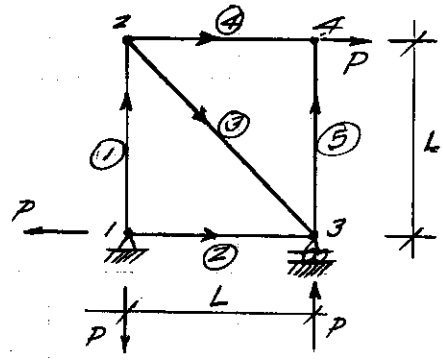
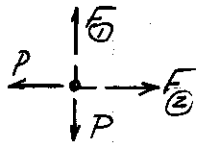
1.




$K_i$ = constant

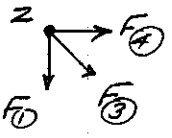
$u_1 = v_1 = 0$

$v_3 = 0$



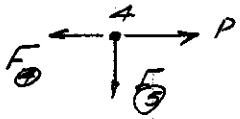

$\Sigma F_x = 0 \rightarrow F_② = P$

$\Sigma F_y = 0 \rightarrow F_① = P$




$\Sigma F_y = 0 \rightarrow -F_① - \frac{1}{\sqrt{2}} F_③ = 0 \rightarrow F_③ = -P\sqrt{2}$

$\Sigma F_x = 0 \rightarrow \frac{1}{\sqrt{2}} F_③ + F_④ = 0 \rightarrow F_④ = P$




$\Sigma F_y = 0 \rightarrow F_⑤ = 0$

Summary:

$F_① = P$
$F_② = P$
$F_③ = -P\sqrt{2}$
$F_④ = P$
$F_⑤ = 0$

$\alpha_1 = 90° \rightarrow \cos\alpha_1 = 0, \sin\alpha_1 = 1$
$\alpha_2 = 0 \rightarrow \cos\alpha_2 = 1, \sin\alpha_2 = 0$
$\alpha_3 = -45° \rightarrow \cos\alpha_3 = \frac{\sqrt{2}}{2}, \sin\alpha_3 = -\frac{\sqrt{2}}{2}$
$\alpha_4 = 0 \rightarrow \cos\alpha_4 = 1, \sin\alpha_4 = 0$
$\alpha_5 = 90° \rightarrow \cos\alpha_5 = 0, \sin\alpha_5 = 1$

$e_1 = \frac{F_1}{K} = \frac{P}{K} = v_2 - v_1$, but $v_1 = 0$

then $v_2 = \frac{P}{K}$

$e_2 = \frac{F_2}{K} = \frac{P}{K} = u_3 - u_1$, but $u_1 = 0$

then $u_3 = \frac{P}{K}$

$e_3 = \frac{F_3}{K} = -\frac{P\sqrt{2}}{K} = (u_3 - u_2)\frac{\sqrt{2}}{2} + (v_3 - v_2)\left(-\frac{\sqrt{2}}{2}\right)$

$\rightarrow (u_3 - u_2) + (v_2 - v_3) = -\frac{2P}{K}$

But $v_2 = \frac{P}{K}$, $v_3 = 0$, $u_3 = \frac{P}{K}$

then $\left(\frac{P}{K} - u_2\right) + \left(\frac{P}{K} - 0\right) = -\frac{2P}{K}$

$\rightarrow u_2 = \frac{4P}{K}$

FE 1

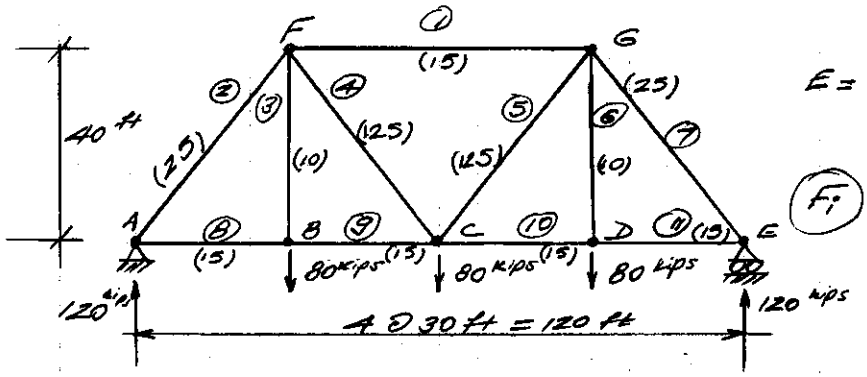
$e_4 = \frac{F_4}{k} = \frac{P}{k} = (u_4 - u_2)$, but $u_2 = \frac{4P}{k}$
then $u_4 = \frac{5P}{k}$

$e_5 = \frac{F_5}{k} = 0 = (v_4 - v_3)$, but $v_3 = 0$
then $v_4 = 0$

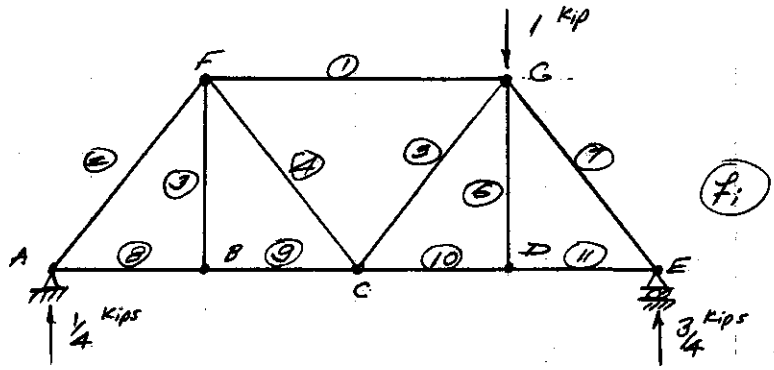
So

$u_1 = 0 \quad v_1 = 0$
$u_2 = \frac{4P}{k} \quad v_2 = \frac{P}{k}$
$u_3 = \frac{P}{k} \quad v_3 = 0$
$u_4 = \frac{5P}{k} \quad v_4 = 0$

2.




$E = 30{,}000$ KSi




| Member | $A_i$ ($in^2$) | $L_i$ (in.) | $F_i$ (Kips) | $f_i$ or $\delta F_i$ | $\frac{F_i L_i}{A_i E}$ | $\alpha_i L_i \Delta T_i$ | $\frac{F_i L_i}{A_i E} \cdot f_i$ | $(\alpha_i L_i \Delta T_i) \cdot f_i$ |
|---|---|---|---|---|---|---|---|---|
| (1) | 15 | 720 | -120 | -.375 | -5760/E | 0 | 2160/E | 0 |
| (2) | 25 | 600 | -150 | -.3125 | -3600/E | 0 | 1125/E | 0 |
| (3) | 10 | 480 | 80 | 0 | 3840/E | 0 | 0 | 0 |
| (4) | 12.5 | 600 | 50 | .3125 | 2400/E | 0 | 750/E | 0 |
| (5) | 12.5 | 600 | 50 | -.3125 | 2400/E | 0 | -750/E | 0 |
| (6) | 10 | 480 | 80 | 0 | 3840/E | 0 | 0 | 0 |
| (7) | 25 | 600 | -150 | -.9375 | -3600/E | 0 | 3375/E | 0 |
| (8) | 15 | 360 | 90 | +.1875 | 2160/E | -0.117 | 405/E | -0.022 |
| (9) | 15 | 360 | 90 | +.1875 | 2160/E | -0.117 | 405/E | -0.022 |
| (10) | 15 | 360 | 90 | .5625 | 2160/E | -0.117 | 1215/E | -0.066 |
| (11) | 15 | 360 | 90 | .5625 | 2160/E | -0.117 | 1215/E | -0.066 |
| | | | | | | | 9900/E | -0.175 |

FE 1

(a) $\Delta_{Gy} = 9900/E = 0.33$ in. ↓

(b) $\Delta_{Gy} = 0.1755$ in. ↑

(c) Let the fabrication error in the length of each one of the four bottom chord members be e

$$\therefore \frac{9900}{E} + e\,(0.1875 + 0.1875 + .5625 + 0.5625) = 0$$

$$e = -0.22 \text{ in.}$$

or $e = 0.22$ in. shortening.