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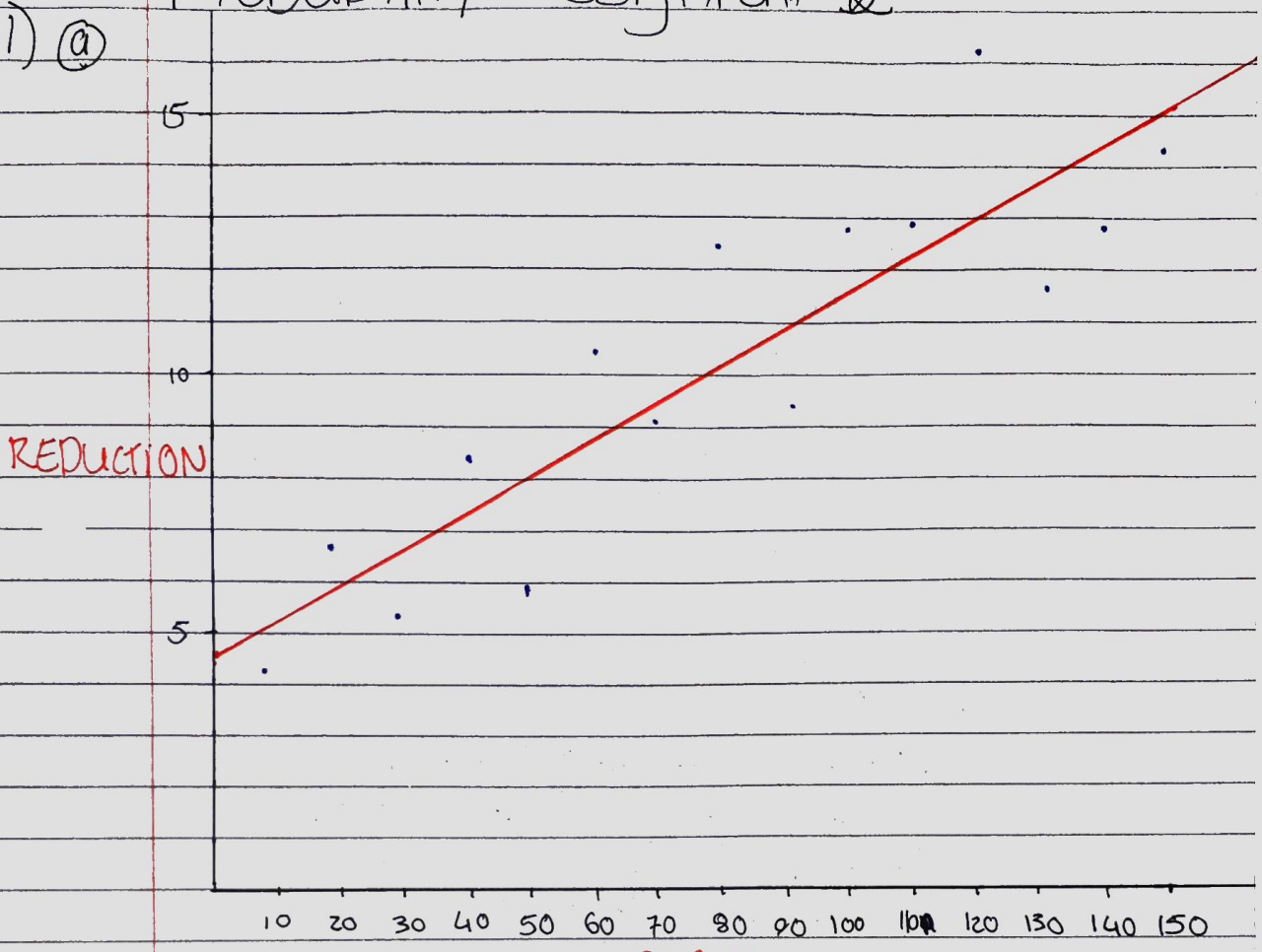
Probability Assignment 2

1) (a)



Yes, as the dose increases, the reduction values increase.

(b) $\frac{S_{xy}}{S_{xx}} = \hat{\beta}_1$ $\quad \hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}$ $\quad \hat{y} = \hat{\beta}_1 x + \hat{\beta}_0$

$\bar{x} = 80 \quad y = 10.173$

$70^2 + 60^2 + 50^2 + 40^2 + 40^2 + 30^2 + 20^2 + 10^2 + 0 + 10^2 + 20^2$
$+ 30^2 + 40^2 + 50^2 + 60^2 + 70^2 = 28000 = S_{xx}$

$-294 - 408 - 260 - 336 - 177 - 208 - 91 + 94 + 256 + 387$
$+ 648 + 585 + 774 + 1001 = 1971 = S_{xy}$

$\hat{\beta}_1 = \frac{1971}{28000} = 0.0704 \quad \hat{\beta}_0 = 10.173 - 0.0704(80) = 4.541$

$\hat{y} = 4.541 + 0.0704x$

(c) Intercept: the estimated average reduction in blood pressure is 4.541 when the dose is 0.

Slope: the estimated average reduction in blood pressure increases by 0.0704 for each unit increase in Dose.

(d) Predicted values: 5.245 5.949 6.653 7.357
8.061 8.765 9.469 10.173 10.877 11.581
12.285 12.989 13.693 14.397 15.101

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

$$= \frac{(-1.045)^2+(0.851)^2+(1.453)^2+(1.043)^2+(-2.161)^2+(1.635)^2+(-0.369)^2+(2.227)^2+(-1.477)^2+(1.219)^2+(0.615)^2+(3.211)^2+(-1.993)^2+(-1.497)^2+(-0.801)^2}{13}$$

$$= \frac{38.665}{13} = 2.974$$

This estimation tells us the accuracy of our model at predicting values. The smaller the MSE: the better the fit.

(e) $E[\epsilon_i] = 0$
The plot of residuals versus predicted is scattered but they are all reasonably close to 0 which means this assumption is reasonable.

$Var(\epsilon_i) = \sigma^2$

There is one outlier in the plot but other than this value the other points are consistently spaced. This assumption is also reasonable.

ϵ_i are independent

There doesn't seem to be any patterns of dependency across the graph so this assumption is reasonable.

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

The QQ plot does follow the straight line fairly closely and thus this is also a reasonable assumption.