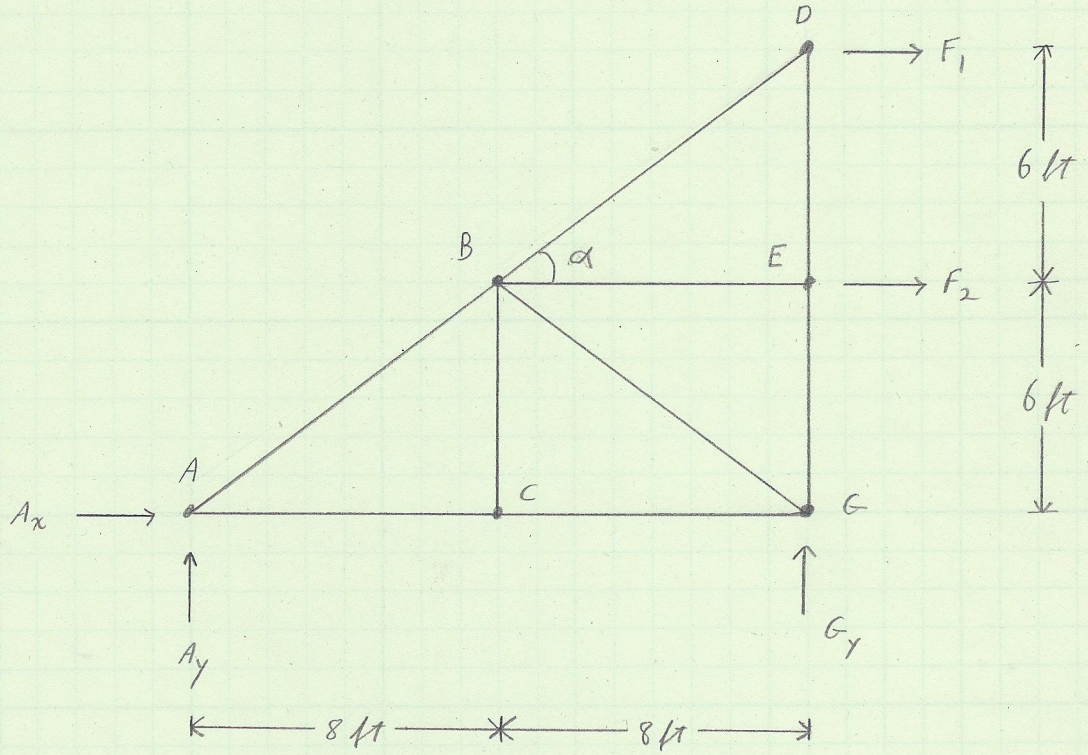
Problem 6.11

Given: $F_1 = F_2 = 10$ kip

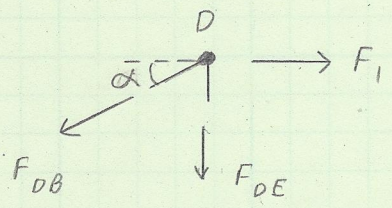
Information in FBD

Find: Axial forces in BD, BE, BG.

Soln: The FBD is:



Consider joint D:



we have the equilibrium equation

$$\Sigma F_x = 0$$

or $$F_1 - F_{DB} \cos\alpha = 0 \quad \text{(kip)}$$

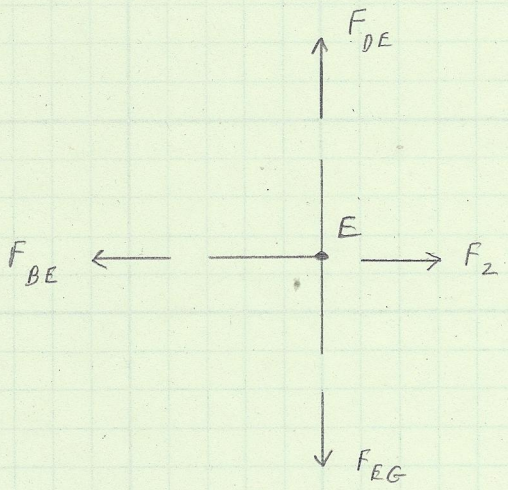
or $$10 - F_{DB}\left(\frac{8}{10}\right) = 0 \quad \text{(kip)}$$

so $F_{BD} = \frac{100}{8} = 12.5$ kips.

Also $\sum F_y = 0$ or $-F_{BD}\sin\alpha - F_{DE} = 0$ kips

or $F_{DE} = -F_{BD}\sin\alpha = -(12.5)\left(\frac{6}{10}\right) = -7.5$ kips

Consider joint E:

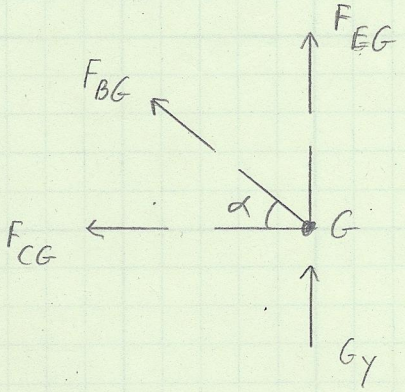


From the equilibrium equations, we have

$F_{EG} = F_{DE} = -7.5$ kips

and $F_{BE} = F_2 = 10$ kips

Consider joint G:



From the equilibrium equations we have

$$\Sigma F_y = F_{EG} + F_{BG}\sin\alpha + G_y = 0 \quad (\text{kip})$$

$$\text{or} \quad -7.5 + F_{BG}\left(\frac{6}{10}\right) + G_y = 0 \quad (\text{kip})$$

$$\text{or} \quad F_{BG} = \frac{7.5 - G_y}{6/10} \quad (\text{kip})$$

Now calculating the moment for the complete structure about point A;

$$\Sigma M_A = -12F_1 - 6F_2 + 16G_y = 0 \quad (\text{ft kip})$$

$$\text{or} \quad G_y = \frac{12F_1 + 6F_2}{16} = \frac{12(10) + 6(10)}{16} = 11.25 \,(\text{kip}).$$

Therefore $$F_{BG} = \frac{7.5 - 11.25}{6/10} = -6.25 \,(\text{kip}).$$

Final answer:

$F_{BD} = 12.5$ kip (tension)

$F_{BE} = -10$ kip (tension)

$F_{BG} = -6.25$ kip (compression)