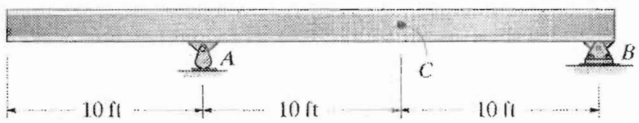
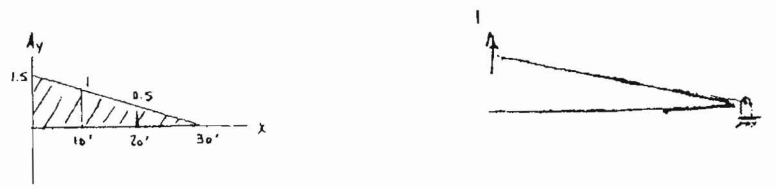
6–5. Draw the influence line for (a) the vertical reaction at A, (b) the shear at C, and (c) the moment at C. Solve this problem using the basic method of Sec. 6–1.

6–6. Solve Prob. 6–5 using Müller-Breslau's principle.



a)

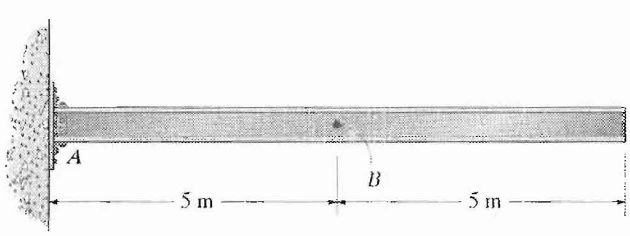


b)

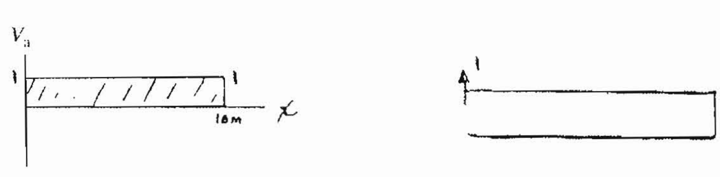
c)

6–7. Draw the influence lines for (a) the shear at the fixed support A, and (b) the moment at B.

***6–8.** Solve Prob. 6–7 using Müller-Breslau's principle.



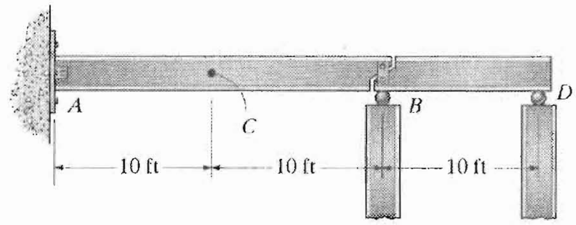
a)

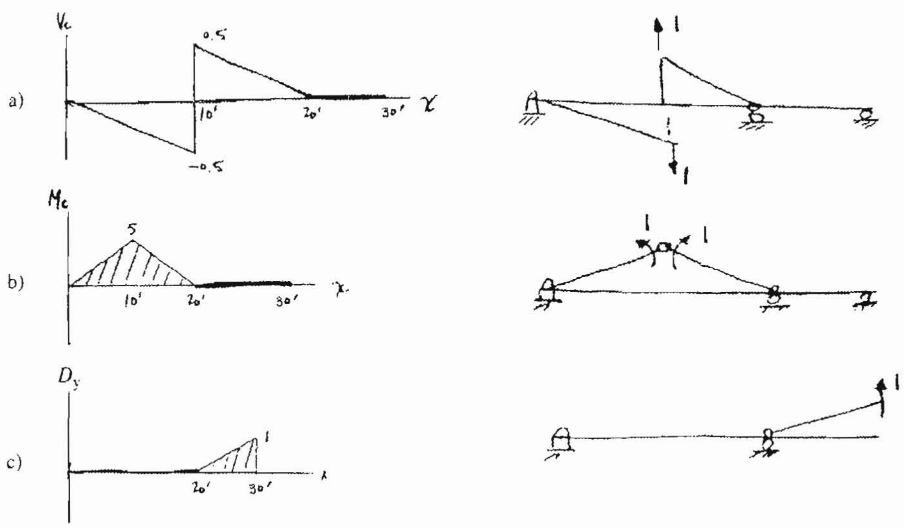


b)

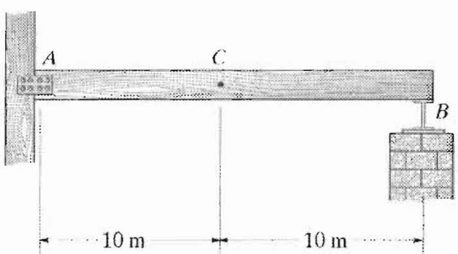
6–17. Draw the influence lines for (a) the shear at C, (b) the moment at C, and (c) the vertical reaction at D. Indicate numerical values for the peaks. There is a short vertical link at B, and A is a pin support. Solve this problem using the basic method of Sec. 6–1.

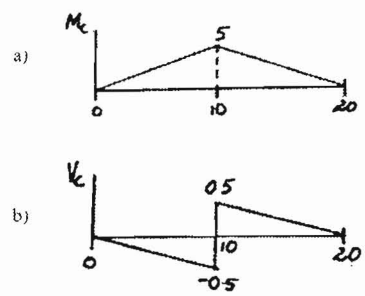
6–18. Solve Prob. 6–17 using Müller-Breslau's principle.





6–19. The beam supports a uniform dead load of 500 N/m and single live concentrated force of 3000 N. Determine (a) the maximum positive moment that can be developed at point C, and (b) the maximum positive shear that can be developed at point C. Assume the support at A is a pin and B is a roller.

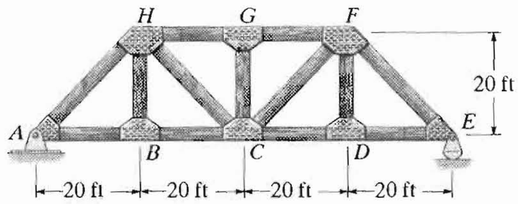


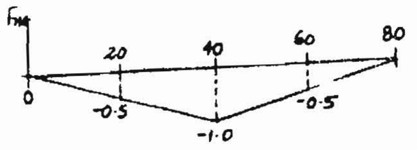


$$(M_C)_{max} = 500\left(\frac{1}{2}\right)(5)(20) + 3000(5)$$
$$= 40\,000 \text{ N}\cdot\text{m} = 40.0 \text{ kN}\cdot\text{m} \qquad \text{Ans}$$

$$(V_C)_{max} = 500\left(\frac{1}{2}\right)(0.5)(10) + 3000(0.5) - 500\left(\frac{1}{2}\right)(0.5)(10)$$
$$= 1500 \text{ N} = 1.50 \text{ kN} \qquad \text{Ans}$$

6–51. Draw the influence line for the force in member *HG*, then determine the maximum live force (tension or compression) that can be developed in this member due to a uniform live load of 800 lb/ft that acts on the bridge deck along the bottom cord of the truss.

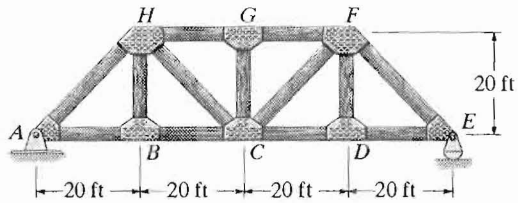




$(F_{HG})_{max(C)} = (0.8)\left(\frac{1}{2}\right)(-1.0)(80) = -32.0\text{ k} = 32.0\text{ k (C)}$ **Ans**

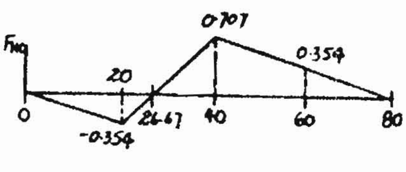
$(F_{HG})_{max(T)} = 0$ **Ans**

***6–52.** Draw the influence line for the force in member *HC*, then determine the maximum live force (tension or compression) that can be developed in this member due to a uniform live load of 800 lb/ft that acts on the bridge deck along the bottom cord of the truss.

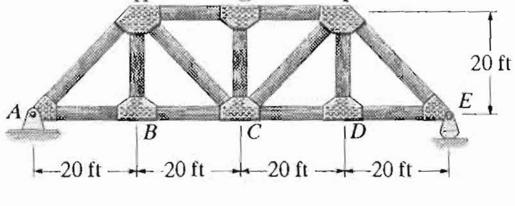


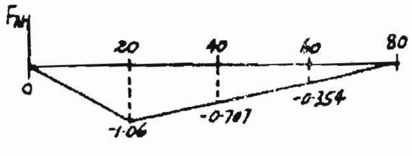
$(F_{HC})_{max(T)} = 0.8\left(\frac{1}{2}\right)(0.7071)(53.333) = 15.1\text{ k (T)}$ **Ans**

$(F_{HC})_{max(C)} = 0.8\left(\frac{1}{2}\right)(-0.3536)(26.67) = -3.77\text{ k} = 3.77\text{ k (C)}$ **Ans**



6–53. Draw the influence line for the force in member *AH*, then determine the maximum live force (tension or compression) that can be developed in this member due to a uniform live load of 800 lb/ft that acts on the bridge deck along the bottom cord of the truss.

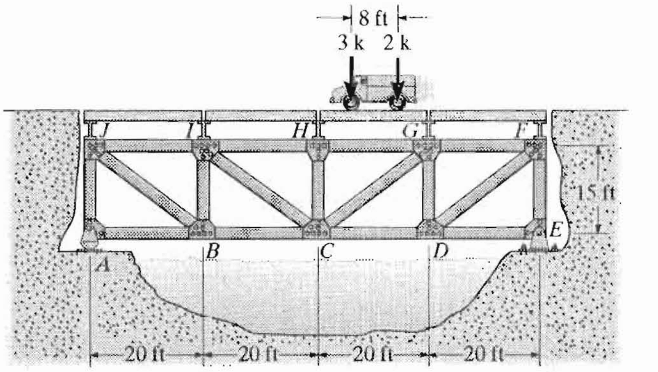


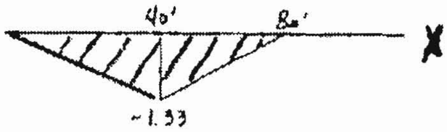


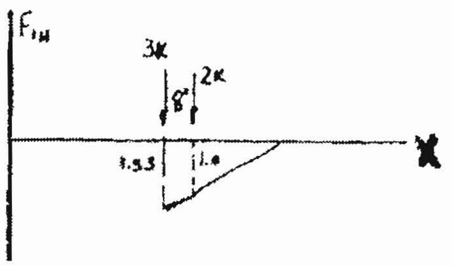
$(F_{AH})_{max(C)} = (0.8)\left(\frac{1}{2}\right)(-1.061)(80) = -33.9\text{ k} = 33.9\text{ k (C)}$ **Ans**

$(F_{AH})_{max(T)} = 0$ **Ans**

6–67. Draw the influence line for the force in member *IH* of the bridge truss. Compute the maximum live force (tension or compression) that can be developed in the member due to a 5-k truck having the wheel loads shown. Assume the truck can travel in *either direction* along the *center* of the deck, so that half the load shown is transferred to each of the two side trusses. Also assume the members are pin connected at the gusset plates.

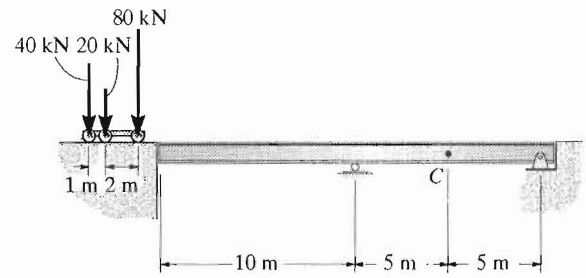


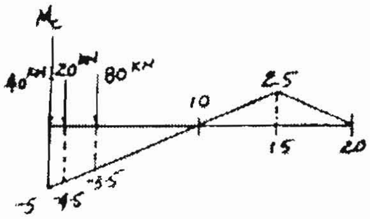




$$(F_{IH})_{max} = \frac{3(1.33) + 2(1.00)}{2} = 3.00\ \text{k (C)}$$ **Ans**

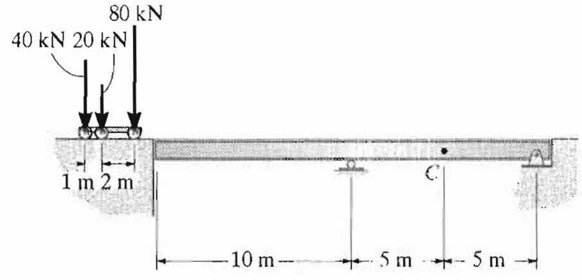
***6–68.** Determine the maximum live moment at *C* caused by the moving loads.

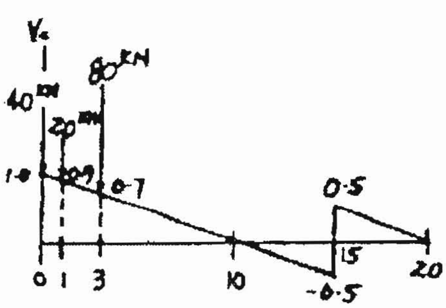




$$(M_C)_{max} = (40)(-5) + 20(-4.5) + 80(-3.5) = -570\ \text{kN}\cdot\text{m}$$ **Ans**

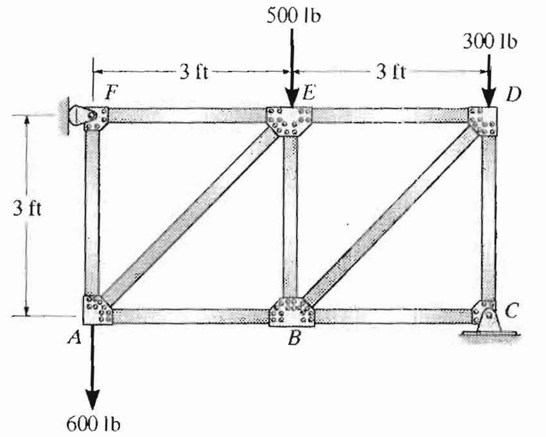
6–69. Determine the maximum live shear at *C* caused by the moving loads.

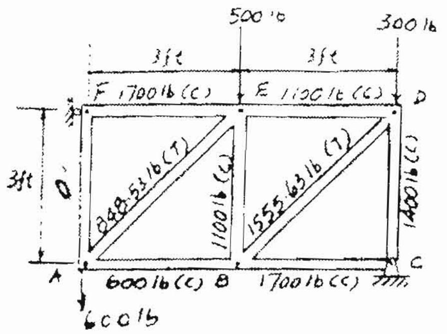


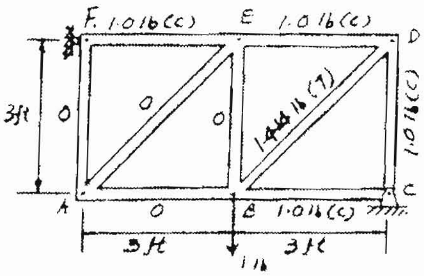


$$(V_C)_{max} = (40)(1) + 20(0.9) + 80(0.7) = 114\ \text{kN}$$ **Ans**

9–11. Determine the vertical displacement of the truss at joint B. Assume all members are pin connected at their end points. Take $A = 0.5\ \text{in}^2$ and $E = 29(10^3)$ ksi for each member. Use the method of virtual work.





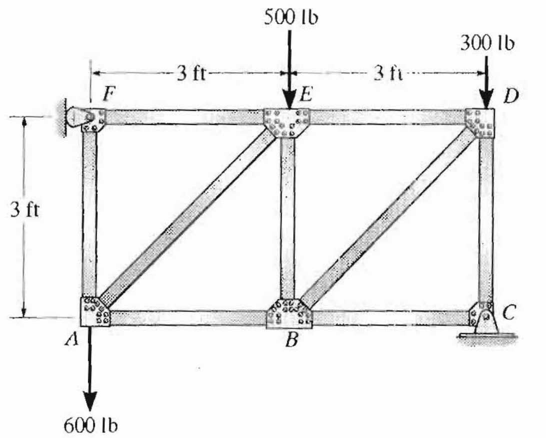


$$\Delta_{B_v} = \Sigma\frac{nNL}{AE} = \frac{1}{AE}[1.414(1555.6)(4.243) + (-1.00)(-1700)(3) + (-1.00)(-1400)(3)$$

$$+ (-1.00)(-1100)(3) + (-1.00)(-1700)(3)]\,(12) = \frac{27\,034(12)}{0.5(29)(10^6)}$$

$$= 0.0224 \text{ in.} \qquad \textbf{Ans}$$

***9–12.** Solve Prob. 9–11 using Castigliano's theorem.



$$\Delta_{B_v} = \Sigma N\left(\frac{\partial N}{\partial P}\right)\frac{L}{AE} = \frac{1}{AE}[(-600)(0)(3) + (848.5)(0)(4.243)$$

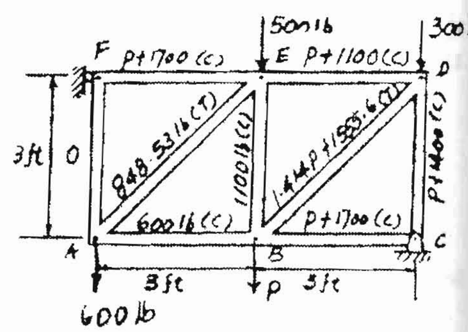
$$+ (-1100)(0)(3) + (1.414P + 1555.6)(1.414)(4.243)$$

$$+(-(P + 1700))(-1)(3) + (-(P + 1400))(-1)(3)$$

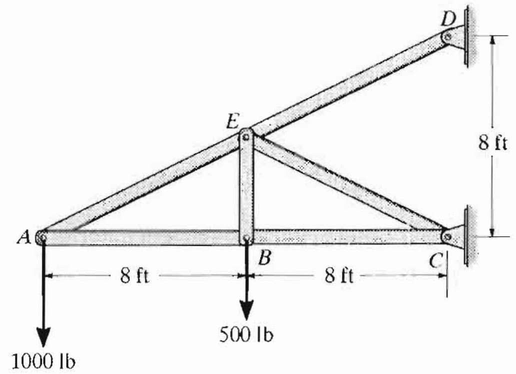
$$+ (-(P + 1100))(-1)(3) + (-(P + 1700))(-1)(3)$$

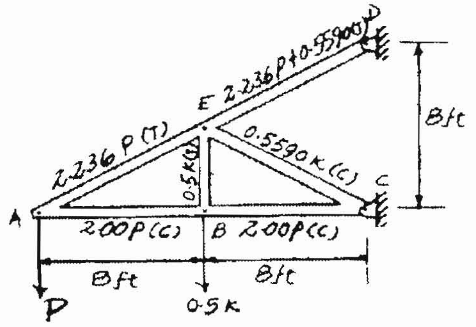
Set $P = 0$ and evaluate

$$\Delta_{B_v} = \frac{27034(12)}{0.5(29)(10^6)} = 0.0224 \text{ in.} \quad \textbf{Ans}$$



9–27. Solve Prob. 9–26 using Castigliano's theorem.



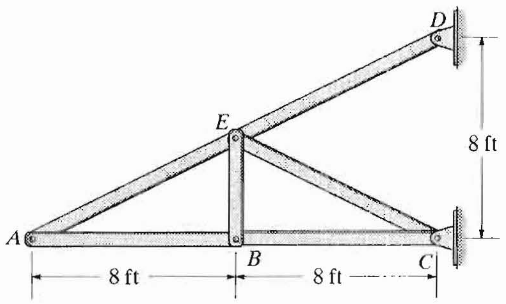


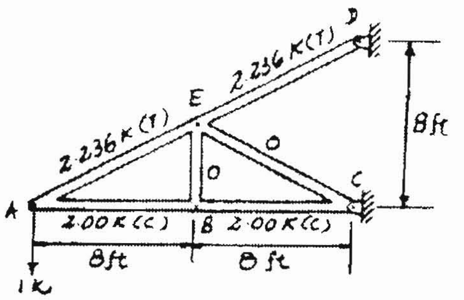
$$\Delta_{A_v} = \Sigma N\left(\frac{\partial N}{\partial P}\right)\frac{L}{AE} = \frac{1}{AE}[-2P(-2)(8) + (2.236P)(2.236)(8.944) + (-2P)(-2)(8)$$
$$+ (2.236P + 0.5590)(2.236)(8.944)](12)$$

Set $P = 1$ and evaluate

$$\Delta_{A_v} = \frac{164.62(12)}{(2)(29)(10^3)} = 0.0341 \text{ in.}$$

***9–28.** Remove the loads on the truss in Prob. 9-26 and determine the vertical displacement of joint A if members AB and BC experience a temperature increase of $\Delta T = 200°\text{F}$. Take $A = 2 \text{ in}^2$ and $E = 29(10^3)$ ksi. Also, $\alpha = 6.60(10^{-6})/°\text{F}$.

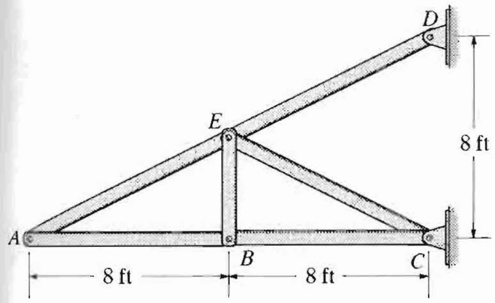


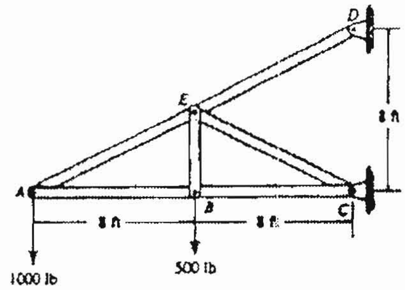


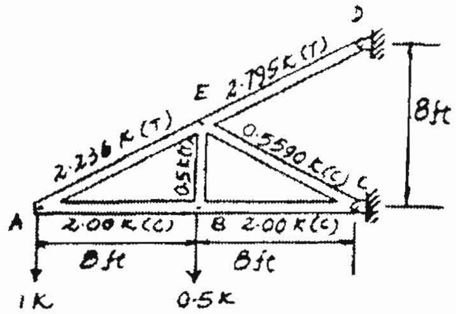
From Prob. 9.26

$$\Delta_{A_v} = \Sigma n\alpha\Delta TL = (-2)(6.60)(10^{-6})(200)(8)(12) + (-2)(6.60)(10^{-6})(200)(8)(12)$$
$$= -0.507 \text{ in.} = 0.507 \text{ in.} \uparrow \qquad \textbf{Ans}$$

9–29. Remove the loads on the truss in Prob. 9–26 and determine the vertical displacement of joint A if member AE is fabricated 0.5 in. too short.





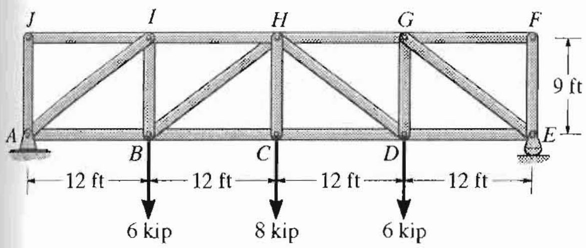


From Prob. 9-26

$$\Delta_{A_v} = \Sigma n\Delta L = (2.236)(-0.5)$$

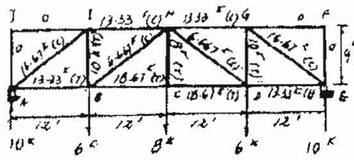
$$= -1.12 \text{ in.} = 1.12 \text{ in.} \uparrow \qquad \textbf{Ans}$$

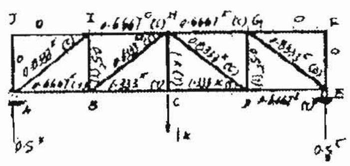
9–30. Use the method of virtual work and determine the vertical displacement of joint C. Take $E = 29(10^3)$ ksi. Each steel member has a cross-sectional area of 4.5 in^2.



member	N	n	L	nNL
AJ	0	0	108	0
AI	-16.67	-0.8333	180	2500
AB	13.33	0.6667	144	1280
BI	10.0	0.500	108	540
BH	-6.667	-0.8333	180	1000
BC	18.67	1.333	144	3584
CH	8.00	1.00	108	864
CD	18.67	1.334	144	3584
DH	-6.667	-0.8333	180	1000
DG	10.00	0.50	108	540
DE	13.33	0.6667	144	1280
EG	-16.67	-0.8333	180	2500
EF	0	0	108	0
FG	0	0	144	0
GH	-13.33	-0.6667	144	1280
HI	-13.33	-0.6667	144	1280
IJ	0	0	144	0

Σ 21232





$$1 \cdot \Delta_{C_v} = \Sigma \frac{nNL}{AE}$$

$$\Delta_{C_v} = \frac{21\,232}{4.5\,(29\,(10^3))} = 0.163 \text{ in.} \qquad \textbf{Ans}$$