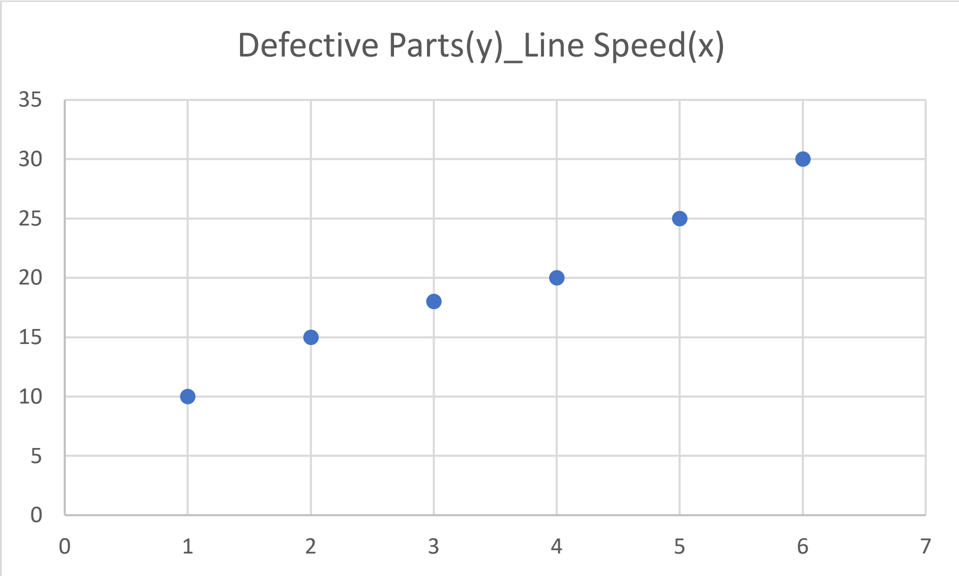
#11 (Total 30 Points)

[1]



What can we observe:

- Obviously, a negative slope.
- Linear relationship

Theoretical model

$$y = \beta_0 + \beta_1 x + \varepsilon$$

Model to be estimated

$$\hat{y} = b_0 + b_1 x$$

[2]

Line Speed (x)	***No. of def. parts (y)***	***x*y***	***x^2***
20	21	20*21=420	20*20=400
20	19	380	400
40	15	600	1600
30	16	480	900
60	14	840	3600
40	17	680	1600
210	**102**	**3400**	**8500**

$$b_1 = \frac{n * \sum x_i * y_i - \sum x_i * \sum y_i}{n * \sum(x_i^2) - (\sum x_i)^2} = \frac{6 * 3400 - (210 * 102)}{6 * 8500 - (210^2)} = -0{,}1478$$

$$b_0 = \bar{y} - b_1 * \bar{x} = \left(\tfrac{1}{6} * 102\right) - \left(-0{,}1478 * \frac{1}{6} * 210\right) = 22{,}1739$$

$$\hat{y}_i = 22{,}1739 - 0{,}1478 * x_i$$

[3]

Coefficient of determination:

$$R^2 = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2} = 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2}$$

$$\hat{y}_1 = 22{,}1739 - 0{,}1478 * x_1 = 22{,}1739 - 0{,}1478 * 20 = \mathbf{19{,}2174}$$

$$(\hat{y}_1 - \bar{y})^2 = \left(19{,}2174 - \left({}^{102}/_{6}\right)^2\right) = \mathbf{4{,}9168}$$

$$(y_i - \bar{y})^2 = \left(21 - \left({}^{102}/_{6}\right)\right)^2 = \mathbf{16{,}0}$$

i	$\hat{y}_i$	$(\hat{y}_i - \bar{y})^2$	$(y_i - \bar{y})^2$
1	**19,2174**	**4,9168**	**16,0**
2	19,2174	4,9168	4,0
3	16,2609	0,5463	4,0
4	17,7391	0,5464	1,0
5	13,3043	13,6578	9,0
6	16,2609	0,5463	0,0
Total	**(not necessary)**	**25,1304**	**34,0**

$$R^2 = \frac{\sum(\hat{y}_i - \bar{y})^2}{\sum(y_i - \bar{y})^2} = \frac{25{,}1304}{34{,}0} = 0{,}7391\ (73{,}91\%)$$

The model explains the data cloud with 73,91%.