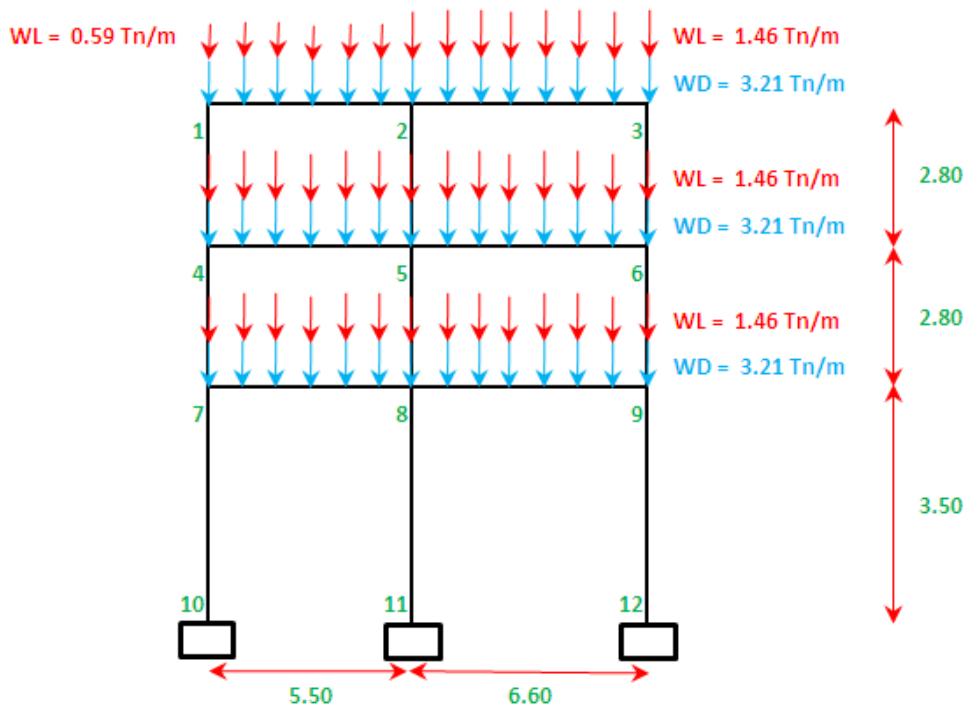


# METODO DE KANI

## Calculadora HP-50G Vs Hoja de Cálculo en Microsoft Excel

MANUAL HECHO POR:  
RENZO XAVIER  
CHÁVEZ HURTADO  
<http://fic-uap.blogspot.com/>



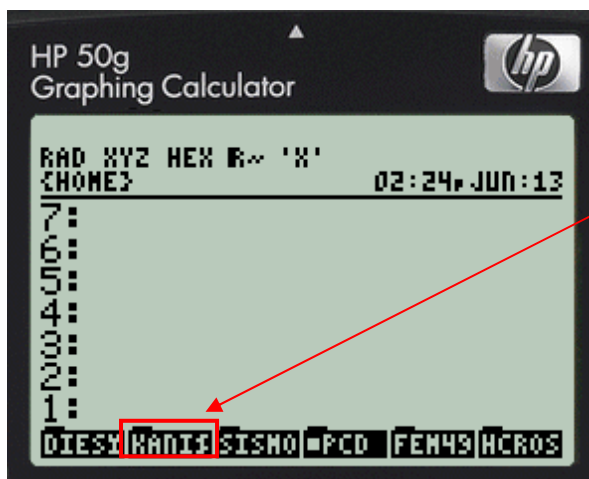
### COMBINACION DE CARGA

$$WU = 1.4 \cdot WD + 1.7 \cdot WL$$

$$WU = 6.98 \text{ Tn/m (General)}$$

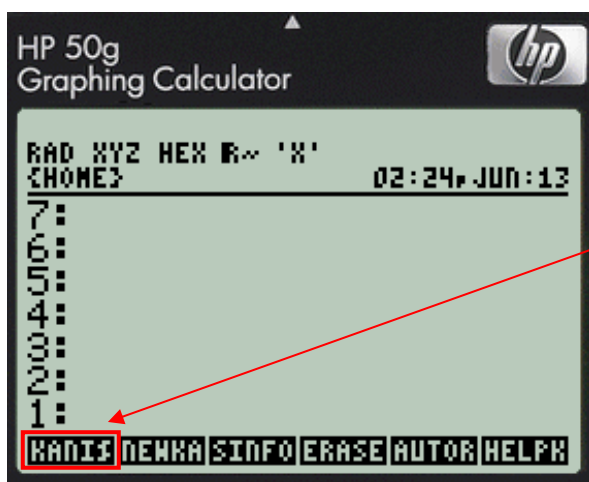
$$WU = 1.4 \cdot WD + 1.7 \cdot WL$$

$$WU = 5.50 \text{ Tn/m (Tramo 1-2)}$$

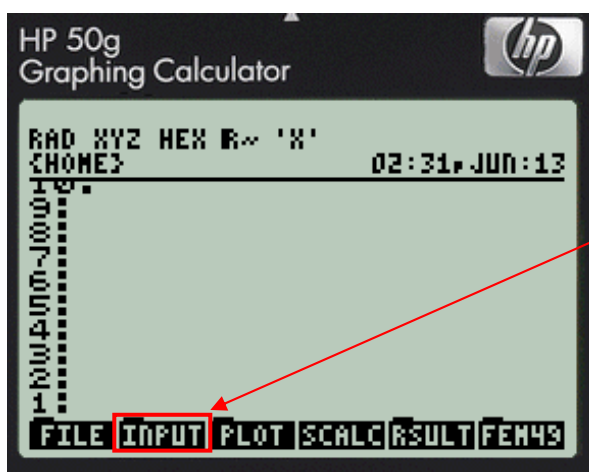


Ingresamos KANI

LUEGO DE INGRESADO AL PROGRAMA



Ingresamos KANI



Ingresamos INPUT

## PRIMER PAÑO. INGRESAR NUDOS

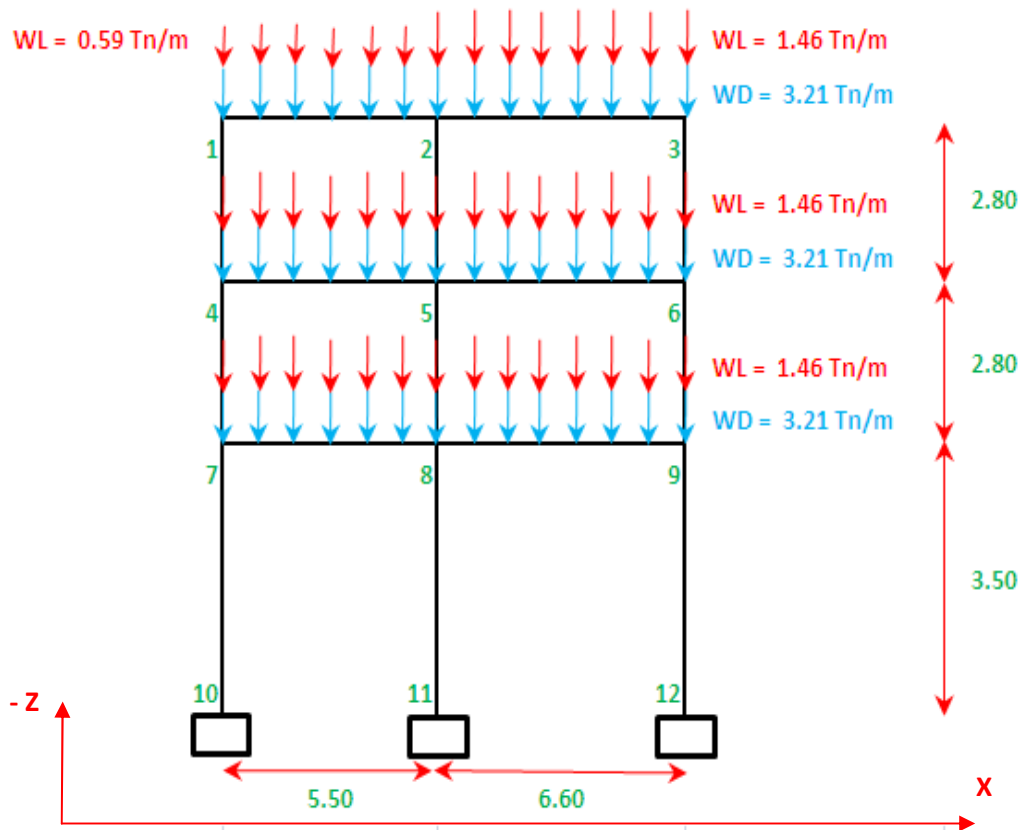
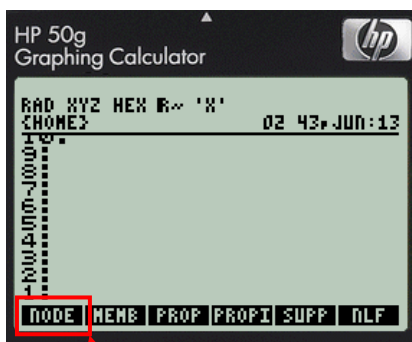


Fig. 1

### Ingresamos a NODE

EL INGRESO DE DATOS ES EN COORDENADAS. (X,Z)

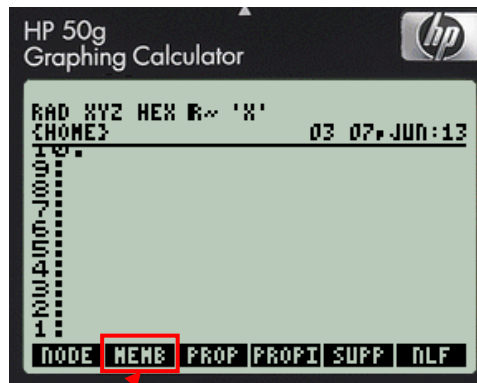
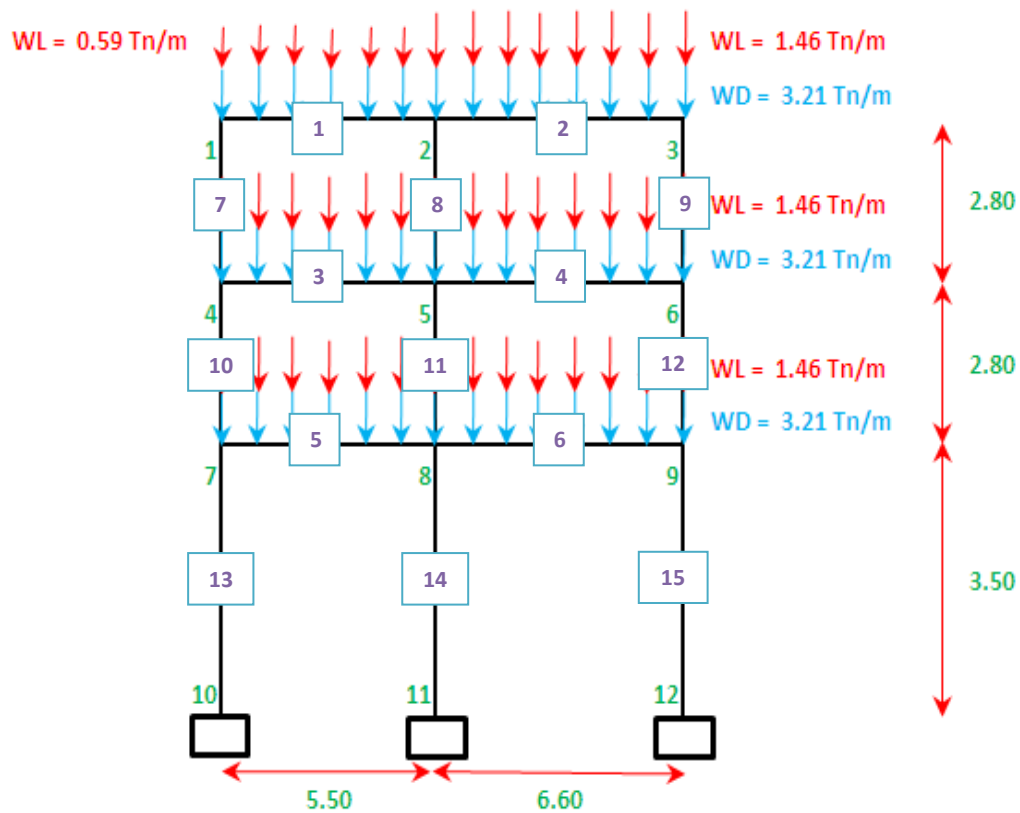
INGRESAR → [0 0] ENTER FINALIZADO → [0 0] CANCELAR



Ingresamos NODE

NODE	X	Z
1	0	-9.10
2	5.50	-9.10
3	12.10	-9.10
4	0.00	-6.30
5	5.50	-6.30
6	12.10	-6.30
7	0	-3.50
8	5.50	-3.50
9	12.10	-3.50
10	0	0
11	5.50	0
12	12.10	0

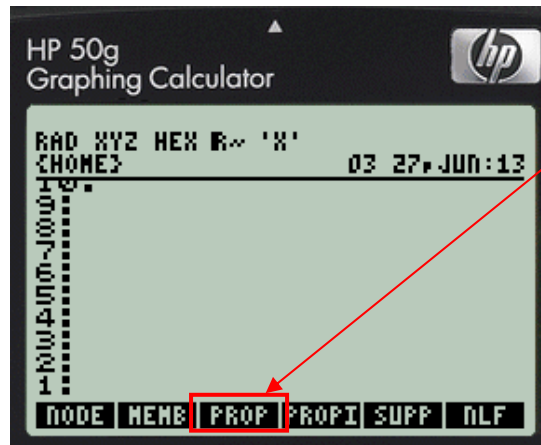
## SEGUNDO PAÑO. INGRESAR MIEMBROS



Ingresamos MEND

Miembro	Ni	Nj	Property
1	1	2	1
2	2	3	1
3	4	5	1
4	5	6	1
5	7	8	1
6	8	9	1
7	1	4	2
8	2	5	2
9	3	6	2
10	4	7	2
11	5	8	2
12	6	9	2
13	7	10	2
14	8	11	2
15	9	12	2

### TERCER PAÑO. INGRESAR PROPIEDADES



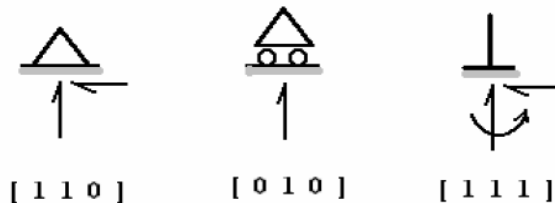
Ingresamos PROP

Propiedad	Area	Inercia	Emod
1	0.25	0.01	2173706.512
2	0.42	0.015	2173706.512

### CUARTO PAÑO. INGRESO DE FORMA DE APOYOS EN LOS NUDOS

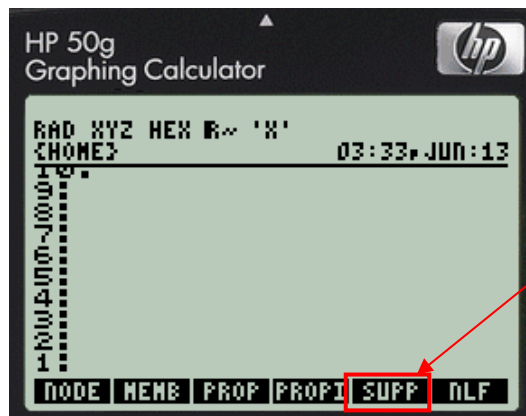
#### APOYOS:

Se hace mención a los apoyos que existen en la estructura a analizar.  
Se debe tener el siguiente criterio para los apoyos:



0 = libre    1 = restringido    < 0 = resorte  
Para nuestra estructura tenemos lo siguiente:

Nudo	Ux	Uz	Ry
1	1	1	1
2	1	1	0
3	0	1	0



Ingresamos SUPP

#### Comando: SUPP

(Support = Soporte)

La sintaxis es la siguiente: [ Node UX? UZ? RY? ]

Donde:

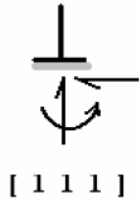
Node = Número del nudo.

UX? = Pregunta si existe restricción en X.

UZ? = Pregunta si existe restricción en Z.

RY? = Pregunta si existe rotación en Y.

Para nuestro ejemplo todos los apoyos son empotrados:



NUDO	Ux	Uz	Ry
10	1	1	1
11	1	1	1
12	1	1	1

## QUINTO PAÑO. INGRESO DE [MLZ] CARGA DISTRIBUIDA

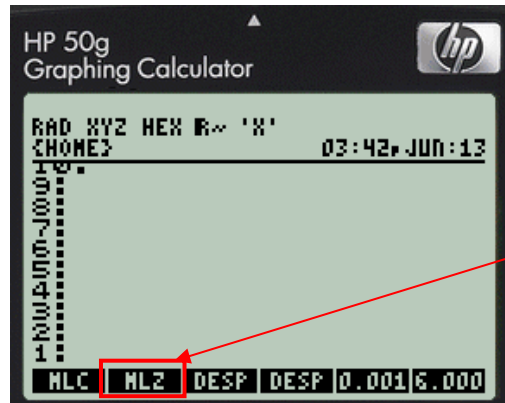
### COMBINACION DE CARGA

$$WU = 1.4 \cdot WD + 1.7 \cdot WL$$

$$WU = 6.98 \text{ Tn/m (General)}$$

$$WU = 1.4 \cdot WD + 1.7 \cdot WL$$

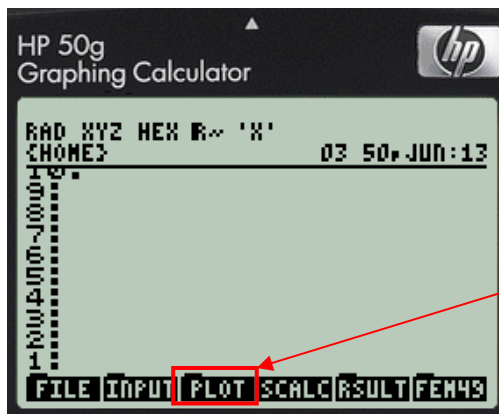
$$WU = 5.50 \text{ Tn/m (Tramo 1-2)}$$



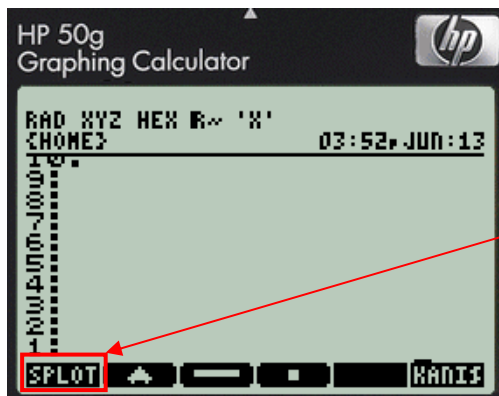
Ingresamos MLZ

Memb	wz1	wz2	d1	d2
1	5.50	5.50	0.00	5.50
2	6.98	6.98	0.00	6.60
3	6.98	6.98	0.00	6.60
4	6.98	6.98	0.00	6.60
5	6.98	6.98	0.00	6.60
6	6.98	6.98	0.00	6.60

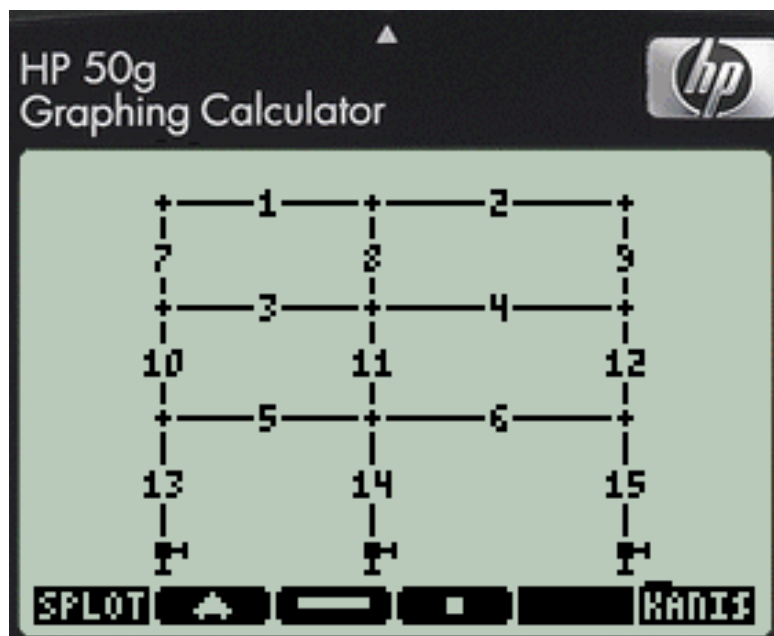
## VOLVEMOS AL MENU PRINCIPAL KANI



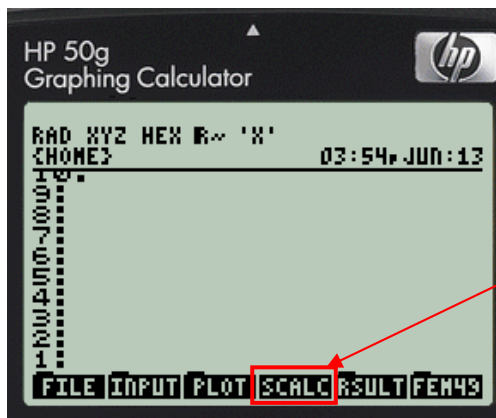
Ingresamos PLOT



Ingresamos SPLOT

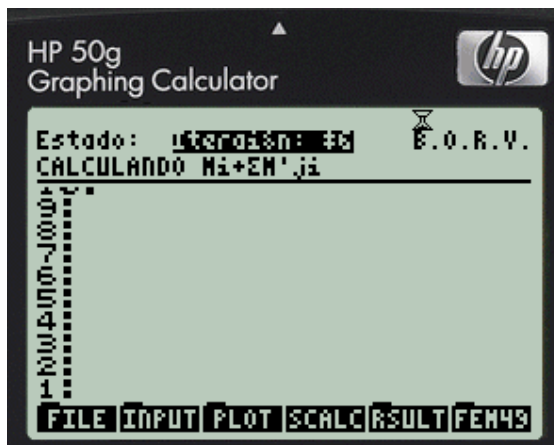


## PRESEIONAMOS CALC

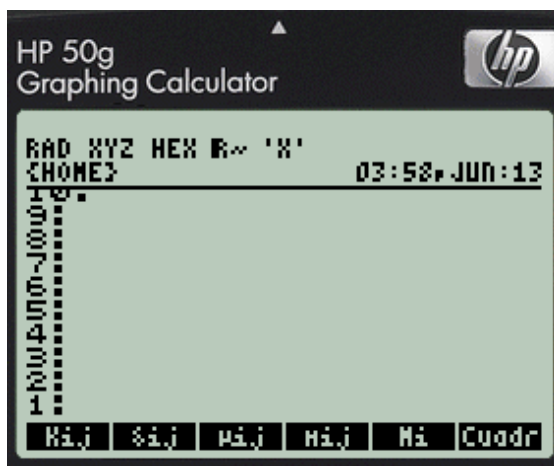


Ingresamos SCALC

CALCULANDO



## PRESEIONAMOS RESUL





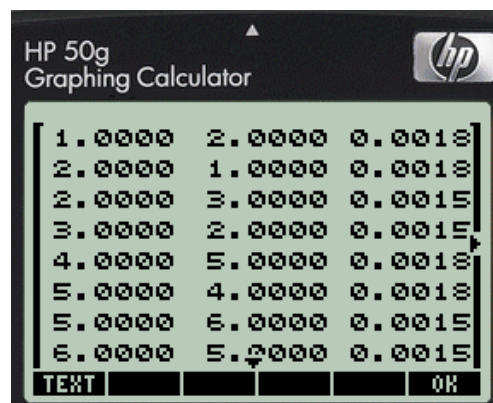
## INTERPRETACIÓN DE LOS RESULTADOS

PRIMERO RIGIDEZ RELATIVA:  $K_{ij} = EI/L$

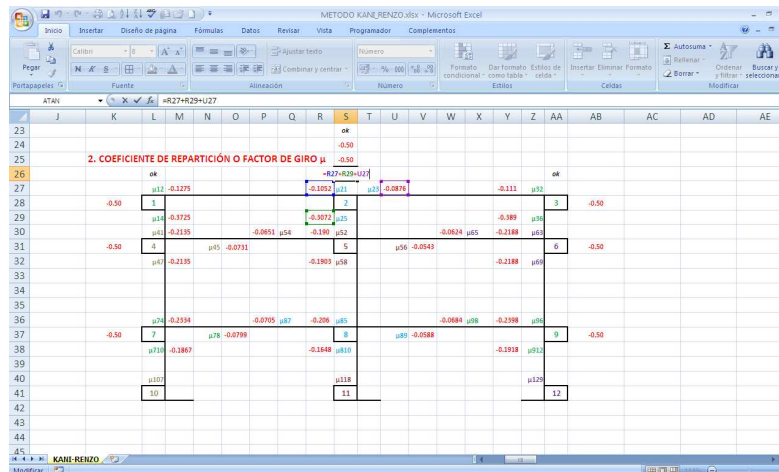
$E = 1$  (Así lo toma la calculadora pero no afecta en los cálculos)

K12 0.00182		0.00182 K21		K23 0.00152		0.00152 K32	
1		2		3			
K14	0.00531	0.00531 K25		0.00531 K36			
K41	0.00531	0.00182 K54	0.00531 K52	0.00152 K65	0.00531 K63		
4		5		6			
K45	0.00182	K56 0.00152		0.00531 K69			
K47	0.00531	0.00531 K58		0.00531 K96			
K74	0.00531	0.00182 K87	0.00531 K85	0.00152 K98	0.00531 K96		
7		8		9			
K78	0.00182	K89 0.00152		0.00425 K912			
K710	0.00425	0.00425 K810		0.00425 K129			
K107	0.00425	0.00425 K118					
10		11		12			

Presionamos



## SEGUNDO COEFICIENTE DE REPARTICIÓN O FACTOR DE GIRO



ok

-0.50

-0.50

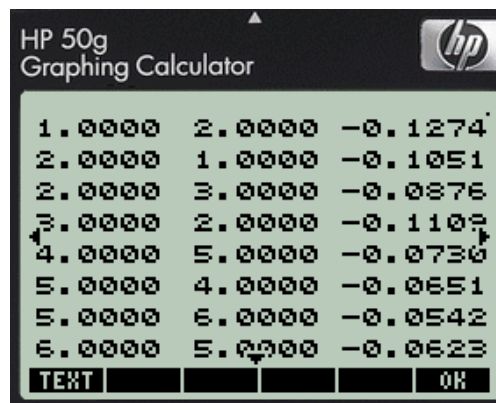
-0.50

ok

ok

	$\mu_{12}$	-0.128		-0.105	$\mu_{21}$	$\mu_{23}$	-0.088		-0.111	$\mu_{32}$	
-0.50	1				2						-0.50
	$\mu_{14}$	-0.372		-0.307	$\mu_{25}$				-0.389	$\mu_{36}$	
	$\mu_{41}$	-0.213		-0.065	$\mu_{54}$	-0.190	$\mu_{52}$		-0.062	$\mu_{65}$	-0.219
-0.50	4				5						-0.50
	$\mu_{45}$	-0.073					$\mu_{56}$	-0.054			
	$\mu_{47}$	-0.213		-0.19	$\mu_{58}$				-0.219	$\mu_{69}$	
-0.50	7				8						-0.50
	$\mu_{74}$	-0.233		-0.071	$\mu_{87}$	-0.206	$\mu_{85}$		-0.068	$\mu_{98}$	-0.24
	$\mu_{78}$	-0.08					$\mu_{89}$	-0.059			
	$\mu_{710}$	-0.187		-0.165	$\mu_{810}$				-0.192	$\mu_{912}$	
	$\mu_{107}$				$\mu_{118}$					$\mu_{129}$	
	10				11						12

Presionamos

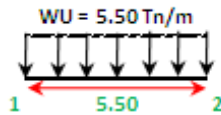


1.0000	2.0000	-0.1274
2.0000	1.0000	-0.1051
2.0000	3.0000	-0.0876
3.0000	2.0000	-0.1109
4.0000	5.0000	-0.0730
5.0000	4.0000	-0.0651
5.0000	6.0000	-0.0542
6.0000	5.0000	-0.0623
TEXT		OK

## TERCERO MOMENTO DE EMPOTRAMIENTO PERFECTO

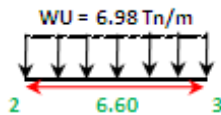
$$MEP_{ij} = \frac{WU * L^2}{12}$$

$$MEPJ_{ji} = -\frac{WU * L^2}{12}$$



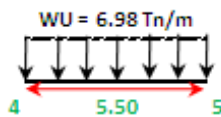
$$MEP_{12} = 13.86 \text{ Tn.m}$$

$$-MEP_{21} = 13.86 \text{ Tn.m}$$



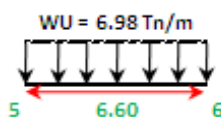
$$MEP_{23} = 25.32 \text{ Tn.m}$$

$$-MEP_{32} = 25.32 \text{ Tn.m}$$



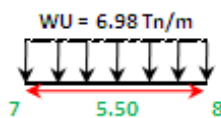
$$MEP_{45} = 17.59 \text{ Tn.m}$$

$$-MEP_{54} = 17.59 \text{ Tn.m}$$



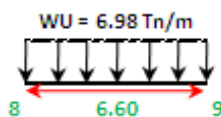
$$MEP_{56} = 25.32 \text{ Tn.m}$$

$$-MEP_{65} = 25.32 \text{ Tn.m}$$



$$MEP_{78} = 17.59 \text{ Tn.m}$$

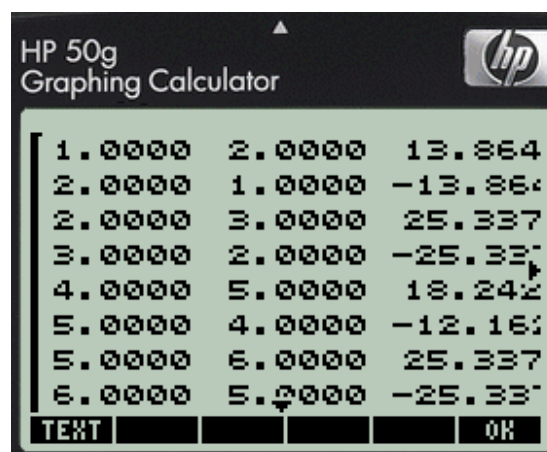
$$-MEP_{87} = 17.59 \text{ Tn.m}$$



$$MEP_{89} = 25.32 \text{ Tn.m}$$

$$-MEP_{98} = 25.32 \text{ Tn.m}$$

Presionamos



## CUARTO CUADRO DE ITERACION

13.86	-0.13	13.86	-13.86	-0.11	11.47	-0.09	25.32	-25.32	-0.11	-25.32
-0.37		-1.58	-1.50		-0.31		-1.25	2.81		-0.39
-4.60		-1.23	-1.50		-4.39		-1.02	2.57		9.85
-3.59		-1.31	-1.31		-3.58		-1.09	2.65		9.02
-3.84		-1.32	-1.30		-3.83		-1.09	2.68		9.29
-3.87		-1.33	-1.30		-3.81		-1.09	2.68		9.38
-3.87		-1.33	-1.30		-3.81		-1.09	2.68		9.39
-3.87		-1.33	-1.30		-3.81		-1.09	2.68		9.39
-3.87		-1.33	-1.30		-3.81		-1.09	2.68		9.39
-3.87		-1.33	-1.30		-3.81		-1.09	2.68		9.39
-2.15					-0.43					2.28
-2.15					-0.43					2.28
-2.15					-0.43					2.28
-2.16					-0.43					2.28
-2.17					-0.42					2.31
-2.24					-0.42					2.47
-2.71					-0.82					3.39
-0.21					-0.19					-0.22
17.59	-0.07	17.59	-17.59	-0.07	7.74	-0.05	25.32	-25.32	-0.06	-25.32
-0.21		-0.93	-0.28		-0.19		-0.23	0.97		-0.22
-2.71		-0.76	-0.14		-0.82		-0.12	0.70		3.39
-2.24		-0.74	-0.14		-0.42		-0.12	0.66		2.47
-2.17		-0.74	-0.15		-0.42		-0.12	0.65		2.31
-2.16		-0.74	-0.15		-0.43		-0.12	0.65		2.28
-2.15		-0.74	-0.15		-0.43		-0.12	0.65		2.28
-2.15		-0.74	-0.15		-0.43		-0.12	0.65		2.28
-2.15		-0.74	-0.15		-0.43		-0.12	0.65		2.28
-2.15		-0.74	-0.15		-0.43		-0.12	0.65		2.28
-3.47					-1.59					5.63
-3.47					-1.59					5.63
-3.47					-1.59					5.63
-3.47					-1.59					5.63
-3.45					-1.60					5.60
-3.33					-1.73					5.26
-0.23					-0.21					-0.24
17.59	-0.08	17.59	-17.59	-0.07	7.74	-0.06	25.32	-25.32	-0.07	-25.32
-0.19		-1.14	-0.59		-0.16		-0.49	1.50		-0.19
-2.67		-1.18	-0.55		-1.39		-0.45	1.60		4.21
-2.76		-1.19	-0.55		-1.28		-0.46	1.61		4.48
-2.78		-1.19	-0.55		-1.28		-0.45	1.61		4.50
-2.78		-1.19	-0.54		-1.27		-0.45	1.61		4.51
0.50		-1.19	-0.54		-1.27		-0.45	1.61		4.51
-2.78		-1.19	-0.54		-1.27		-0.45	1.61		4.51
-2.78		-1.19	-0.54		-1.27		-0.45	1.61		4.51
-2.78		-1.19	-0.54		-1.27		-0.45	1.61		4.51
-2.78		-1.19	-0.54		-1.27		-0.45	1.61		4.51
0.00					0.00					0.00

## Cálculo del pórtico paso a paso:

### Iteración:

Se empieza del nudo 3 (Los cálculos fueron en una de hoja calculo Microsoft Excel es por eso la Variación de los decimales)

METODO KANI-RENZO.xlsx - Microsoft Excel

3. ITERACION

4. MOMENTOS FINALES

$$M_{ik} = \bar{M}_{ik} + 2(M'_{ik}) + M'_{ki}$$

Momento	M. Final	Para graficar
M12 =	9.90 Tn.m	- 9.90 Tn.m
M21 =	- 17.79 Tn.m	- 17.79 Tn.m
M23 =	25.83 Tn.m	- 25.83 Tn.m
M32 =	- 21.05 Tn.m	- 21.05 Tn.m
M45 =	15.96 Tn.m	- 15.96 Tn.m
M54 =	- 18.62 Tn.m	- 18.62 Tn.m
M56 =	25.07 Tn.m	- 25.07 Tn.m
M65 =	- 24.48 Tn.m	- 24.48 Tn.m
M78 =	14.66 Tn.m	- 14.66 Tn.m
M87 =	- 19.86 Tn.m	- 19.86 Tn.m
M89 =	26.02 Tn.m	- 26.02 Tn.m
M98 =	- 22.56 Tn.m	- 22.56 Tn.m
M14 =	- 9.90 Tn.m	9.90 Tn.m
M41 =	- 8.18 Tn.m	- 8.18 Tn.m
M47 =	- 7.78 Tn.m	7.78 Tn.m
M74 =	- 9.10 Tn.m	- 9.10 Tn.m
M710 =	- 5.56 Tn.m	5.56 Tn.m
M107 =	- 2.78 Tn.m	- 2.78 Tn.m
M25 =	- 8.04 Tn.m	8.04 Tn.m
M52 =	- 4.66 Tn.m	- 4.66 Tn.m

METODO KANI-RENZO.xlsx - Microsoft Excel

Opciones de Excel

Avanzadas

Mostrar opciones para este libro: METODO KANI-RENZO.xlsx

Mostrar opciones para esta hoja: KANI-RENZO

Mostrar barra de desplazamiento horizontal

Mostrar barra de desplazamiento vertical

Mostrar fichas de hojas

Agrupar fechas en el menú Autofiltro

Para objetos, mostrar:

Todo

Nada (ocultar objetos)

Mostrar encabezados de fila y columna

Mostrar fórmulas en celdas en lugar de los resultados calculados

Mostrar saltos de página

Mostrar un cero en celdas que tienen un valor cero

Mostrar símbolos de esquema si se aplica un esquema

Mostrar líneas de división

Color de cuadrícula

Fórmulas

Permitir cálculos multiproceso

Número de procesos de cálculo

Usar todos los procesadores de esta equipo: 1

4. MOMENTOS FINALES

$$M_{ik} = \bar{M}_{ik} + 2(M'_{ik}) + M'_{ki}$$

Momento	M. Final	Para graficar
M12 =	9.90 Tn.m	- 9.90 Tn.m
M21 =	- 17.79 Tn.m	- 17.79 Tn.m
M23 =	25.83 Tn.m	- 25.83 Tn.m
M32 =	- 21.05 Tn.m	- 21.05 Tn.m
M45 =	15.96 Tn.m	- 15.96 Tn.m
M54 =	- 18.62 Tn.m	- 18.62 Tn.m
M56 =	25.07 Tn.m	- 25.07 Tn.m
M65 =	- 24.48 Tn.m	- 24.48 Tn.m
M78 =	14.66 Tn.m	- 14.66 Tn.m
M87 =	- 19.86 Tn.m	- 19.86 Tn.m
M89 =	26.02 Tn.m	- 26.02 Tn.m
M98 =	- 22.56 Tn.m	- 22.56 Tn.m
M14 =	- 9.90 Tn.m	9.90 Tn.m
M41 =	- 8.18 Tn.m	- 8.18 Tn.m
M47 =	- 7.78 Tn.m	7.78 Tn.m
M74 =	- 9.10 Tn.m	- 9.10 Tn.m
M710 =	- 5.56 Tn.m	5.56 Tn.m
M107 =	- 2.78 Tn.m	- 2.78 Tn.m
M25 =	- 8.04 Tn.m	8.04 Tn.m
M52 =	- 4.66 Tn.m	- 4.66 Tn.m

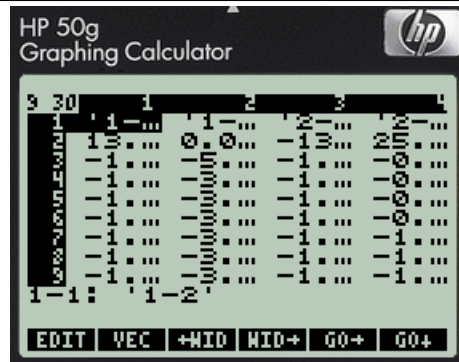
**Observación:** La iteración se empieza del momento más alto es lo recomendable pero el HP50G empieza de cualquier nudo.

En resumen obtenemos: Calculado en Microsoft Excel.

13.86	-0.13	13.86	-13.86	-0.11	11.47	-0.09	25.32	-25.32	-0.11	-25.32
-0.37		-1.33	-1.30		-0.31		-1.09	2.68		-0.39
-3.87					-3.81					9.39
-2.15					-0.43					2.28
-0.21					-0.19					-0.22
17.59	-0.07	17.59	-17.59	-0.07	7.74	-0.05	25.32	-25.32	-0.06	-25.32
-0.21		-0.74	-0.15		-0.19		-0.45	0.65		-0.22
-2.15					-0.43					2.28
-3.47					-1.59					5.63
-0.23					-0.21					-0.24
17.59	-0.08	17.59	-17.59	-0.07	7.74	-0.06	25.32	-25.32	-0.07	-25.32
-0.19		-1.19	-0.54		-0.16		-0.45	1.61		-0.19
-2.78					-1.27					4.51
0.00					0.00					0.00

Presionamos

Iteracción hallado en HP50G



**Observación:** La diferencia son simplemente decimales.

**Resultados de la iteración HP50G (Solo la ultima Iteración)**

Nudos	1-2	1-4	2-1	2-3	2-5	3-2	3-6	4-5	4-1
MEP	13.8646	0	-13.865	25.3374	0	-25.337	0	18.2429	0
ITERACION	-1.3314	-3.8942	-1.2044	-1.0037	-3.5228	2.661	9.3396	-0.7554	-2.2095

Nudos	4-7	5-4	5-6	5-2	5-8	6-5	6-3	6-9	7-8
MEP	0	-12.162	25.3374	0	0	0	-25.337	0	0
ITERACION	-2.2095	-0.4582	-0.3819	-1.3402	-1.3402	0.666	2.3397	2.3397	-1.2108

Nudos	7-4	7-10	8-7	8-9	8-5	8-11	9-8	9-6	9-12
MEP	18.2429	0	0	-12.162	25.3374	0	0	-25.337	0
ITERACION	-3.5415	-2.8332	-0.8626	-0.7188	-2.5228	-2.0183	1.6205	5.6876	4.5501

Nudos	10-7	11-8	12-9
MEP	0	0	0
ITERACION	0	0	0



## QUINTO MOMENTOS FINALES.

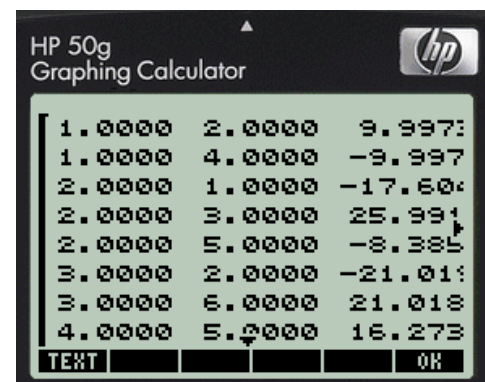
Momento Final hallado: Calculado en Microsoft Excel.

$$M_{ik} = \overline{M}_{ik} + 2(M'_{ik}) + M'_{ki}$$

Momento	M. Final	Para graficar
M12 =	9.90 Tn.m	- 9.90 Tn.m
M21 =	- 17.79 Tn.m	- 17.79 Tn.m
M23 =	25.83 Tn.m	- 25.83 Tn.m
M32 =	- 21.05 Tn.m	- 21.05 Tn.m
M45 =	15.96 Tn.m	- 15.96 Tn.m
M54 =	- 18.62 Tn.m	- 18.62 Tn.m
M56 =	25.07 Tn.m	- 25.07 Tn.m
M65 =	- 24.48 Tn.m	- 24.48 Tn.m
M78 =	14.66 Tn.m	- 14.66 Tn.m
M87 =	- 19.86 Tn.m	- 19.86 Tn.m
M89 =	26.02 Tn.m	- 26.02 Tn.m
M98 =	- 22.56 Tn.m	- 22.56 Tn.m
M14 =	- 9.90 Tn.m	9.90 Tn.m
M41 =	- 8.18 Tn.m	- 8.18 Tn.m
M47 =	- 7.78 Tn.m	7.78 Tn.m
M74 =	- 9.10 Tn.m	- 9.10 Tn.m
M710 =	- 5.56 Tn.m	5.56 Tn.m
M107 =	- 2.78 Tn.m	- 2.78 Tn.m
M25 =	- 8.04 Tn.m	8.04 Tn.m
M52 =	- 4.66 Tn.m	- 4.66 Tn.m
M58 =	- 2.45 Tn.m	2.45 Tn.m
M85 =	- 3.61 Tn.m	- 3.61 Tn.m
M811 =	- 2.55 Tn.m	2.55 Tn.m
M118 =	- 1.27 Tn.m	- 1.27 Tn.m
M36 =	21.05 Tn.m	- 21.05 Tn.m
M63 =	13.95 Tn.m	13.95 Tn.m
M69 =	10.20 Tn.m	- 10.20 Tn.m
M96 =	13.55 Tn.m	13.55 Tn.m
M912 =	9.01 Tn.m	- 9.01 Tn.m
M129 =	4.51 Tn.m	4.51 Tn.m

Presionamos

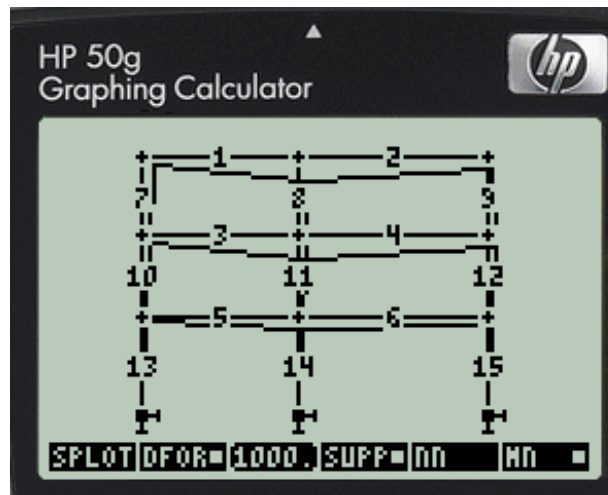
Momento Final hallado en el HP50G





## SEXTO GRAFICOS

Ingresar al FEM49 y presionar SCALC después PLOT – SPLOT



Ingresar a RESULT – QUERY

El FEM49 te grafica Miembro por miembro

