

# Assignment 06

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## Problem 10.8.1

### Inputs

Parameter	Value
Simulation Input	
Problem	1
NONLIN	0 (Linear)
ITERMAX	25
Epsilon	0.001
GAMA1 (Acceleration Parameter)	0.5
GAMA2 (Penalty Term)	$10^8$
Domain Input	
X0	0
Y0	0
X_length	6
Y_length	2
Mesh Input	
NX	10
NY	6
NPE	4
DX	[1 1 1 1 0.5 0.5 0.25 0.25 0.25 0.25]
DY	[0.25 0.25 0.5 0.5 0.25 0.25]
NDF	2
IEL	1
NGPF	2
NGPR	1
Loading Condition	
DP	1
F = [FX FY]	[0 0]
MU	1
Essential Boundary Conditions	
NSPV	39
ISPV	[1 77 76 75 74 73 72 71 70 69 68 67 56 45 34 23 12 1 2 34 5 6 7 8 9 10 11 77 76 75 74 73 72 71 70 69 68 67; 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2]
VSPV	[0 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]

Natural Boundary Condition	
NSSV	31
ISSV	[1 2 3 4 5 6 7 8 9 10 11 22 33 44 55 66 77 1 11 22 33 44 55 66 77 67 56 45 34 23 12; 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2]'
VSSV	<code>zeros(max(size(ISSV)),1)</code>

## Results

x	Gama = 1		Gama = 100		Gama = 10^8	
	10*6 - L4	5*3 - Q9	10*6 - L4	5*3 - Q9	10*6 - L4	5*3 - Q9
1.00	0.0303	0.0310	0.6563	0.6513	0.7576	0.7505
2.00	0.0677	0.0691	1.3165	1.3062	1.5135	1.4992
3.00	0.1213	0.1233	1.9911	1.9769	2.2756	2.2557
4.00	0.2040	0.2061	2.6960	2.6730	3.0541	3.0238
4.50	0.2611	0.2631	3.0718	3.0463	3.4648	3.4307
5.00	0.3297	0.3310	3.4347	3.3956	3.8517	3.8029
5.25	0.3674	0.3684	3.6120	3.5732	4.0441	3.9944
5.50	0.4060	0.4064	3.7388	3.6874	4.1712	4.1085
5.75	0.4438	0.4443	3.8316	3.7924	4.2654	4.2160
6.00	0.4793	0.4797	3.8362	3.7862	4.2549	4.1937

Table 1:  $V_x(x,0)$ 

y	10*6 - L4		5*3 - Q9	
	Vx (x = 4)	Vx (x = 6)	Vx (x = 4)	Vx (x = 6)
0	3.0541	4.2549	3.0238	4.1937
0.25	3.0074	4.2127	2.9796	4.1719
0.5	2.8526	4.0360	2.8250	3.9621
1	2.2655	3.4093	2.2446	3.3808
1.5	1.3051	2.1793	1.2897	2.1208
1.75	0.6979	1.5183	0.6893	1.4559
2	0.0000	0.0000	0.0000	0.0000

Table 2: Horizontal velocity  $V_x(x,y)$  vs vertical distance  $y$

x	10*6 - L4		x	5*3 - Q9	
	Top Plate Pressure	Centerline Pressure		Top Plate Pressure	Centerline Pressure
0.500	8.0304	7.3828	0.423	7.9839	7.3238
1.500	7.7064	6.9978	1.577	7.5964	6.8854
2.500	6.8346	6.2573	2.423	6.8666	6.2635
3.500	5.8653	5.0972	3.577	5.7138	4.9424
4.250	4.4726	4.0086	4.211	4.5390	4.0165
4.750	4.3387	3.0012	4.789	4.2338	2.8925
5.125	2.9554	2.2705	5.106	3.1200	2.2742
5.375	4.5657	1.4866	5.394	4.4606	1.4509
5.625	2.9580	0.8717	5.606	3.0684	0.9609
5.875	7.5452	0.0069	5.894	7.2777	-0.0140

Table 3: Pressure vs Horizontal distance x (Near top plate & centerline)

$V_x(x,y)$  vs  $y$

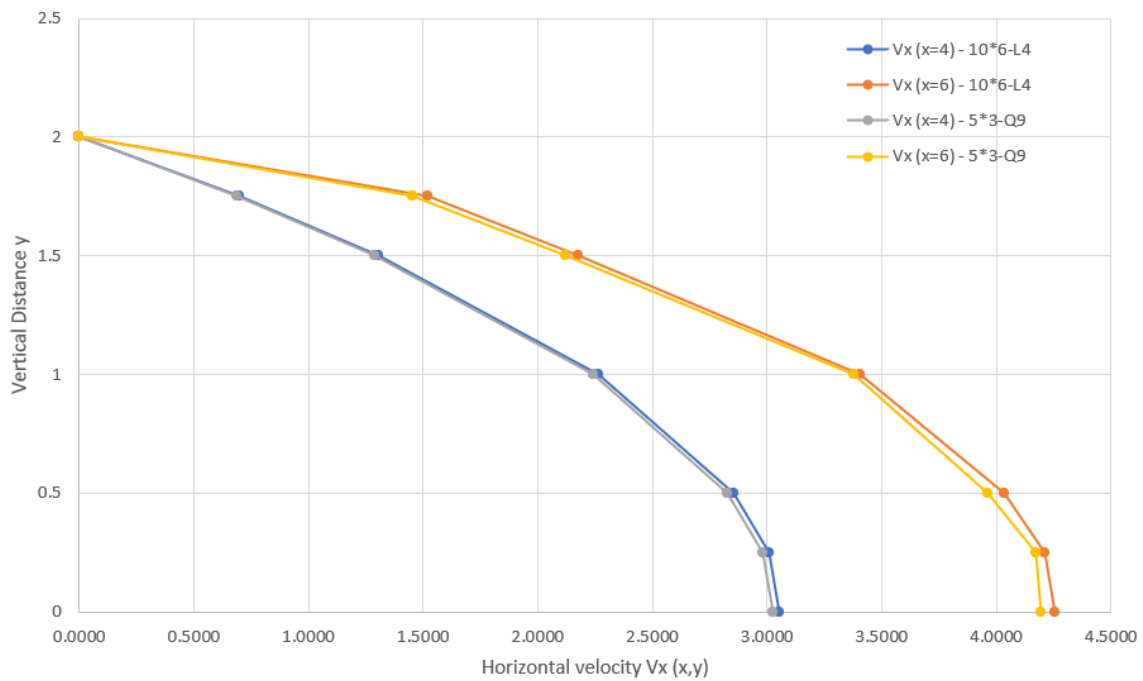


Figure 1: Horizontal Velocity field  $V_x$  at  $x = 4$  &  $x = 6$

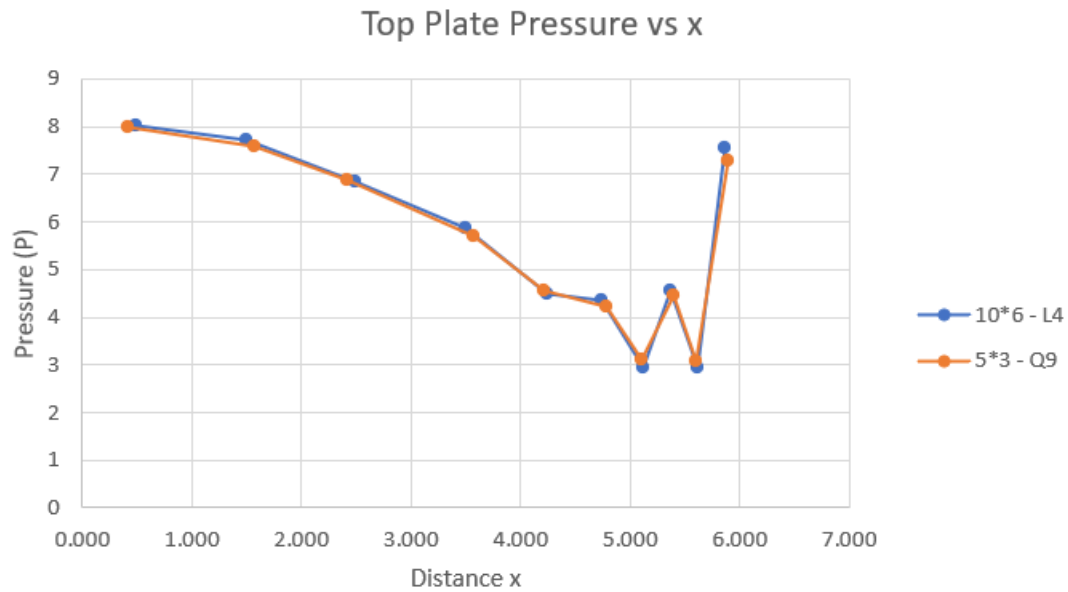


Figure 2: Top Plate Pressure vs x

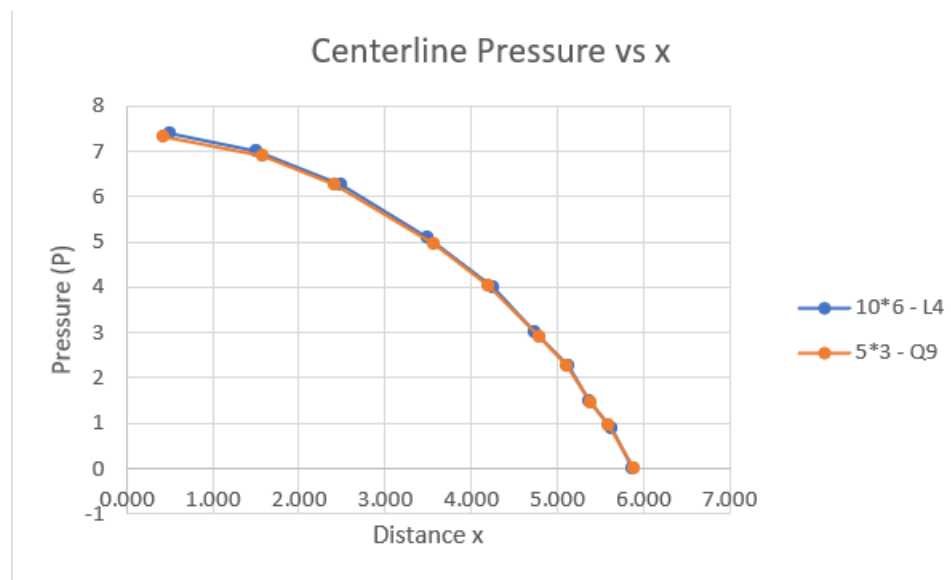


Figure 3: Centerline Pressure vs x

## Problem 10.8.4

### Inputs

Parameter	Value
Simulation Input	
Problem	2
NONLIN	1
ITERMAX	25
Epsilon	0.001

[illegible]

Natural Boundary Condition	
NSSV	0
ISSV	[ ]
VSSV	[ ]

## Results

y	Mesh: 8*8 - L4							Mesh: 4*4 - Q9						
	Linear	250		500		750		Linear	250		500		750	
Re ->		DI	NI	DI	NI	DI	NI		DI	NI	DI	NI	DI	NI
0.125	-0.0579	-0.0367	-0.0367	-0.0239	-0.0235	-0.0128	-0.0121	-0.0615	-0.0412	-0.0410	-0.0131	-0.0120	0.0146	0.0151
0.250	-0.0988	-0.0688	-0.0689	-0.0502	-0.0498	-0.0320	-0.0310	-0.1039	-0.0851	-0.0848	-0.0520	-0.0502	0.0017	0.0031
0.375	-0.1317	-0.0944	-0.0947	-0.0733	-0.0732	-0.0533	-0.0526	-0.1393	-0.1283	-0.1283	-0.1133	-0.1119	-0.0481	-0.0459
0.500	-0.1471	-0.0911	-0.0915	-0.0696	-0.0701	-0.0569	-0.0573	-0.1563	-0.1305	-0.1311	-0.1284	-0.1295	-0.1086	-0.1079
0.625	-0.0950	-0.0176	-0.0177	0.0043	0.0037	0.0020	0.0010	-0.1118	-0.0437	-0.0442	-0.0494	-0.0517	-0.0901	-0.0908
0.750	0.0805	0.0469	0.0479	0.0414	0.0414	0.0323	0.0322	0.0481	0.0753	0.0753	0.1042	0.1042	0.0549	0.0517
0.875	0.4500	0.2616	0.2617	0.1712	0.1714	0.1207	0.1198	0.4186	0.2833	0.2838	0.2139	0.2133	0.1495	0.1482

Table 4: velocity  $V_x(0.5,y)$  for different Reynold's number

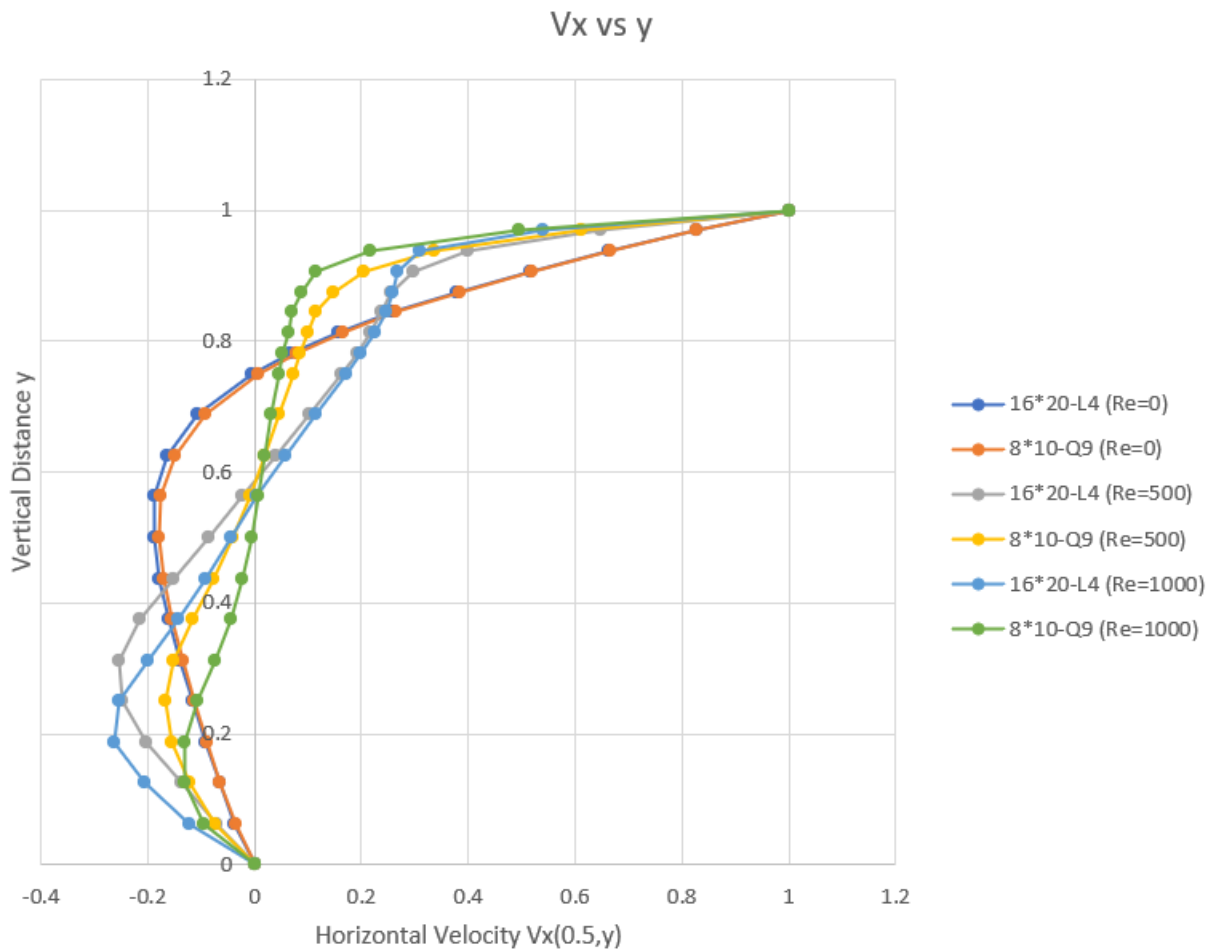


Figure 4: Horizontal Velocity  $V_x(0.5,y)$  vs  $y$  for  $Re = 0, 500, 1000$

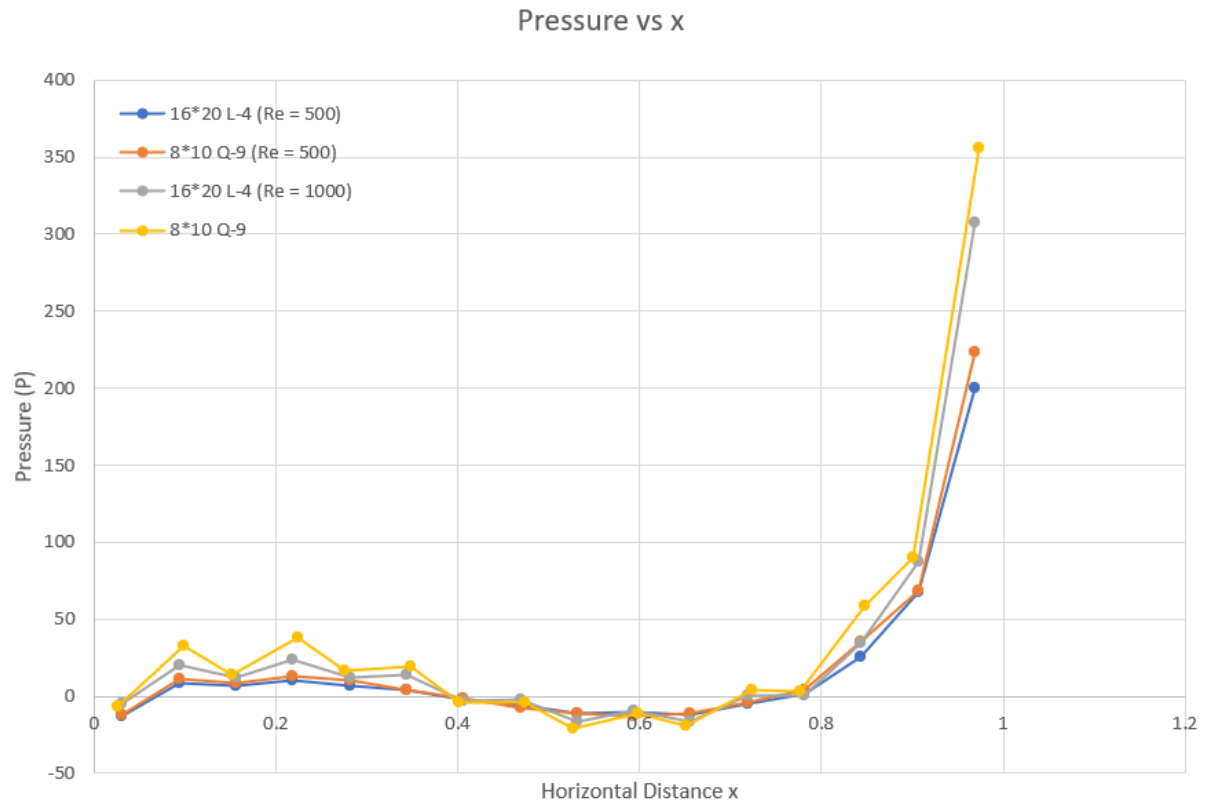


Figure 5: Plot of Pressure P along the top wall of the cavity