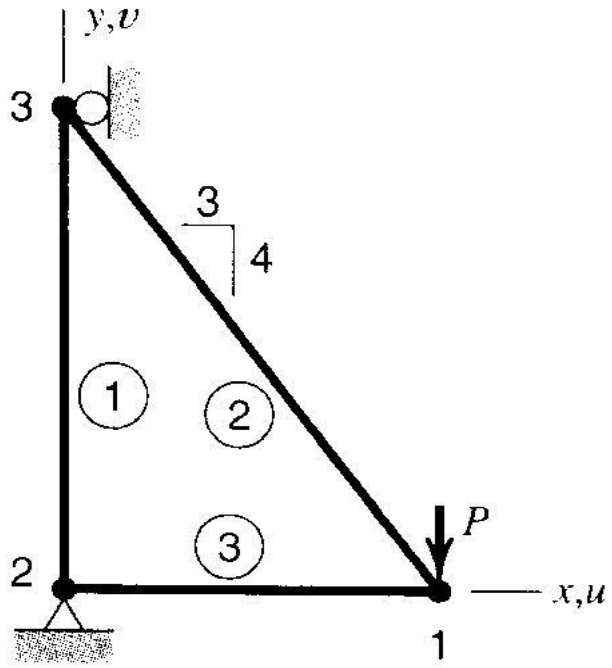

Step 1: Grid creation with elements, nodes and properties

	A	B	C	D	E	F	G	H
1	P	10000	N					
2								
3	element	1st node	2nd node	L	A	E	beta	k
4	1	2	3	2000	100	206000	1.570796	10300
5	2	1	3	2500	100	206000	2.214297	8240
6	3	1	2	1500	100	206000	3.141593	13733.33

Step 2: Individual stiffness matrices

Step 2.1: Orientation contributions

$$[K] = \frac{AE}{L}\begin{bmatrix} \cos^2\beta & \cos\beta\sin\beta & -\cos^2\beta & -\cos\beta\sin\beta \\ \cos\beta\sin\beta & \sin^2\beta & -\cos\beta\sin\beta & -\sin^2\beta \\ -\cos^2\beta & -\cos\beta\sin\beta & \cos^2\beta & \cos\beta\sin\beta \\ -\cos\beta\sin\beta & -\sin^2\beta & \cos\beta\sin\beta & \sin^2\beta \end{bmatrix}$$

[K1]'=k1*	0.00	0.00	0.00	0.00	u2
	0.00	1.00	0.00	-1.00	v2
	0.00	0.00	0.00	0.00	u3
	0.00	-1.00	0.00	1.00	v3
[K2]'=k2*	0.36	-0.48	-0.36	0.48	u1
	-0.48	0.64	0.48	-0.64	v1
	-0.36	0.48	0.36	-0.48	u3
	0.48	-0.64	-0.48	0.64	v3
[K3]'=k3*	1.00	0.00	-1.00	0.00	u1
	0.00	0.00	0.00	0.00	v1
	-1.00	0.00	1.00	0.00	u2
	0.00	0.00	0.00	0.00	v2

Step 2.2: Matrix expansion

[K1]=k1*	0.00	0.00	0.00	0.00	0.00	0.00	u1
	0.00	0.00	0.00	0.00	0.00	0.00	v1
	0.00	0.00	0.00	0.00	0.00	0.00	u2
	0.00	0.00	0.00	1.00	0.00	-1.00	v2
	0.00	0.00	0.00	0.00	0.00	0.00	u3
	0.00	0.00	0.00	-1.00	0.00	1.00	v3
[K2]=k2*	0.36	-0.48	0.00	0.00	-0.36	0.48	u1
	-0.48	0.64	0.00	0.00	0.48	-0.64	v1
	0.00	0.00	0.00	0.00	0.00	0.00	u2
	0.00	0.00	0.00	0.00	0.00	0.00	v2
	-0.36	0.48	0.00	0.00	0.36	-0.48	u3
	0.48	-0.64	0.00	0.00	-0.48	0.64	v3
[K3]=k3*	1.00	0.00	-1.00	0.00	0.00	0.00	u1
	0.00	0.00	0.00	0.00	0.00	0.00	v1
	-1.00	0.00	1.00	0.00	0.00	0.00	u2
	0.00	0.00	0.00	0.00	0.00	0.00	v2
	0.00	0.00	0.00	0.00	0.00	0.00	u3
	0.00	0.00	0.00	0.00	0.00	0.00	v3

Step 2.3: Multiplying by $k_i = \frac{A_i E_i}{L_i}$

[K1] =

0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	10300	0	-10300
0	0	0	0	0	0
0	0	0	-10300	0	10300

[K2] =

2966.4	-3955.2	0	0	-2966.4	3955.2
-3955.2	5273.6	0	0	3955.2	-5273.6
0	0	0	0	0	0
0	0	0	0	0	0
-2966.4	3955.2	0	0	2966.4	-3955.2
3955.2	-5273.6	0	0	-3955.2	5273.6

[K3] =

13733.333	-1.68254E-12	-13733.33	1.683E-12	0	0
-1.68E-12	2.06136E-28	1.683E-12	-2.06E-28	0	0
-13733.33	1.68254E-12	13733.333	-1.68E-12	0	0
1.683E-12	-2.06136E-28	-1.68E-12	2.061E-28	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Step 3: Sum individual matrices to obtain the global stiffness matrix and complete the governing equation

16699.73	-3955.20	-13733.33	0.00	-2966.40	3955.20		u1		0
-3955.20	5273.60	0.00	0.00	3955.20	-5273.60		v1		-P
-13733.33	0.00	13733.33	0.00	0.00	0.00	*	u2=0	=	rh2
0.00	0.00	0.00	10300.00	0.00	-10300.00		v2=0		rv2
-2966.40	3955.20	0.00	0.00	2966.40	-3955.20		u3=0		rh3
3955.20	-5273.60	0.00	-10300.00	-3955.20	15573.60		v3		0

Step 4: Swap rows and columns to isolate the two problems (unknown displacement/known forces vs unknown forces/known displacements)

swap 3rd and 6th column

16699.73	-3955.20	3955.20	0.00	-2966.40	-13733.33
-3955.20	5273.60	-5273.60	0.00	3955.20	0.00
-13733.33	0.00	0.00	0.00	0.00	13733.33
0.00	0.00	-10300.00	10300.00	0.00	0.00
-2966.40	3955.20	-3955.20	0.00	2966.40	0.00
3955.20	-5273.60	15573.60	-10300.00	-3955.20	0.00

swap 3rd and 6th row

16699.73	-3955.20	3955.20	0.00	-2966.40	-13733.33	u1		0
-3955.20	5273.60	-5273.60	0.00	3955.20	0.00	v1	-P	
3955.20	-5273.60	15573.60	-10300.00	-3955.20	0.00	v3		0
0.00	0.00	-10300.00	10300.00	0.00	0.00	v2=0	rv2	
-2966.40	3955.20	-3955.20	0.00	2966.40	0.00	u3=0	rh3	
-13733.33	0.00	0.00	0.00	0.00	13733.33	u2=0	rh2	

Step 5: Solve first problem to obtain unknown displacements

16699.733	-3955.2	3955.2	*	u1	=	0
-3955.2	5273.6	-5273.6		v1		-10000
3955.2	-5273.6	15573.6		v3		0

inverse matrix

7.282E-05	5.46117E-05	1.994E-20
5.461E-05	0.00032767	9.709E-05
1.617E-20	9.70874E-05	9.709E-05

u1	=	-0.546117	mm
v1	=	-3.276699	mm
v3	=	-0.970874	mm

Step 6: Solve second problem to obtain unknown forces

coefficients multiplying the previously unknown displacements

1.683E-12	-2.06136E-28	-10300
-2966.4	3955.2	-3955.2
-13733.33	1.68254E-12	0

rv2	=	10000
rh3	=	-7500
rh2	=	7500

Step 7: Compute nodal forces

52	**Nodal forces**								
53									
54	F2x		0.00	0.00	0.00	0.00	u_2	0.00	0
55	F2y		0.00	1.00	0.00	-1.00	v_2	0.00	10000
56	F3x		0.00	0.00	0.00	0.00	u_3	0.00	0
57	F3y		0.00	-1.00	0.00	1.00	v_3	-0.97	-10000
58									
59	F1x		0.36	-0.48	-0.36	0.48	u_1	-0.55	7500
60	F1y		-0.48	0.64	0.48	-0.64	v_1	-3.28	-10000
61	F3x		-0.36	0.48	0.36	-0.48	u_3	0.00	-7500
62	F3y		0.48	-0.64	-0.48	0.64	v_3	-0.97	10000
63									
64			-0.60	0.80	0	0	F'1		-12500
65		T	0	0	-0.60	0.80	F'3		12500
66									
67									
68									
69	F1x		1.00	0.00	-1.00	0.00	u_1	-0.55	-7500
70	F1y		0.00	0.00	0.00	0.00	v_1	-3.28	0
71	F2x		-1.00	0.00	1.00	0.00	u_2	0.00	7500
72	F2y		0.00	0.00	0.00	0.00	v_2	0.00	0

Rotate if nodal forces are needed in the local coordinate system