$ Sales = 10.07 $ (billions)

(v) $y = -4.930 + 0.03x$

at $x = 100$

$y = -4.930 + 0.03(100) = -1.93$

Sales can't be negative, it's always positive. So it makes no sense.
Or we can say that the value is less than minimum no. of shops to atleast get positive sales.

Q.4 In the question there are two parameters on which ~~temperature~~ amount of rainfall is dependent.

Let's assume θ_1 = temperature

θ_2 = Humidity.

And clearly mentioned that we have used polynomial eqn of degree 2.

$\therefore$ Y can be written as

$Y = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_2^2 + \theta_5 x_1 x_2$

$Y = \theta_0 + \theta_1 x_1 + \theta_2 x^2$

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So looking at the eqn their are 3 parameter to learn $[\theta_0, \theta_1, \theta_2]$

Q.5.

(1) Multi-variable linear Regression:-

→ As the output is in a continous manner and also their are two parameter 10th and 12th marks.

→ Thus Regression must be perfect match for such situation.

(2) classification. (Logistic Regression)

→ As the output is discrete, thus classification is good enough to predict

→ Here as the input parameters are either 0/1 ∴ it must be a good choice.

(3) KNN classifier:

→ As the input parameters are kind of continous thus KNN can be used.

→ Plotting becomes easily in case of continous input values.

Q.6. Model M_1

Let Accuracy be A_i
Sensitivity be Se_i
Specifivity be Sp_i
Precision be P_i
Recall be R_i

For Model M_1

$$A_1 = \frac{TP+TN}{\text{Total}} = \frac{150+250}{500} = \frac{400}{500} = 0.8$$

$$Se_1 = \frac{TP}{TP+FN} = \frac{150}{150+40} = \frac{150}{190} = 0.789$$

$$Sp_1 = \frac{TN}{TN+FP} = \frac{250}{250+60} < 0.81$$

$$P_1 = \frac{TP}{TP+FP} = \frac{150}{150+60} = \frac{150}{210} = 0.714$$

$$R_1 = Se_1 = 0.789.$$

For Model M2

$$A_2 = \frac{450}{500} = 0.9.$$

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$$Se_2 = \frac{TP}{TP+PN} = 0.975$$

$Sp_2 = 0.847$

$P_2 = 0.980$

$R_2 = Se_2 = 0.975$.

So looking at all the parameters we conclude that M_2 is better as compared to M_1

ble $P_2 > P_1$ $A_2 > A_1$ $R_2 > R_1$