$$R^2 = \frac{\Sigma(\hat{y}-\bar{y})^2}{\Sigma(y-\bar{y})^2}, \quad r = \sqrt{R^2}$$

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Regression

5.5/6

(a)

$$\Sigma y_i = na + b\Sigma x_i$$

$$\Sigma x_i y_i = a\Sigma x_i + b\Sigma x_i^2$$

x	y	x_i^2	$x_i y_i$
100	20	10000	2000
150	18	22500	2700
200	15	40000	3000
300	12	90000	3600
400	9	160000	3600
500	5	250000	2500
600	2	360000	1200
2250	81	932500	18600

$$81 = 7a + 2250b \quad \times \frac{2250}{}$$

$$18600 = 2250a + 932500b \quad \times 7$$

$$182412 = 15750a + 5067000b$$

$$-130200 = -15750a + 6527500b$$

$$52212 = -1460500b$$

$$b = -0.035$$

$$a = 22.99$$

$$\therefore y = 22.99 - 0.035x$$

$$\bar{y} = \frac{\Sigma y}{n} = 108.571$$

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$n = 7$

(2)

x	y	x_i^2	$x_i y_i$	$\hat{y}$	$y - \bar{y}$	$\hat{y} - \bar{y}$
260	150	67600	39000	158.01	-8.01	49.44
80	70	6400	5600	64.41	5.59	-44.16
240	155	57600	37200	147.61	7.39	39.04
100	65	10000	6500	74.81	-9.81	-33.76
160	110	25600	17600	106.01	3.99	-2.56
180	115	32400	20700	116.41	-1.41	7.84
140	95	19600	13300	95.61	-0.61	-12.96
1160	760	219200	139900			

$$760 = 7a + 1160b$$
$$139900 = 1160a + 219200b$$

On solving,

$$y = 22.81 + 0.52x$$

$(y - \bar{y})^2$	$(\hat{y} - \bar{y})^2$
64.1601	2444.3136
31.2481	1950.1056
54.6121	1524.1216
96.2361	1139.7376
15.9201	6.5536
1.9881	61.4656
0.3721	167.9616
264.5367	14649.5216

$$R^2 = \frac{14649.5216/2}{7485.72}$$

$$R^2 = 0.9744$$

$t = \frac{b}{Sb}$ $\quad Sb = \sqrt{\frac{\Sigma (y_i - \hat{y})^2}{(n-k-1)\Sigma (x_i - \bar{x})^2}}$

$n = 10$, $k = 1$

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(3)

x_i	y_i	x_i^2	$x_i y_i$	$\hat{y}$	$(x_i - \bar{x})^2$	$(y_i - \hat{y})^2$
13	6.2	169	80.6	7	0	0.64
6	8.6	36	51.6	4.9	49	13.69
14	7.2	196	100.8	7.3	1	0.01
11	4.5	121	49.5	6.4	4	3.61
17	9.0	289	153	8.2	16	0.64
9	3.5	81	31.5	5.8	16	5.29
13	6.5	169	84.5	7	0	0.25
17	9.3	289	158.1	8.2	16	1.21
18	9.5	324	171	8.5	25	1
12	5.7	144	68.4	6.7	1	1
130	70	1818	949		128	27.34

$\bar{x} = \frac{130}{10} = 13$ ⓐ $\begin{cases} 70 = 10a + 130b \\ 7 = a + 13b \\ a = 7 - 13b \end{cases}$; $949 = 130a + 1818b$

$949 = 910 - 1690b + 1818b$

$39 = 128b$

$b = 0.30$

$a = 7 - 3.9$

$a = 3.1$

$\hat{y} = 3.1 + 0.30x$

$Sb = \sqrt{\frac{27.34}{(10-1-1) \times 128}} = \sqrt{\frac{27.34}{8 \times 128}}$

$= \sqrt{0.0266}$

$= 0.163$

$t = \frac{b}{Sb} = \frac{0.30}{0.16} = 1.875 < 2.360$

∴ Not a relationship.

$n-k-1$
$= 6-1-1 = 4$

$\bar{x} = \frac{126.16}{n=6}$

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(c4)

x	y	x_i^2	$x_i y_i$	$\hat{Y}$	$(Y-\hat{Y})^2$	$(x_i-\bar{x})^2$
117	2.07	13689	242.19			83.9056
128	2.86	16384	358.4			3.3856
127	3.14	16129	398.78			0.7056
119	2.26	14161	268.94			51.2656
131	3.40	17161	445.4			23.2256
135	3.89	18225	525.15			78.1456
757	17.56	95749	2238.86			240.83

(6)

$17.56 = 6a + 757b \quad \times 757$

$2238.86 = 757a + 95749b \quad \times 6$

$13292.92 = ( ) + 573049b$

$13433.16 = ( ) + 574494b$

$140.24 = 1445b$

$b = 0.097$

(6)

$Y = -8.109 + 0.088X$

$t_{table} = 2.132 \quad (Y_i - \bar{Y})^2 = 2.39$

attendance = 120

$Se = \sqrt{\frac{(2.39)^2 - 0.088 \times 0.04 \times 2.39}{6-1-1}}$

$Se^2 = \frac{5.6404 - 0.008428}{4}$

$Se^2 = 1.4079961$

$Se = 1.1865$

3b)

$x_i - \bar{x}$
-9.16
1.84
0.84
-7.16
4.84
8.84
0.04

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$$\Rightarrow \boxed{\hat{y} \pm t_{n-1<-1}\,(se)}$$

$$\hat{y} = -8.109 + 0.088 \times 120$$
$$= 2.451$$

$$2.451 \pm 2.132 \times 1.1865$$

$$\Rightarrow \underline{2.451 \pm 2.529} \qquad (4.98)$$
$$\underline{-0.078}$$

$$se = \sqrt{\frac{\Sigma(y_i-\bar{y})^2 - b\Sigma(x_i-\bar{x})(y_i-\bar{y})}{n-1<-1}}$$

$$2.451 \pm 2.132 \times .361$$

$$\rightarrow \boxed{2.451 \pm 0.769} \leftarrow \qquad (3.22)$$