Example 12.6, page: 446 : (Yusra Elkamali)

Use the following variable (X) is the number of cubic feet moved as Independent variable to predict the total number of labor hours(Y) by answering the following questions:

Feet(X)	Hours(Y)	X^2	Y^2	XY
545	24	297025	576	13080
400	13.5	160000	182.25	5400
562	26.25	315844	689.0625	14752.5
540	25	291600	625	13500
220	9	48400	81	1980
344	20	118336	400	6880
569	22	323761	484	12518
340	11.25	115600	126.5625	3825
900	50	810000	2500	45000
285	12	81225	144	3420
865	38.75	748225	1501.5625	33518.75
831	40	690561	1600	33240
344	19.5	118336	380.25	6708
360	18	129600	324	6480
750	28	562500	784	21000
650	27	422500	729	17550
415	21	172225	441	8715
275	15	75625	225	4125
557	25	310249	625	13925
1028	45	1056784	2025	46260
793	29	628849	841	22997
523	21	273529	441	10983
564	22	318096	484	12408
312	16.5	97344	272.25	5148
757	37	573049	1369	28009
600	32	360000	1024	19200
796	34	633616	1156	27064
577	25	332929	625	14425
500	31	250000	961	15500
695	24	483025	576	16680
1054	40	1110916	1600	42160
486	27	236196	729	13122
442	18	195364	324	7956
1249	62.5	1560001	3906.25	78062.5
995	53.75	990025	2889.0625	53481.25
1397	79.5	1951609	6320.25	111061.5
Totals: 22520	1042.5	16842944	37960.5	790134.5

Find:

1) The regression coefficients b_0 ,b_1 ,

2) Interpret the slope of this problem.

3) Write the estimated regression equation (prediction line).

4)Predict the mean labor hours for moving 500 cubic feet

Solution :

1) The regression coefficients :

a) $\mathbf{b_1 = \frac{SSXY}{SSX}}$, $\mathbf{SSXY = \sum XY - \frac{(\sum X)(\sum Y)}{n} = 790134.5 - \frac{22520*1042.5}{36} = 137992.8333}$

$$SSX = \sum X^2 - \frac{(\sum X)^2}{n} = 16842944 - \frac{(22520)^2}{36} = 2755432.889$$

$$b_1 = \frac{137992.8333}{2755432.889} = 0.05$$

$\bar{X} = 625.555556$, $\bar{Y} = 28.95833333$, n=36

b) $b_0 = \bar{Y} - b_1\bar{X}$ = **28.95833333 – (0.05*625.555556) = -2.31944444**

b_0 =-2.319

2) **For every cubic foot increase in the amount moved, predicted mean labor hours are estimated to increase by 0.05 hours.**

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3)**The prediction Line is : $\hat{Y} = b_0 + b_1X$**

$\hat{Y} = -2.319 + 0.05X$

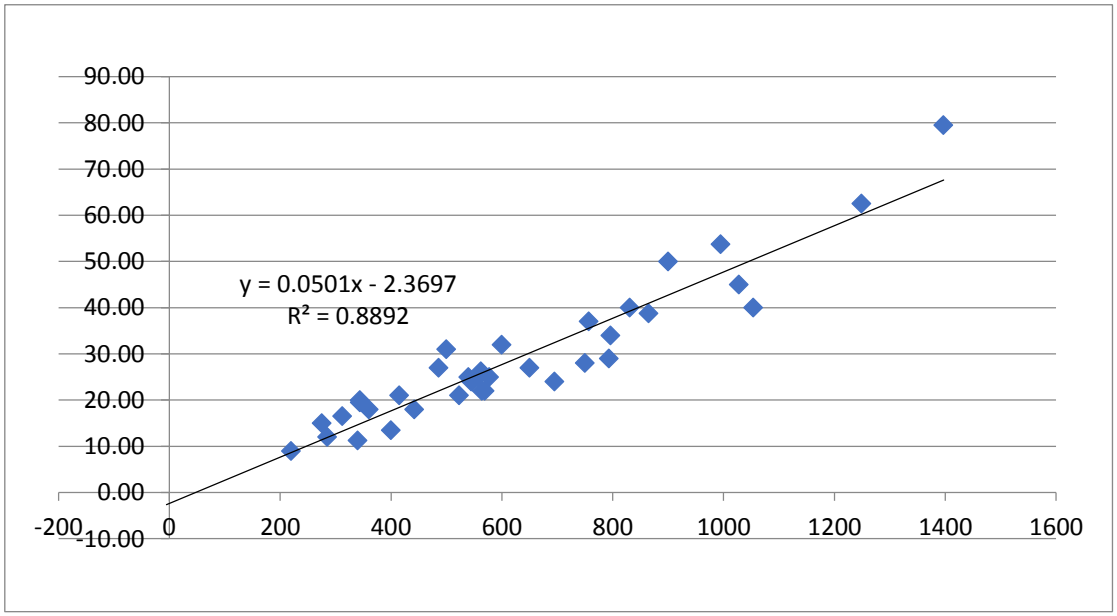
4)Predict the mean labor hours for moving 500 cubic feet

$\hat{Y} = -2.319 + 0.05(500) = 22.68$

Other Solution : (Dr . Maher Badawi)

Feet(X)	Hours(Y)	$(X-\bar{X})$	$(Y-\bar{Y})$	$(X-\bar{X})(Y-\bar{Y})$	$(X-\bar{X})^2$	$\hat{Y}$
545	24.00	-80.556	-4.96	399.4212963	6489.197531	24.9
400	13.50	-225.56	-15.46	3486.712963	50875.30864	17.7
562	26.25	-63.556	-2.71	172.1296296	4039.308642	25.8
540	25.00	-85.556	-3.96	338.6574074	7319.753086	24.7
220	9.00	-405.56	-19.96	8094.212963	164475.3086	8.65
344	20.00	-281.56	-8.96	2522.268519	79273.53086	14.9
569	22.00	-56.556	-6.96	393.5324074	3198.530864	26.1
340	11.25	-285.56	-17.71	5056.712963	81541.97531	14.7
900	50.00	274.444	21.04	5774.768519	75319.75309	42.7
285	12.00	-340.56	-16.96	5775.25463	115978.0864	11.9
865	38.75	239.444	9.79	2344.560185	57333.64198	40.9
831	40.00	205.444	11.04	2268.449074	42207.41975	39.2
344	19.50	-281.56	-9.46	2663.046296	79273.53086	14.9
360	18.00	-265.56	-10.96	2910.046296	70519.75309	15.7
750	28.00	124.444	-0.96	-119.2592593	15486.41975	35.2
650	27.00	24.4444	-1.96	-47.87037037	597.5308642	30.2
415	21.00	-210.56	-7.96	1675.671296	44333.64198	18.4
275	15.00	-350.56	-13.96	4893.171296	122889.1975	11.4
557	25.00	-68.556	-3.96	271.3657407	4699.864198	25.5
1028	45.00	402.444	16.04	6455.87963	161961.5309	49.1
793	29.00	167.444	0.04	6.976851852	28037.64198	37.3
523	21.00	-102.56	-7.96	816.1712963	10517.64198	23.8
564	22.00	-61.556	-6.96	428.3240741	3789.08642	25.9
312	16.50	-313.56	-12.46	3906.37963	98317.08642	13.3
757	37.00	131.444	8.04	1057.032407	17277.64198	35.5
600	32.00	-25.556	3.04	-77.73148148	653.0864198	27.7
796	34.00	170.444	5.04	859.3240741	29051.30864	37.5
577	25.00	-48.556	-3.96	192.1990741	2357.641975	26.5
500	31.00	-125.56	2.04	-256.3425926	15764.19753	22.7
695	24.00	69.4444	-4.96	-344.3287037	4822.530864	32.4
1054	40.00	428.444	11.04	4730.740741	183564.642	50.4
486	27.00	-139.56	-1.96	273.2962963	19475.75309	22
442	18.00	-183.56	-10.96	2011.462963	33692.64198	19.8
1249	62.50	623.444	33.54	20911.36574	388682.9753	60.2
995	53.75	369.444	24.79	9159.143519	136489.1975	47.5
1397	79.50	771.444	50.54	38990.08796	595126.5309	67.6
				137992.8333	**2755432.889**	

a.



b. $b_1 = \dfrac{SSXY}{SSX} = \dfrac{\sum (X-\bar{X})(Y-\bar{Y})}{\sum (X-\bar{X})^2} = \dfrac{\sum XY - \dfrac{(\sum X)(\sum Y)}{n}}{\sum X^2 - \dfrac{\left(\sum X\right)^2}{n}}$

$$b_1 = \frac{SSXY}{SSX} = \frac{\sum (X-\bar{X})(Y-\bar{Y})}{\sum (X-\bar{X})^2} = \frac{137992.833}{2755432.889} = 0.05$$

$$b_0 = \bar{Y} - b_1\bar{X} = 28.9583 - 0.05(625.556) = 2.3697$$

c. For every cubic foot increase in the amount moved, predicted mean labor hours are estimated to increase by 0.05 hours.

d. $Y = b_0 + b_1 X = -2.3697 + 0.05(500) = 22.67$ hours.