Y = viscosity

A = Concentration − +
B = feedrate − +

$2^2 = 4$ **Yates** - full factorial 2^{n-1} low, 2^{n-1} high

	A	B	y
1	−	−	145
2	+	−	154
3	−	+	132
4	+	+	149
5	−	−	147
6	+	−	150
7	−	+	137
8	+	+	152

special notation

	A	B	AB			Total
(1)	−	−	+	145	147	292
a	+	−	−	154	150	304
b	−	+	−	132	137	269
ab	+	+	+	149	152	301

Grand mean = 145.75

Contrast

$$A = a + ab - (1) - b$$
$$= 304 + 301 - 292 - 269$$
$$= 44$$

$$B = 269 + 301 - 292 - 304$$
$$= -26$$

$$AB = (1) + ab - a - b$$
$$= 292 + 301 - 304 - 269$$
$$= 20$$

$K = 2$
$n = 2$

$$\text{Effect} = \frac{\text{Contrast}}{n\,2^{K-1}}$$

$K = \#$ of factors
$n = \#$ of reps

$$\text{Effect } A = \frac{44}{(2)\,2^{2-1}} = \frac{44}{4} = 11$$

$$\text{Effect } B = \frac{-26}{4} = -6.5$$

$$\text{Effect } AB = \frac{20}{4} = 5$$

Term	Effect	Coefficient
Constant	[illegible]	145.75
A	11	5.5
B	-6.5	-3.25
AB	5	2.5

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + \hat{\beta}_3 x_1 x_2$$

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}(A) + \hat{\beta}_2(B) + \hat{\beta}_3 (A)(B)$$

$$\boxed{\hat{y} = 145.75 + 5.5(A) - 3.25(B) + 2.5(A)(B)}$$

Predict viscosity will be at low level concent. (A) and high level (B) feed rate

(A) -1

(B) +1

$$\hat{y} = 145.75 + 5.5(-1) - 3.25(1) + 2.5(-1)(1)$$

$$SS = \frac{(\text{contrast})^2}{n2^k}$$

$$SS_A = \frac{(44)^2}{2(2^2)} = 242$$

$$SS_B = \frac{(-26)^2}{2(2^2)} = 84.5$$

$$SS_{AB} = \frac{(20)^2}{2(2^2)} = 50$$

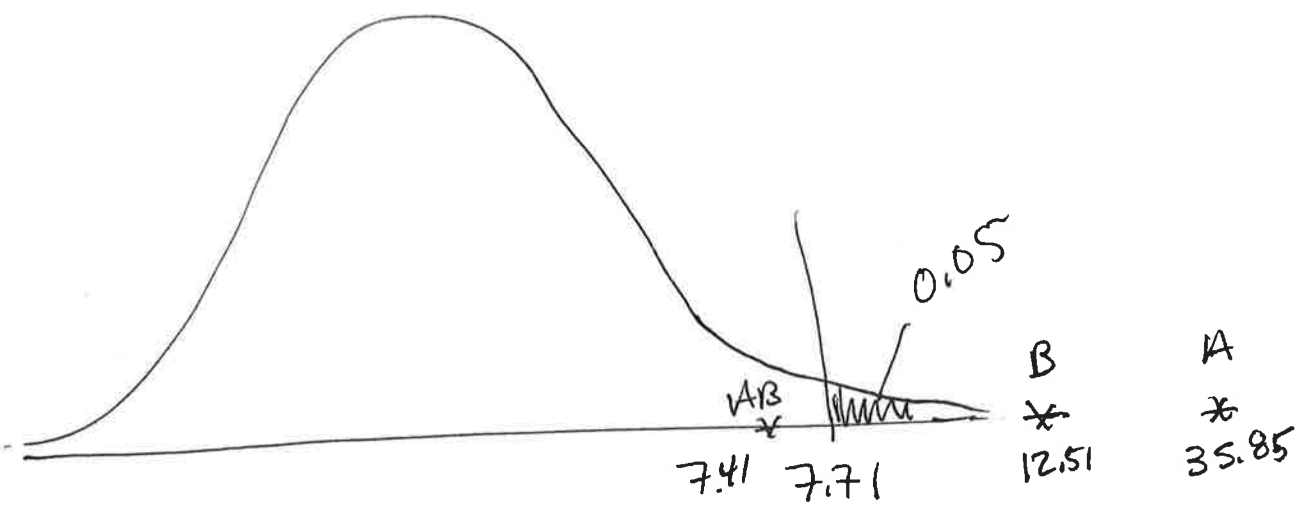
ANOVA

Source of Variation	SS	DF	Mean Square	F
A	242	1	242	35.85
B	84.5	1	84.5	12.51
AB	50	1	50	7.41
Error	27	4	6.75	
Total	$\boxed{403.5}$	7		

$$SS_T = \left[145^2 + 154^2 + 132^2 + 149^2 + 147^2 + 150^2 + 137^2 + 152^2\right] - \frac{\left[292 + 304 + 269 + 301\right]^2}{8}$$

~~2=3104~~

~~403.5~~



Ho: $\hat{\beta}_A = 0$ Reject

Ho: $\hat{\beta}_B = 0$ Reject

Ho: $\hat{\beta}_{AB} = 0$ Do not reject.

Factor A & B are significant

Interaction AB is not