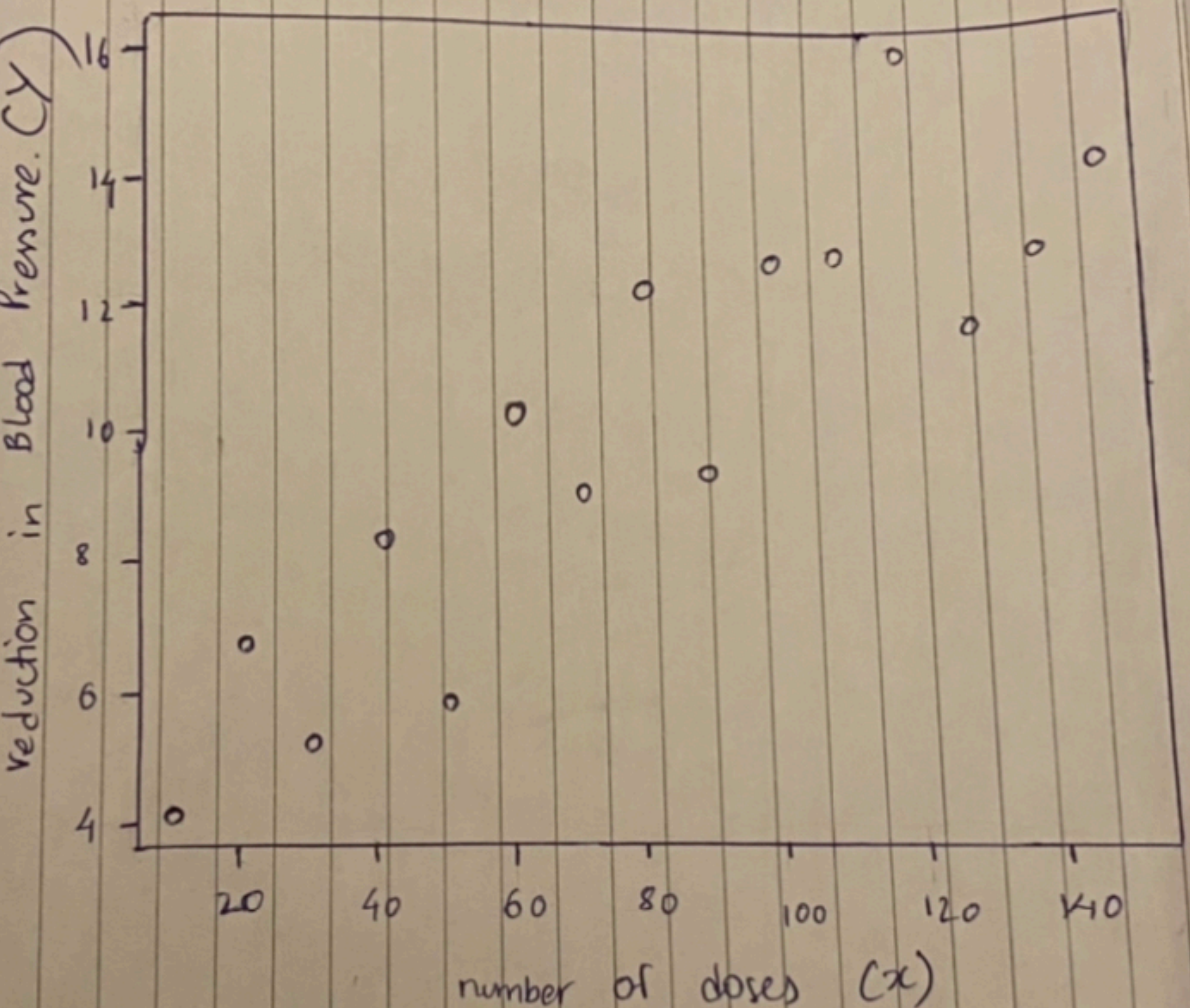
1) a)


reduction in Blood Pressure (Y)
16
14
12
10
8
6
4
20
40
60
80
100
120
140
number of doses (x)

Yes there seems to be an indication that the mean value of y depends on x. (as if we switch x values, we would end up with a completely different mean in the graph.)

1) b)

x_i	y_i	x_i^2	y_i^2	$x_i y_i$
10	4.2	100	17.64	42
20	6.8	400	46.24	136
30	5.2	900	27.04	156
40	8.4	1600	70.56	336
50	5.9	2500	34.81	295
60	10.4	3600	108.16	624
70	9.1	4900	82.81	637
80	12.4	6400	~~163.84~~ → 153.76	992
90	9.4	8100	88.36	846
100	12.8	10000	163.84	1280
110	12.9	12100	166.41	1419
120	16.2	14400	262.44	1944
130	11.7	16900	136.89	1521
140	12.9	19600	166.41	1806
150	14.3	22500	204.49	2145
Σ 1200	152.6	124000	1729.86	14179

$n = 15$

$\bar{x} = \frac{1200}{15} = 80$ $\quad \bar{y} = \frac{152.6}{15} = 10.173$

$$S_{xx} = \sum_{i=1}^{n} x_i^2 - n\bar{x}^2 = 124000 - 15(6400) = 28,000$$

$$S_{xy} = \sum_{i=1}^{n} x_i y_i - n\bar{x}\bar{y} = 14179 - 15(80)(10.173) = 1971.4$$

The slope $\hat{\beta}_1 = \dfrac{S_{xy}}{S_{xx}} = \dfrac{1971.4}{28000} = 0.0704$

The intercept $\hat{\beta}_0 = \bar{Y} - \hat{\beta}_1 \bar{X}$

$= 10.1733 - (0.0704)(80)$

$= \cancel{4.5484} \quad 4.5413$

fitted SLR model, the equation of the Line for scatterplot is $\cancel{\hat{y} = 20}$.

$$\hat{y} = 0.0704x + 4.5413$$

1) c) $\hat{y} = \underbrace{0.0704}_{\beta_1} x + \underbrace{4.5413}_{\beta_0}$

$\beta_0 \rightarrow$ intercept Parameter, the expected mean of y when $x=0$ is 4.5413

$\beta_1 \rightarrow$ Slope Parameter, the change in the expected mean of y for a unit increase in x is 0.0704

Slope Interpretation: The change in the expected mean ~~redu~~ of the reduction in blood pressure (Y) caused by the drug for a unit increment in the dose is 0.0704

Intercept Interpretation: When the number of doses given are zero, the mean reduction in blood pressure still seems to remain around 4.5413 according to this SLR model.

1) d) $\hat{\sigma}^2 (MSE) = \frac{1}{n-2} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$

y_i	$\hat{y}_i$	$(y_i - \hat{y}_i)^2$
4.2	5.2453	1.0927
6.8	5.9493	0.7237
5.2	6.6533	2.1121
8.4	7.3573	1.0872
5.9	8.0613	4.6712
10.4	8.7653	2.6722
9.1	9.4693	0.1364
12.4	10.1733	4.9582
9.4	10.8773	2.1824
12.8	11.5813	1.4852
12.9	12.2833	0.3779
16.2	12.9893	10.3086
11.7	13.6933	3.9732
12.9	14.3973	2.2419
14.3	15.031	0.6421
	Σ	38.6650

$$\hat{\sigma}^2 (MSE) = \frac{1}{15-2} (38.6650)$$

$$= \frac{1}{13} (38.6650) = 2.9742$$

1) e) assumptions in terms of errors.

1) $E[\epsilon_i]=0$

2) $Var(\epsilon_i)=\sigma^2$ (doesn't depend on i)

3) ϵ_i are independent

4) $\epsilon_i \sim N(0,\sigma^2)$

1) ~~EEC~~ $E[\epsilon_i]=0$: we can see from the mean on the graph. which cuts through zero, this will hold.

2) $Var(\epsilon_i)=\sigma^2$ (doesn't depend on i):
we can ~~assume~~ say that it is reasonable to assume that $Var(\epsilon_i)=\sigma^2$ as we can't see a clear increasing /decreasing pattern.

3) ϵ_i are independent: This is clearly visible from the graph as none of the ϵ_i value seem to effect any other ϵ_i

4) $\epsilon_i \sim N(0,\sigma^2)$: from the QQ plot, this assumption doesn't seem reasonable since some points at the tail deviate from the normal distribution slightly.