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Numerical Assignment 03

Q:-1
$n = 10$

(a)
$$y = a_0 + a_1 x$$

$$a_1 = \frac{(n \Sigma x_i y_i - \Sigma x_i \Sigma y_i)}{n \Sigma x_i^2 - (\Sigma x_i)^2}$$

$$a_1 = \frac{(10(911) - (95)(82))}{10(1277) - (95)^2}$$

$$\boxed{a_1 = 0.35246996}$$

(b)
$$a_0 = \bar{y} - a_1 \bar{x}$$

$$= (8.2) - (0.35246996)(9.5)$$

$$\boxed{a_0 = 4.851535381}$$

(c)
$$r = \frac{(n \Sigma x_i y_i - (\Sigma x_i)(\Sigma y_i))}{\left(\sqrt{n \Sigma x_i^2 - (\Sigma x_i)^2}\right)\left(\sqrt{n \Sigma y_i^2 - (\Sigma y_i)^2}\right)}$$

$$r = \frac{((10)(911) - (95)(82))}{\left(\sqrt{10(1277) - (95)^2}\right)\left(\sqrt{10(728) - (82)^2}\right)}$$

$$\boxed{r = 0.9147672849}$$

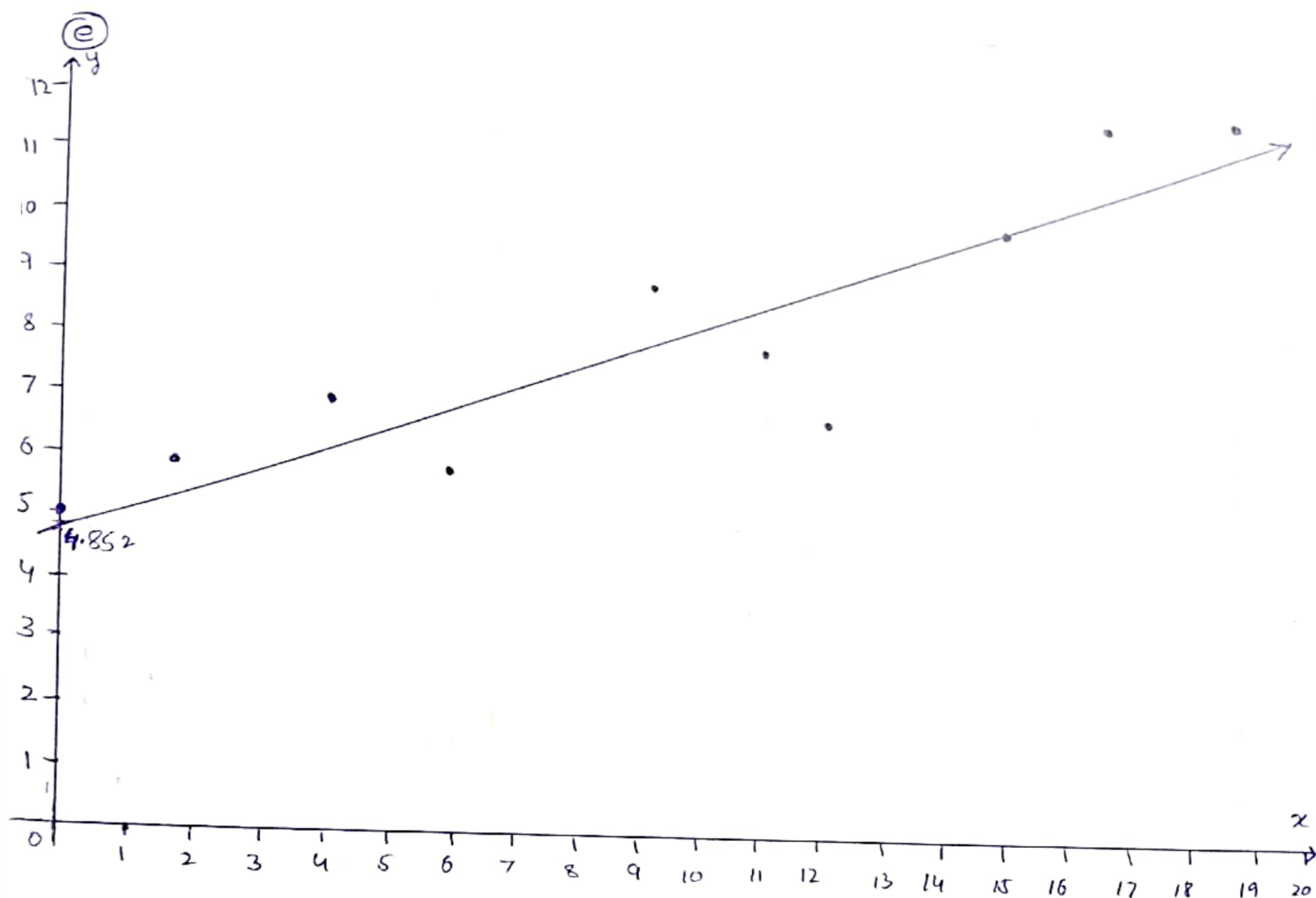| X	Y	x^2	y^2	X·Y	e	e'
0	5	0	25	0	+0.148	-1.90288
2	6	4	36	12	+0.4435	-2.27698
4	7	16	49	28	+0.7335	-2.65108
6	6	36	36	36	-0.966	1.72302
9	9	81	81	81	+0.976	-2.39928
11	8	121	64	88	-0.7287	1.97482
12	7	144	49	84	2.08	5.34892
15	10	225	100	150	-0.1385	1.22662
17	12	289	144	204	+1.156	-1.52158
19	12	361	144	228	+0.4515	0.47842
$\Sigma =$	$\Sigma =$	$\Sigma =$	$\Sigma =$	$\Sigma =$		
95	82	1277	728	911		

$\bar{X} = 9.5$ $\bar{Y} = 8.2$

(d)
$$y = 4.851535381 + 0.35246996x \quad \left(\text{by substituting } a_0 \text{ and } a_1 \text{ in the line equation}\right)$$

$$y = a_0 + a_1 x + e$$

$$\text{error} = e = -(4.851535381 + 0.35246996x) + y$$

Now by substituting x, y are we can find (e), e is being shown/written down in the above tab.

The graph shows a scatter plot with y-axis labeled from 0 to 12 and x-axis from 0 to 20, with a line starting at approximately $y = 4.852$ and increasing to the upper right. The plot is marked with an encircled (e) at the top left.

(f) By switching the values of x and y, a_0 and a_1 comes out

$$a_1 = \frac{(n \sum y_i x_i - \sum y_i \sum x_i)}{n \sum y_i^2 - (\sum y_i)^2} = 2.3741$$

$$a_0 = \bar{x} - a_1 \bar{y} = -9.96762$$
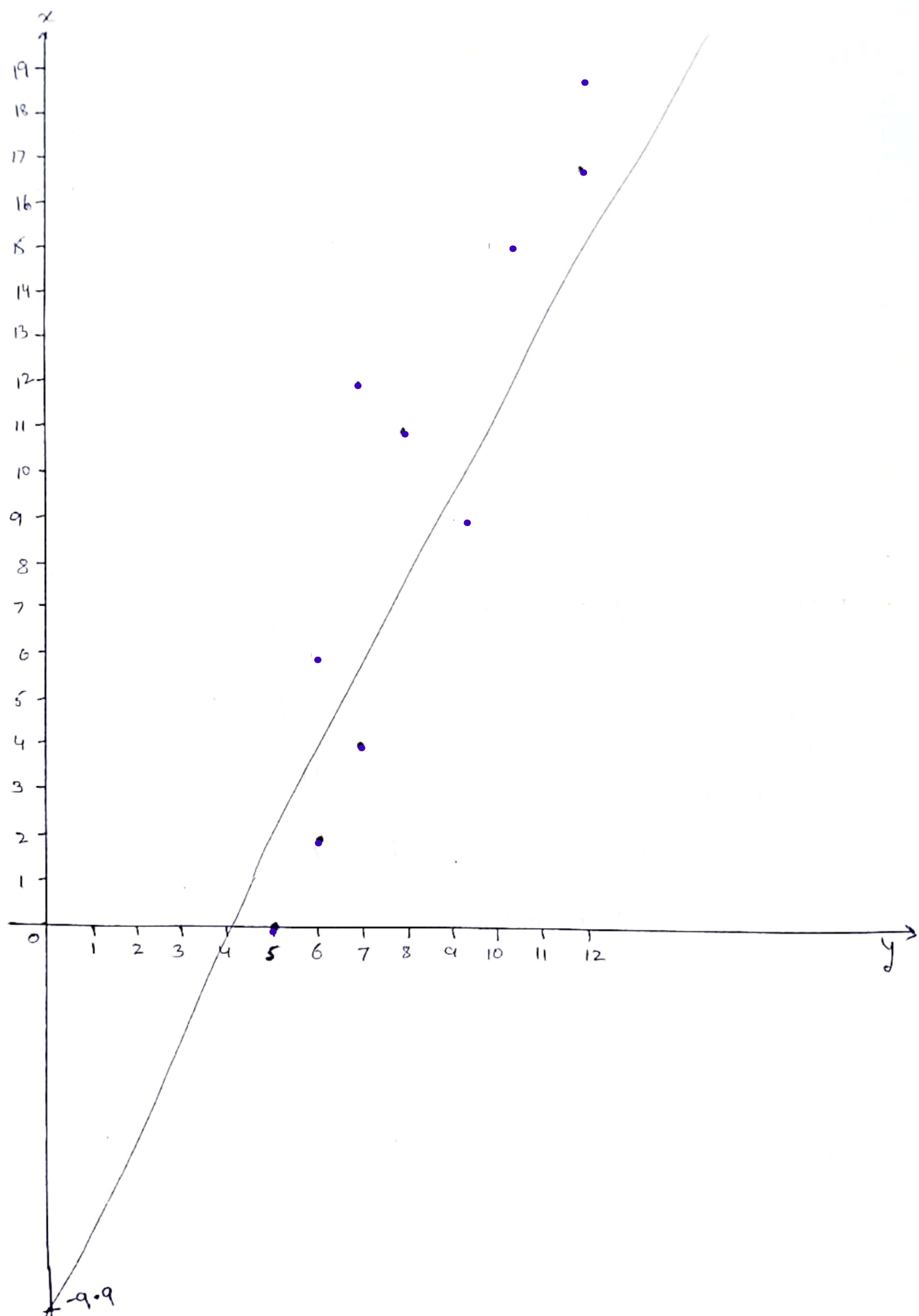
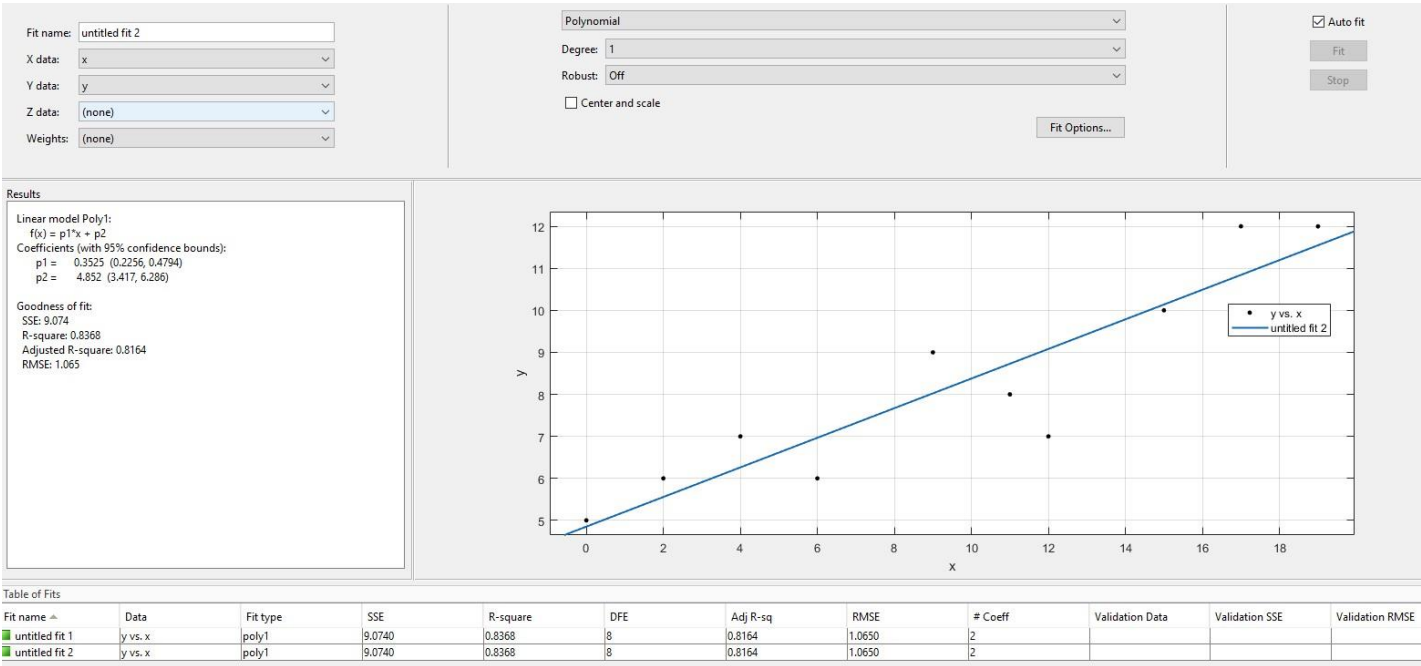$$x = a_0 + a_1 y + e' \quad , \quad e' = -(a_0 + a_1 y) + x$$

e' is also listed in the previous tab.
value of (r) will be same

(g) regression with y versus x is must more better
as the relative error $e's$ less wrt x versus y.

(h) faulty measurement, as by substituting $x = 5$ or $y = 15$
in the equations (part e and part f) the error comes
out to be very large.

Question# 2 Part (a)

Fit name: untitled fit 2
X data: x
Y data: y
Z data: (none)
Weights: (none)

Polynomial
Degree: 1
Robust: Off
☐ Center and scale

☑ Auto fit
Fit
Stop

Fit Options...

Results

Linear model Poly1:
    f(x) = p1*x + p2
Coefficients (with 95% confidence bounds):
    p1 =   0.3525 (0.2256, 0.4794)
    p2 =   4.852 (3.417, 6.286)

Goodness of fit:
    SSE: 9.074
    R-square: 0.8368
    Adjusted R-square: 0.8164
    RMSE: 1.065

Table of Fits

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE	# Coeff	Validation Data	Validation SSE	Validation RMSE
untitled fit 1	y vs. x	poly1	9.0740	0.8368	8	0.8164	1.0650	2			
untitled fit 2	y vs. x	poly1	9.0740	0.8368	8	0.8164	1.0650	2			

Question# 2 Part (b)

Fit name: untitled fit 2
X data: x
Y data: y
Z data: (none)
Weights: (none)

Polynomial
Degree: 3
Robust: Off
☐ Center and scale

☑ Auto fit
Fit
Stop

Fit Options...

Results

Linear model Poly3:
    f(x) = p1*x^3 + p2*x^2 + p3*x + p4
Coefficients (with 95% confidence bounds):
    p1 =   0.001508 (-0.00356, 0.006577)
    p2 =   -0.03047 (-0.1781, 0.1171)
    p3 =   0.4245 (-0.743, 1.592)
    p4 =   5.158 (2.814, 7.503)

Goodness of fit:
    SSE: 6.735
    R-square: 0.8789
    Adjusted R-square: 0.8183
    RMSE: 1.059

Table of Fits

Fit name	Data	Fit type	SSE	R-square	DFE	Adj R-sq	RMSE	# Coeff	Validation Data	Validation SSE	Validation RMSE
untitled fit 1	y vs. x	poly1	9.0740	0.8368	8	0.8164	1.0650	2			
untitled fit 2	y vs. x	poly3	6.7349	0.8789	6	0.8183	1.0595	4			