

# Multiple Regression in Excel Engineering Calculations



# Question

A batch reactor was used to study the reaction of ozones in the presence of alkenes. The data below are for one of the alkenes studied, cis-2-butene

The following experimental initial reaction rate data were obtained for the reaction rate:

$(r) \times 10^7, \text{mol/l} - \text{s}$	$[O_3], \text{mol/l}$	$[\text{butane}], \text{mol/l}$
1.5	.01	$10^{-12}$
3.2	.02	$10^{-11}$
3.5	.015	$10^{-10}$
5.0	.005	$10^{-9}$
8.8	.001	$10^{-8}$
4.7	.018	$10^{-9}$



# Solution

<u><math>(r) \times 10^7, \text{mol/l} - \text{s}</math></u>	$[O_3], \text{mol/l}$	$[\text{butane}], \text{mol/l}$
1.5 $\rightarrow 1.5 \times 10^{-7}$	.01	$10^{-12}$
3.2	.02	$10^{-11}$
3.5	.015	$10^{-10}$
5.0	.005	$10^{-9}$
8.8	.001	$10^{-8}$
4.7	.018	$10^{-9}$

Investigate the quality of fit of the data to a reaction rate expression of the form:

$$r = k[O_3]^a[\text{butane}]^b$$




자연로그

$$\ln r = \ln k + a \ln [O_3] + b \ln [\text{butane}]$$





# Solution

fx							
C	D	E	F	G	H	I	
	$r \times 10^7$	$r$	[O3]	[butane]			
	1.5	0.00000015	0.01	1.00E-12			
	3.2	0.00000032	0.02	1.00E-11			
	3.5	0.00000035	0.015	1.00E-10			
	5	0.0000005	0.005	1.00E-09			
	8.8	0.00000088	0.001	1.00E-08			
	4.7	0.00000047	0.018	1.00E-09			
							
	$\ln r = \ln k + a \cdot \ln [\text{O}_3] + b \cdot \ln [\text{butane}]$						





# Solution

중입 순서1 - MICROSOFT EXCEL

1 데이터

2 데이터 분석

D	E	F	G	H	I	J	K	L	M	N	O	P
r X 10 <sup>7</sup>	r	[O3]	[butane]	lnr	ln[O3]	ln[butane]						
1.5	0.00000015	0.01	1.00E-12	-15.7126	-4.60517	-27.631						
3.2	0.00000032	0.02	1.00E-11	-14.9549	-3.91202	-25.3284						
3.5	0.00000035	0.015	1.00E-10	-14.8653	-4.19971	-23.0259						
5	0.0000005	0.005	1.00E-09	-14.5087	-5.29832	-20.7233						
8.8							.4207					
4.7							.7233					

3

통계 데이터 분석

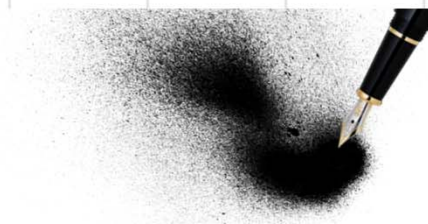
4

확인

최소

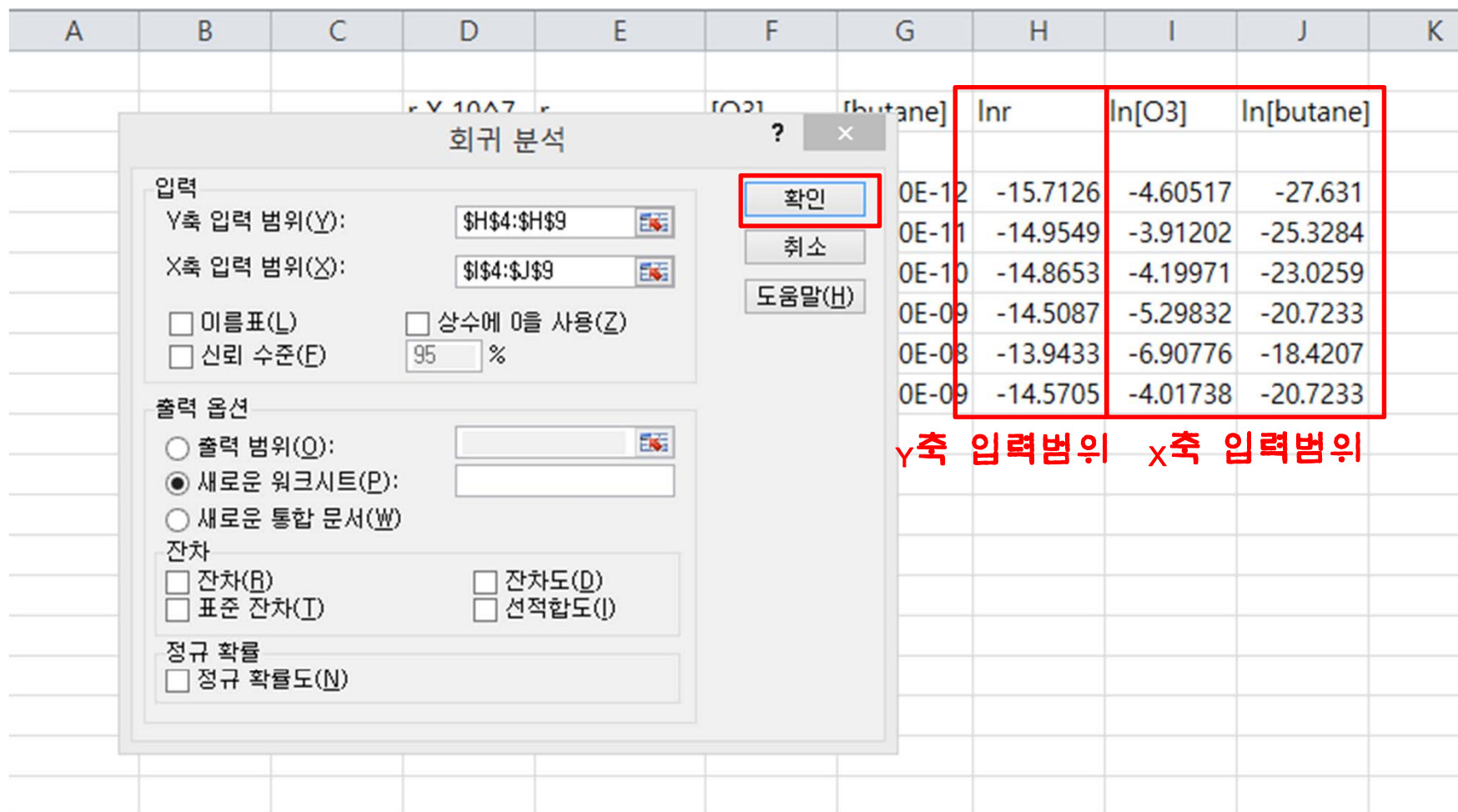
도움말(H)

lnr=lnk+a\*lnr





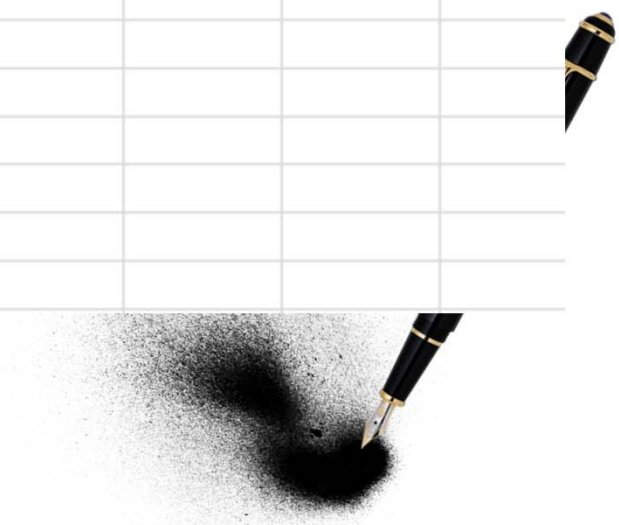
# Solution



The image shows an Excel spreadsheet with a regression analysis dialog box open. The dialog box is titled "회귀 분석" (Regression Analysis). The input ranges are set to Y-axis: \$H\$4:\$H\$9 and X-axis: \$\$4:\$J\$9. The confidence level is 95%. The output options are set to "새로운 워크시트(P)" (New Worksheet). The data table below shows the regression results for ln[r], ln[O3], and ln[butane].

	lnr	ln[O3]	ln[butane]
0E-12	-15.7126	-4.60517	-27.631
0E-11	-14.9549	-3.91202	-25.3284
0E-10	-14.8653	-4.19971	-23.0259
0E-09	-14.5087	-5.29832	-20.7233
0E-08	-13.9433	-6.90776	-18.4207
0E-09	-14.5705	-4.01738	-20.7233

**Y축 입력범위**    **X축 입력범위**





# Solution

A1		f <sub>x</sub> 요약 출력									
	A	B	C	D	E	F	G	H	I	J	
1	요약 출력										
2											
3	회귀분석 통계량										
4	다중 상관	0.967251									
5	결정계수	0.935574									
6	조정된 결	0.892624									
7	표준 오차	0.192336									
8	관측수	6									
9											
10	분산 분석										
11		자유도	제공할	제공 평균	F 비	유의한 F					
12	회귀	2	1.611618	0.805809	21.78258	0.016353					
13	잔차	3	0.11098	0.036993							
14	계	5	1.722598								
15											
16		계수	표준 오차	t 통계량	P-값	하위 95%	상위 95%	하위 95.0%	상위 95.0%		
17	Y 절편	-11.2622	1.084111	-10.3884	0.001903	-14.7123	-7.81207	-14.7123	-7.81207		
18	X 1	-0.03056	0.096109	-0.318	0.771334	-0.33642	0.275299	-0.33642	0.275299		
19	X 2	0.16096	0.032299	4.983426	0.015533	0.05817	0.263749	0.05817	0.263749		
20											
21											
22											



# Solution

$$\ln r = \ln k + a \ln [O_3] + b \ln [\text{butane}]$$

$$\ln k = -11.26$$

$$a = -0.0031$$

$$b = 0.161$$

$$k = e^{-11.26} \rightarrow k = 1.3 \times 10^{-5}$$



식에 대입

$$r = 1.3 \times 10^{-5} [O_3]^{-0.031} [\text{butane}]^{0.161}$$



# Summary

- ❖ :
- ❖ : 가
- ❖ : 가 가 .



Thank You

