

```

data one;                                orthopoly.sas  Section 3.3 of Kuehl
  input density yield;
  linear=density;
  quadratic=density**2;
  cubic=density**3;
  quartic=density**4;
  lack_of_fit=density;
  cards;
10 12.2
10 11.4
10 12.4
20 16.0
20 15.5
20 16.5
30 18.6
30 20.2
30 18.2
40 17.6
40 19.3
40 17.1
50 18.0
50 16.4
50 16.6
;
proc glm;
  class density;
  model yield=density;
run;

proc glm;
  class lack_of_fit;
  model yield=linear lack_of_fit;
run;

proc glm;
  class lack_of_fit;
  model yield=linear quadratic lack_of_fit;
run;

proc glm;
  class lack_of_fit;
  model yield=linear quadratic cubic lack_of_fit;
run;

proc glm;
  class lack_of_fit;
  model yield=linear quadratic cubic quartic lack_of_fit;
run;

proc glm;
  model yield=density density*density / solution clparm;
  estimate 'Mean Yield at Density 25' intercept 1 density 25 density*density 625;
run;
proc glm;
  model yield=density density*density;
  output out=two
    predicted=yhat
    stdp=stderrm
    lclm=l95mean
    uclm=u95mean
  / alpha=0.05;
run;

```

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	87.60000000	21.90000000	29.28	<.0001
Error	10	7.48000000	0.74800000		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.921329 5.273597 0.864870 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
density	4	87.60000000	21.90000000	29.28	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
density	4	87.60000000	21.90000000	29.28	<.0001

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	87.60000000	21.90000000	29.28	<.0001
Error	10	7.48000000	0.74800000		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.921329 5.273597 0.864870 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
linear	1	43.20000000	43.20000000	57.75	<.0001
lack_of_fit	3	44.40000000	14.80000000	19.79	0.0002

Source	DF	Type III SS	Mean Square	F Value	Pr > F
linear	0	0.00000000	.	.	.
lack_of_fit	3	44.40000000	14.80000000	19.79	0.0002

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	87.60000000	21.90000000	29.28	<.0001
Error	10	7.48000000	0.74800000		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.921329 5.273597 0.864870 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
linear	1	43.20000000	43.20000000	57.75	<.0001
quadratic	1	42.00000000	42.00000000	56.15	<.0001
lack_of_fit	2	2.40000000	1.20000000	1.60	0.2487

Source	DF	Type III SS	Mean Square	F Value	Pr > F
linear	0	0.00000000	.	.	.
quadratic	0	0.00000000	.	.	.
lack_of_fit	2	2.40000000	1.20000000	1.60	0.2487

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	87.60000000	21.90000000	29.28	<.0001
Error	10	7.48000000	0.74800000		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.921329 5.273597 0.864870 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
linear	1	43.20000000	43.20000000	57.75	<.0001
quadratic	1	42.00000000	42.00000000	56.15	<.0001
cubic	1	0.30000000	0.30000000	0.40	0.5407
lack_of_fit	1	2.10000000	2.10000000	2.81	0.1248

Source	DF	Type III SS	Mean Square	F Value	Pr > F
linear	0	0.00000000	.	.	.
quadratic	0	0.00000000	.	.	.
cubic	0	0.00000000	.	.	.
lack_of_fit	1	2.10000000	2.10000000	2.81	0.1248

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	87.60000000	21.90000000	29.28	<.0001
Error	10	7.48000000	0.74800000		
Corrected Total	14	95.08000000			

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0.921329 5.273597 0.864870 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
linear	1	43.20000000	43.20000000	57.75	<.0001
quadratic	1	42.00000000	42.00000000	56.15	<.0001
cubic	1	0.30000000	0.30000000	0.40	0.5407
quartic	1	2.10000000	2.10000000	2.81	0.1248
lack_of_fit	0	0.00000000	.	.	.

Source	DF	Type III SS	Mean Square	F Value	Pr > F
linear	0	0	.	.	.
quadratic	0	0	.	.	.
cubic	0	0	.	.	.
quartic	0	0	.	.	.
lack_of_fit	0	0	.	.	.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	85.20000000	42.60000000	51.74	<.0001
Error	12	9.88000000	0.82333333		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.896088 5.532788 0.907377 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
density	1	43.20000000	43.20000000	52.47	<.0001
density*density	1	42.00000000	42.00000000	51.01	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
density	1	58.21604278	58.21604278	70.71	<.0001
density*density	1	42.00000000	42.00000000	51.01	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	5.800000000	1.12358553	5.16	0.0002
density	0.720000000	0.08562469	8.41	<.0001
density*density	-0.010000000	0.00140011	-7.14	<.0001

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	85.20000000	42.60000000	51.74	<.0001
Error	12	9.88000000	0.82333333		
Corrected Total	14	95.08000000			

R-Square Coeff Var Root MSE yield Mean
0.896088 5.532788 0.907377 16.40000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
density	1	43.20000000	43.20000000	52.47	<.0001
density*density	1	42.00000000	42.00000000	51.01	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
density	1	58.21604278	58.21604278	70.71	<.0001
density*density	1	42.00000000	42.00000000	51.01	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > t
Mean Yield at Density 25	17.5500000	0.34897668	50.29	<.0001

Parameter 95% Confidence Limits
Mean Yield at Density 25 16.7896451 18.3103549

Parameter	Estimate	Standard Error	t Value	Pr > t	95% Confidence Limits
Intercept	5.800000000	1.12358553	5.16	0.0002	3.351917431 8.248082569
density	0.720000000	0.08562469	8.41	<.0001	0.533439830 0.906560170
density*density	-0.010000000	0.00140011	-7.14	<.0001	-0.013050585 -0.006949415

Obs	density	yield	yhat	stderrm	l95mean	u95mean
1	10	12	12.0	0.49303	10.9258	13.0742
2	20	16	16.2	0.31927	15.5044	16.8956
3	30	19	18.4	0.36510	17.6045	19.1955
4	40	18	18.6	0.31927	17.9044	19.2956
5	50	17	16.8	0.49303	15.7258	17.8742