PROBLEM # 1

Use Excel to calculate and graph the Leverett J-Function, $J(S_w)$ for the following laboratory data. Remember that $J(S_w)$ is dimensionless and to work in consistent units.

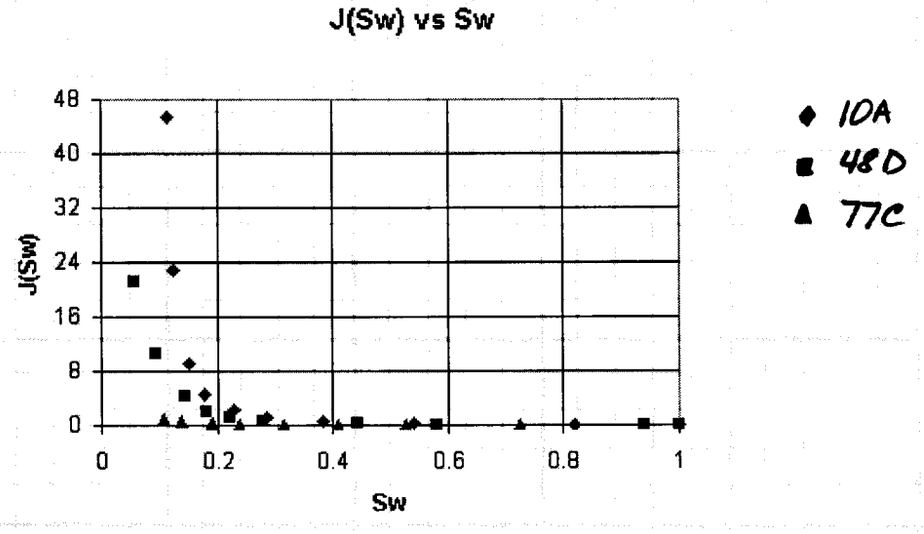
Sample	10A	48D	77C	Other Lab Data
Depth	9304.1 ft	9342.6 ft	9374.8 ft	Fluid System: Air-Water
k(md)	45	6.3	11	$\theta = 0$ degrees
ϕ	0.197	0.129	0.133	$\sigma = 72$ dynes/cm

THEORY

$$J(S_w) = \frac{p_c}{\sigma \cos\theta}\sqrt{\frac{k}{\phi}}$$

SOLUTION

p_c (psi)	S_w	S_w	S_w	$J(S_w)$	$J(S_w)$	$J(S_w)$
0	1	1	1	0	0	0
1	1	1	1	0.045467	0.021023	0.000865
2	0.82	0.941	1	0.090935	0.042047	0.00173
5	0.541	0.581	0.726	0.227337	0.105117	0.004326
10	0.381	0.443	0.527	0.454674	0.210234	0.008652
25	0.285	0.279	0.41	1.136684	0.525584	0.021629
50	0.228	0.221	0.314	2.273368	1.051168	0.043258
100	0.179	0.181	0.238	4.546737	2.102336	0.086516
200	0.152	0.144	0.191	9.093474	4.204672	0.173032
500	0.125	0.094	0.138	22.73368	10.51168	0.432581
1000	0.115	0.057	0.109	45.46737	21.02336	0.865162

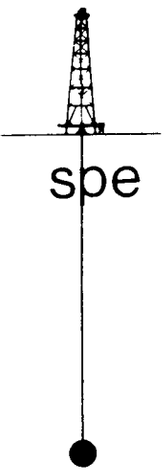


CONCLUSION

$0.05 < S_{wi} < 0.1$

PROBLEM # 2

Use Excel to calculate and graph Log p_c vs Log S_w^* for Samples 10A & 48D above. Determine S_{wi} and λ and the power equation best fitting the data.



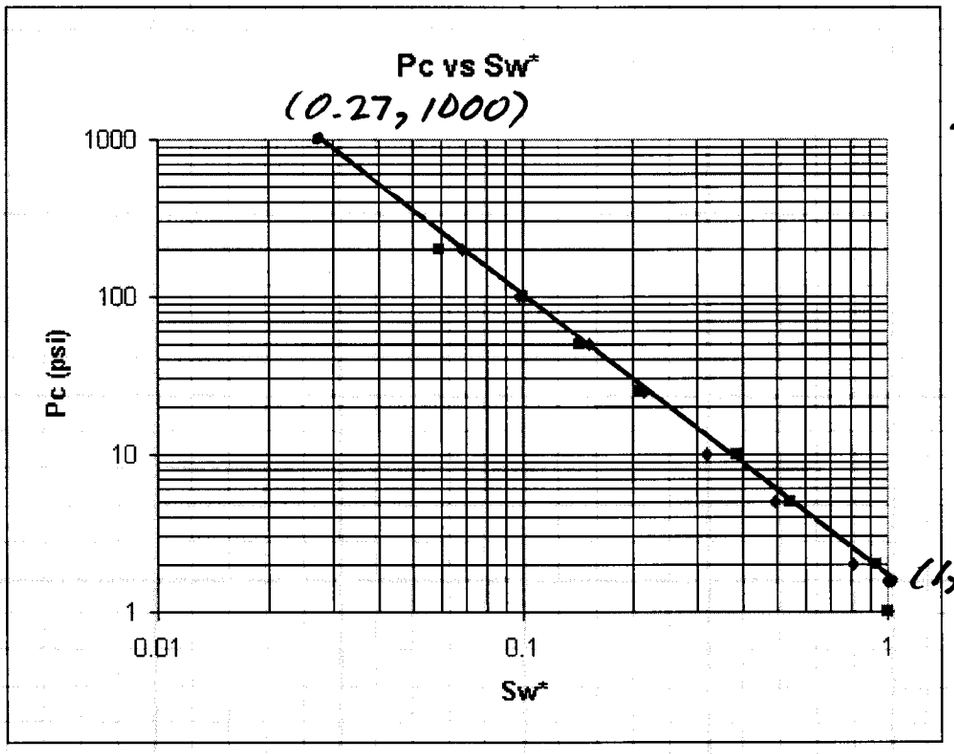
THEORY

$$p_c = p_d (S_w^*)^{-1/\lambda},\ S_w^* = \frac{S_w - S_{wi}}{1 - S_{wi}},\ p_{cD} = \frac{p_c}{p_d},\ S_{wD} = 1 - S_w^*$$

SOLUTION

S_{wi} = 0.09 -

10A Sw*	48D Sw*	pc
1	1	1
0.802198	0.935165	2
0.495604	0.53956	5
0.31978	0.387912	10
0.214286	0.207692	25
0.151648	0.143956	50
0.097802	0.1	100
0.068132	0.059341	200



$$m = \frac{\log(y_2/y_1)}{\log(x_2/x_1)}$$

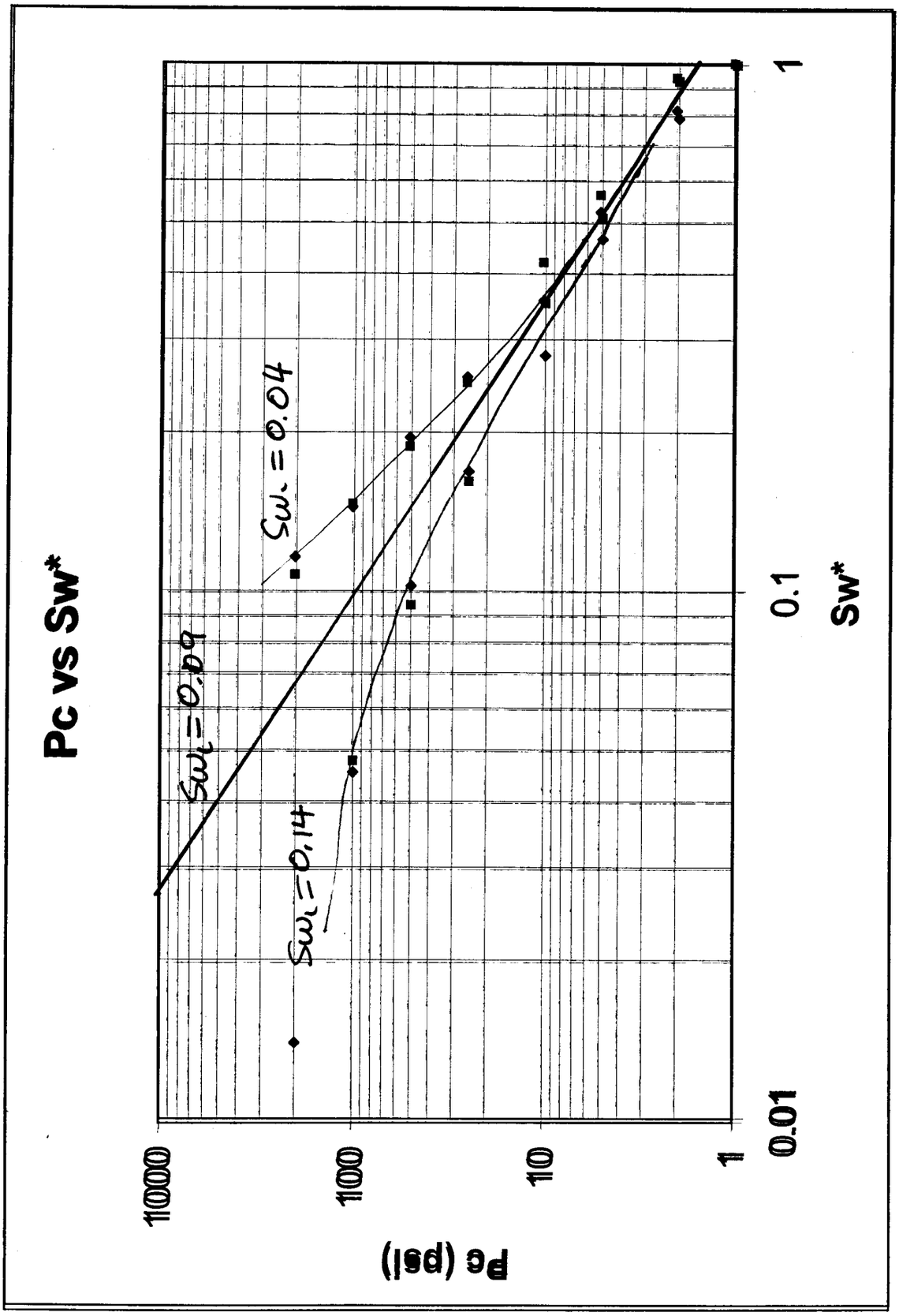
$= -1.776$

$\Rightarrow \lambda = 0.563$

$p_d = 1.64$ psia

CONCLUSION

$p_c = 1.64 S_w^* - 1.776$; $\lambda = 0.563$, $S_{wi} = 0.09$


Pc vs Sw*
Swi = 0.09
Swi = 0.04
Swi = 0.14
Pc (psi)
10000
1000
100
10
1
0.01
0.1
1
Sw*

0.28	0.72	9.486833
0.48	0.52	5.070926
0.63	0.37	4.091966
0.75	0.25	3.618136

BONUS PROBLEM

Dimensionless Capillary Pressure Type Curve