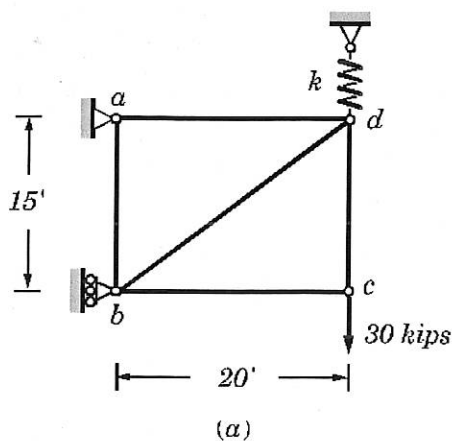


Ans:

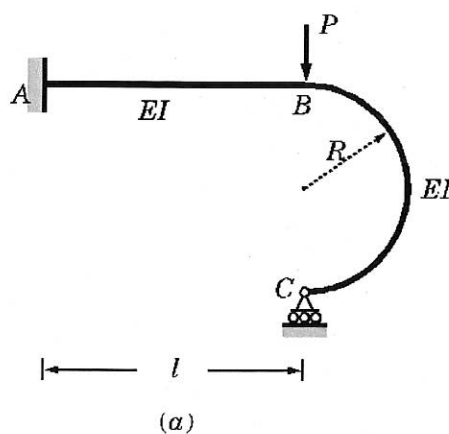
水平位移  $d_H = 7.90 \frac{PL}{AE} (\rightarrow)$  ; 垂直位移  $d_V = 4 \frac{PL}{AE} (\downarrow)$

5. 試求下圖桁架中 c 點的垂直位移。所有桿件之斷面積皆為  $2 \text{ in}^2$  ,  $E = 30 \times 10^3 \text{ ksi}$  , 彈簧常數  $k = 25 \text{ k/in}$  。



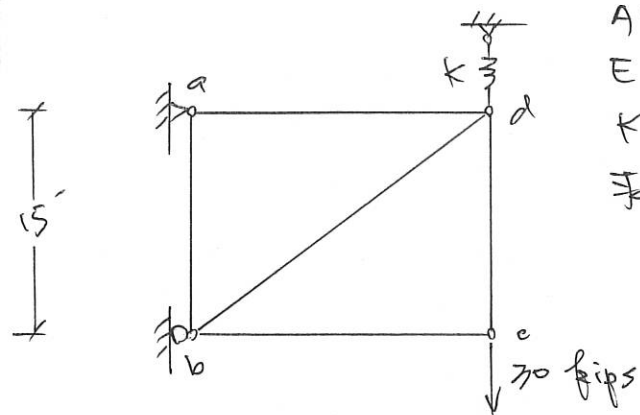
Ans:  $c_V = 0.423 \text{ in} (\downarrow)$

6. 試求圖示結構中 C 點反力及 B 點垂直位移。



Ans: C 點反力  $R_C = \frac{2Pl^3}{3\pi R^3 + 2l^3} (\uparrow)$

B 點垂直位移  $\Delta_B = \frac{Pl^3 \pi R^3}{(3\pi R^3 + 2l^3)EI} (\downarrow)$



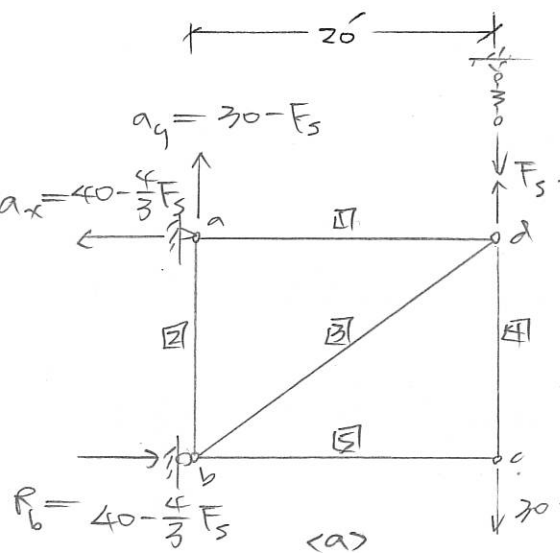
$$A = 2 \text{ in}^2$$

$$E = 30 \times 10^3 \text{ ksi}$$

$$k = 25 \frac{\text{k}}{\text{in}}$$

$$\text{求 } \Delta_{d,v} \text{ 條件}$$

	圖(a)	長度 (ft)	圖(b)	圖(c)
1	$40 - \frac{4}{3}F_s = 25$	20	$-\frac{4}{3}$	$\frac{4}{3}$
2	$30 - F_s = 18.75$	15	-1	1
3	$-50 + \frac{5}{3}F_s = -31.25$	25	$\frac{5}{3}$	$-\frac{5}{3}$
4	30	15	0	1
5	0	20	0	0

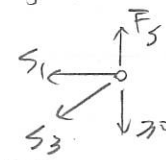


①. 判別靜不定度,  $R_e = 1$ . 取  $F_s$  為贅力 求各桿內力

$$R_b = [(30)(20) - (F_s)(20)] \times \frac{1}{15} = 40 - \frac{4}{3}F_s$$

$$a_x = 40 - \frac{4}{3}F_s$$

$$a_y = 30 - F_s$$



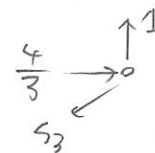
$$S_3 \times \frac{4}{5} = -(40 - \frac{4}{3}F_s)$$

$$\Rightarrow S_3 = -50 + \frac{5}{3}F_s$$

②. 施加 1 單位力 於 d 點

$$S_3 \times \frac{4}{5} = \frac{4}{3}$$

$$\Rightarrow S_3 = \frac{4}{3} \times \frac{5}{4} = \frac{5}{3}$$



③. 依 5 個條件

$$\Delta_{d,v} = -\frac{F_s}{25} = \frac{1}{AE} \left[ (40 - \frac{4}{3}F_s)(20)(12)(-\frac{4}{3}) \right.$$

$$+ (30 - F_s)(15)(12)(-1)$$

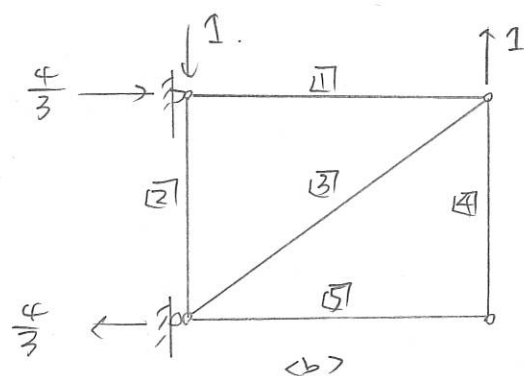
$$+ (-50 + \frac{5}{3}F_s)(25)(12)(\frac{5}{3}) \left. \right]$$

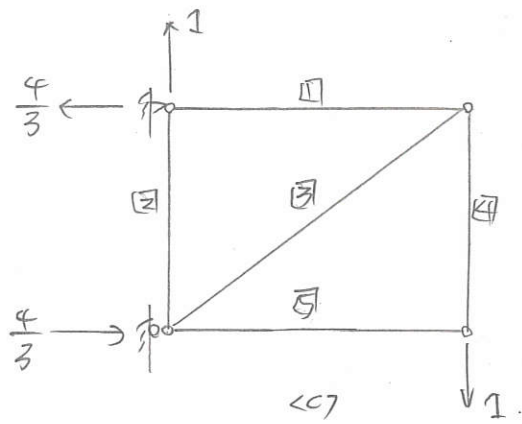
$$= \frac{1}{2 \times 30 \times 10^3} \left[ -12800 + \frac{12800}{3}F_s - 9400 + 180F_s \right.$$

$$\left. - 25000 + \frac{25000}{3}F_s \right]$$

$$= \frac{1}{60000} \left[ -43200 + 1440F_s \right]$$

$$\Rightarrow F_s = \frac{43200}{3840} = \frac{45}{4} = 11.25 \text{ kips}$$





④ 施力、單位力  $\leq C$  桌.

$$\Delta_c = \frac{1}{9E} \left[ (25)(20)(12)\left(\frac{4}{3}\right) + (18.75)(15)(12)(1) \right. \\ \left. + (-31.25)\left(-\frac{5}{3}\right)(25)(12) + (30)(15)(12)(1) \right] \\ = \frac{32400}{2 \times 30 \times 10^3} \\ = 0.54 \text{ in } (\downarrow).$$

$$= 0.54 \text{ in } (\downarrow)$$

正確為  $C_v = 0.423 \text{ in (d)}$