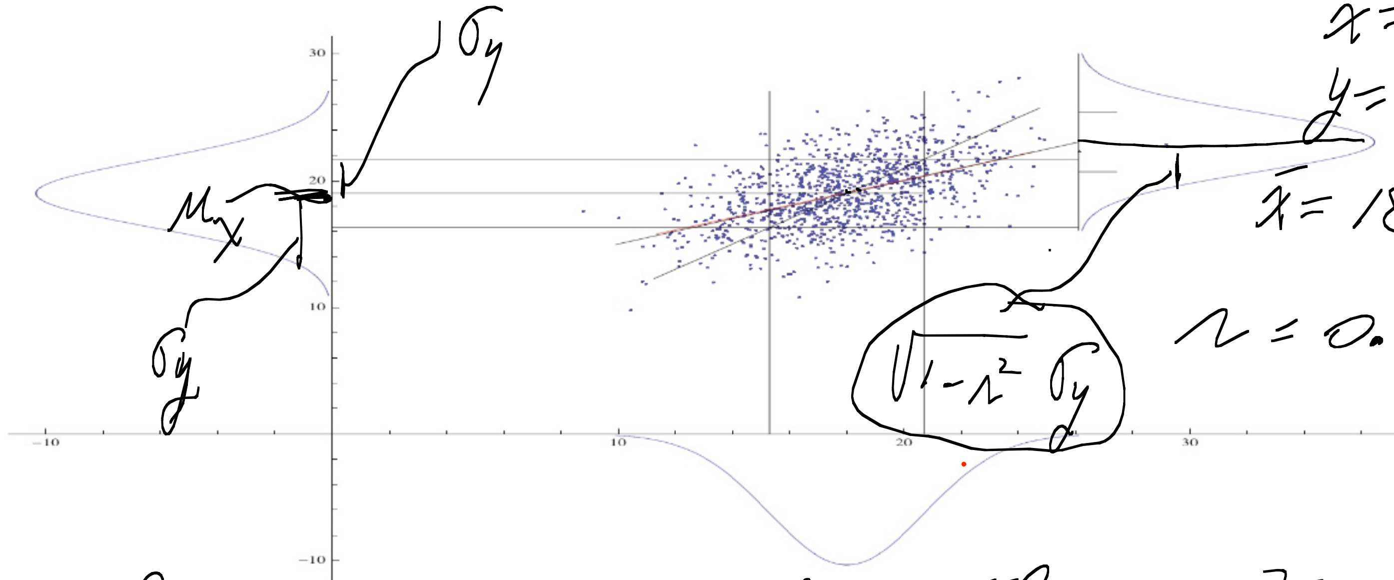
GALTON $n = 1078$

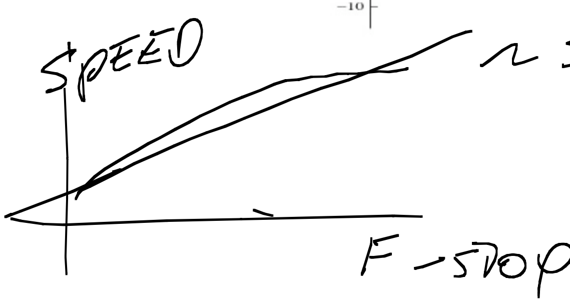
$x = F\ HT - 50$

$y = SON\ HT - 50$

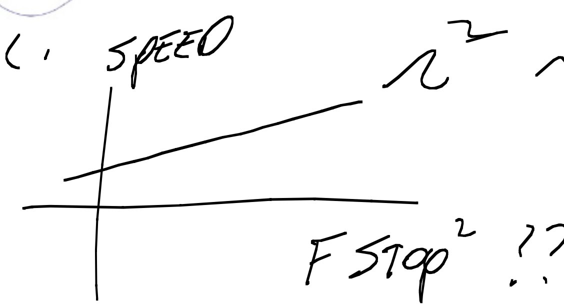
$\bar{x} = 18 \quad \bar{y} = 19$

$r = 0.78$



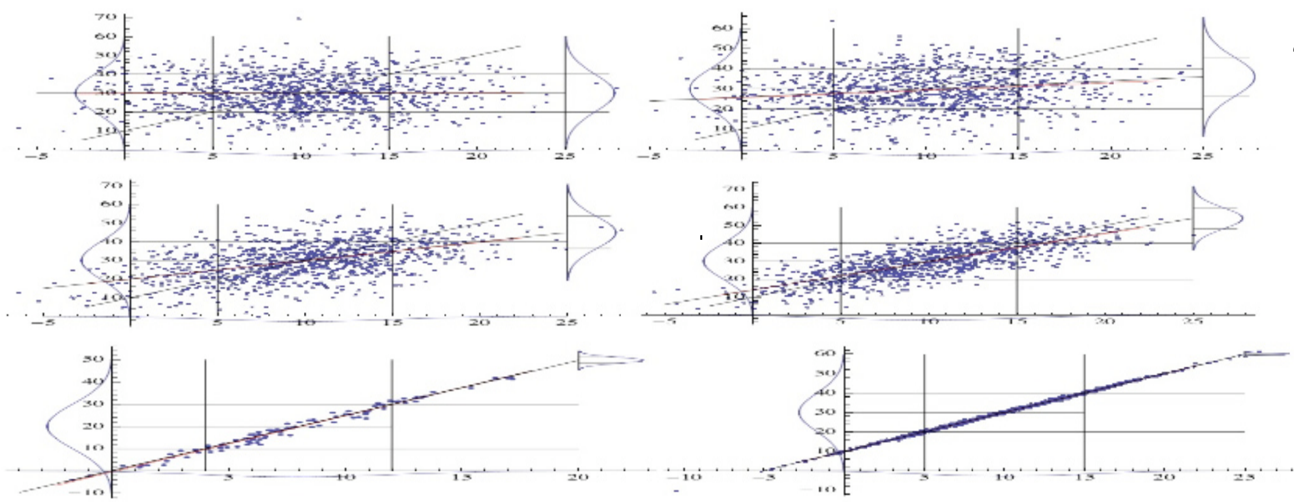


r SUBSTANTIAL.



$r^2 \sim .64$

r = 0



r = .2

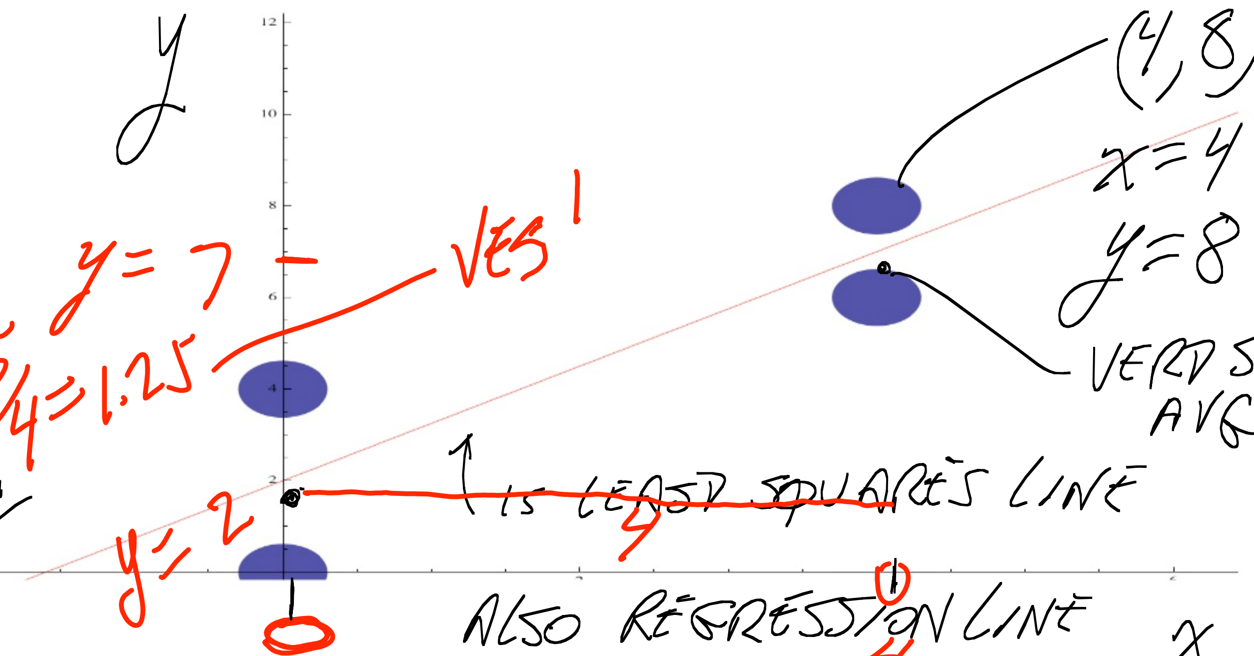
r = .5

r = .8

r = .99

r = .999

x	y
0	0
0	4
4	6
4	8

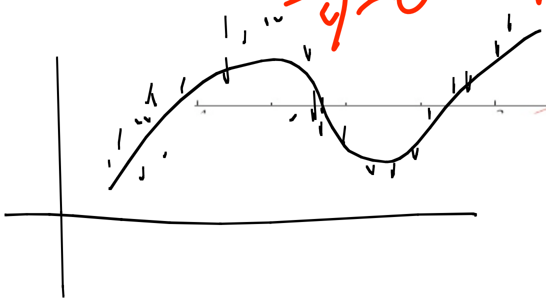


SLOPE INDEED $\frac{7-2}{4-0}=5/4=1.25$ YES!

↑ IS LEAST SQUARES LINE

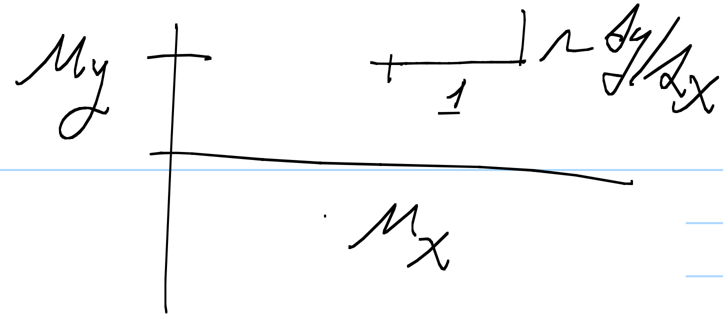
ALSO REGRESSION LINE

"FOR NORMAL PLOTS" REGR LINE EXISTS AND IS SAME AS LEAST SQUARES LINE



FORMULA: FOR LEAST SQUARES LINE

SLOPE $= r\,\sigma_y/\sigma_x = r\, s_y/s_x$

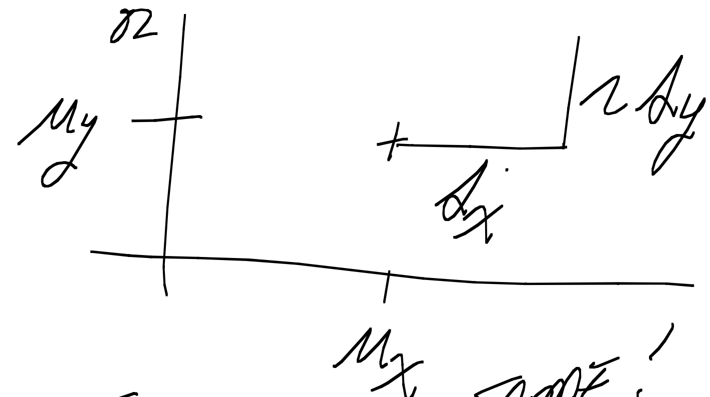


In[60]:= **regrtable[{0, 0, 4, 4}, {0, 4, 6, 8}]**

Out[60]//MatrixForm=

x	y	x^2	y^2	xy
0	0	0	0	0
0	4	0	16	0
4	6	16	36	24
4	8	16	64	32
—	—	—	—	—
2.	4.5	8.	29.	14.

AVGS



$\mu_x = 2$

$\mu_y = 4.5$

$\overline{x^2} = 8$

$\overline{y^2} = 29$

$\overline{xy} = 14$

n DIVISOR

$\sigma_x = (\text{pop}^N \text{SD})\ \sqrt{\overline{x^2} - \bar{x}^2} = \sqrt{8 - 2^2} = 2$ SAME!

$\sigma_y = {}'' \sqrt{\overline{y^2} - \bar{y}^2} = \sqrt{29 - 4.5^2} = \sqrt{8.75}$

$$r = \frac{\overline{xy} - \bar{x}\bar{y}}{\sigma_x \sigma_y} = \frac{14 - 2(4.5)}{2\sqrt{8.25}} = .845$$

$$\text{slope} = r\,\frac{\sigma_y}{\sigma_x} = \frac{\overline{xy} - \bar{x}\bar{y}}{\sigma_x \cancel{\sigma_y}} \frac{\cancel{\sigma_y}}{\sigma_x} = \frac{\overline{xy} - \bar{x}\bar{y}}{\sigma_x^2} \quad \begin{matrix} 5 \\ 4 \end{matrix}$$

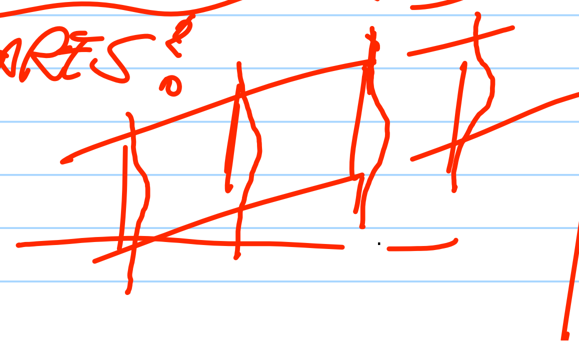
$$= 1.25 \ \text{slope}$$

SO YES, 1.25 IS SLOPE OF REGRESSION LINE!!

WHAT ABOUT LEAST SQUARES?

NORMAL PLOT:

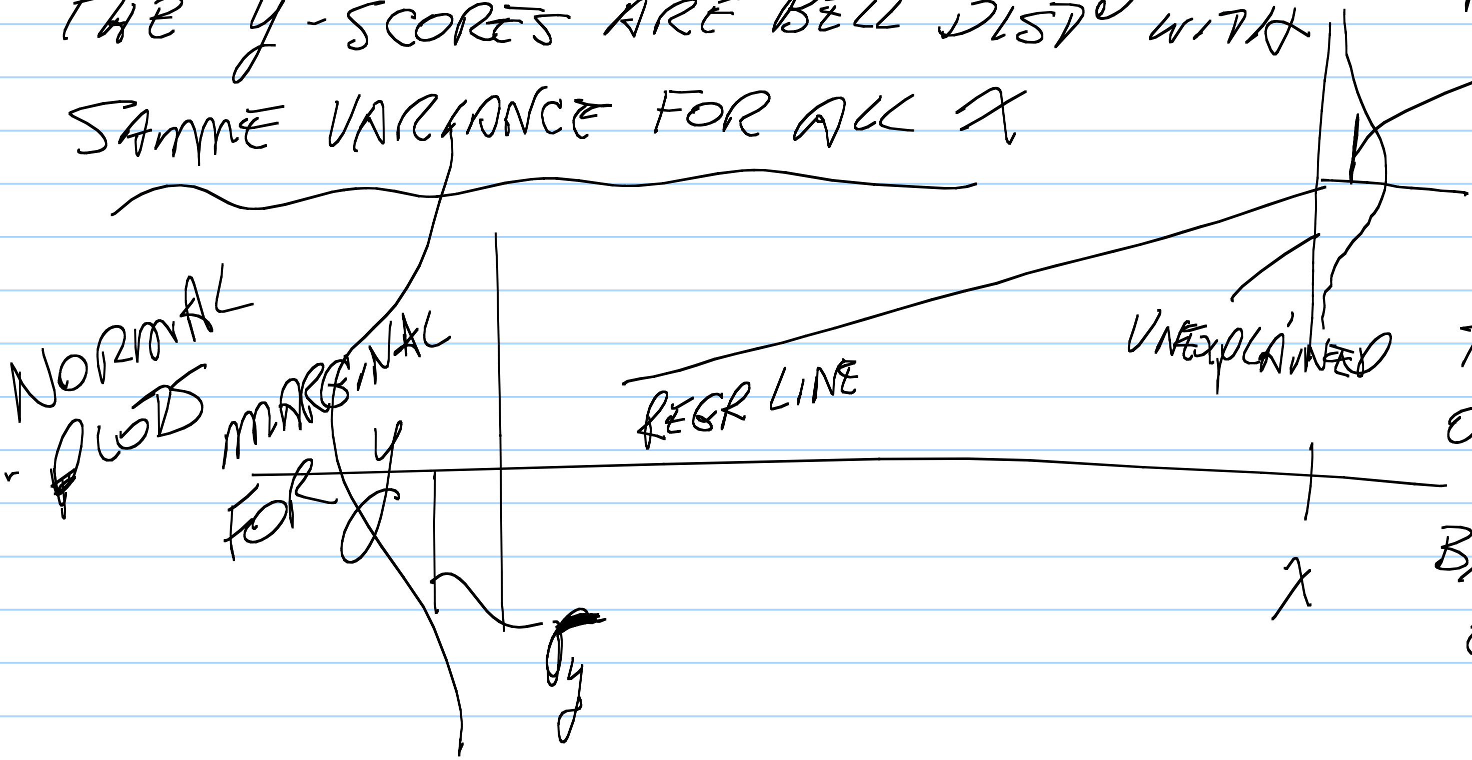
GALTON
SEEDS



FATH + SON

GALTON ALSO FOUND WITHIN EACH x-STRIP (FIXING x)
THE y-SCORES ARE BELL DIST^{D} WITH
SAME VARIANCE FOR ALL x

$\sigma_y \sqrt{1-r^2}$



CALL r^2
THE FRACTION
OF σ_y^2 EXPLAINED
BY REGRESSION
ON x

SO IF $r = .7$ $\quad r^2 = .49$ REGR ON x EXPLAINS $\approx 49\%$
OF σ_y^2.