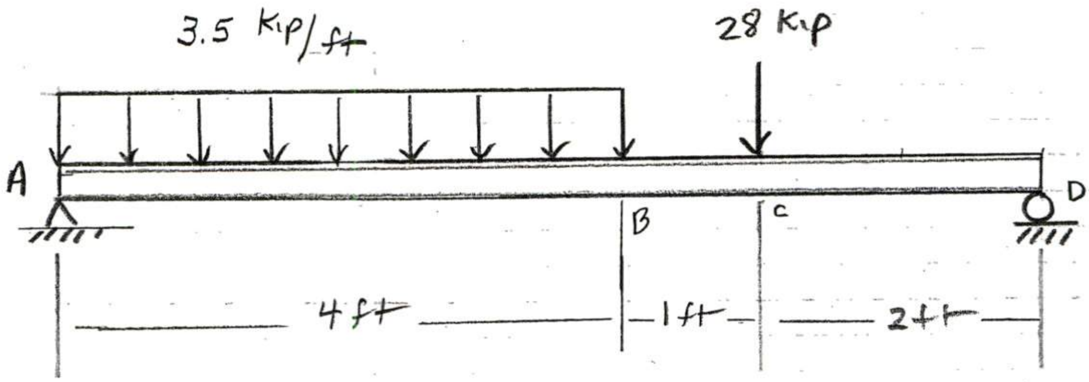
Show all work for full credit. You may work with ONE other person. One page of notes (Front & Back). Tables. Algebra and Trig Cheat Sheets.

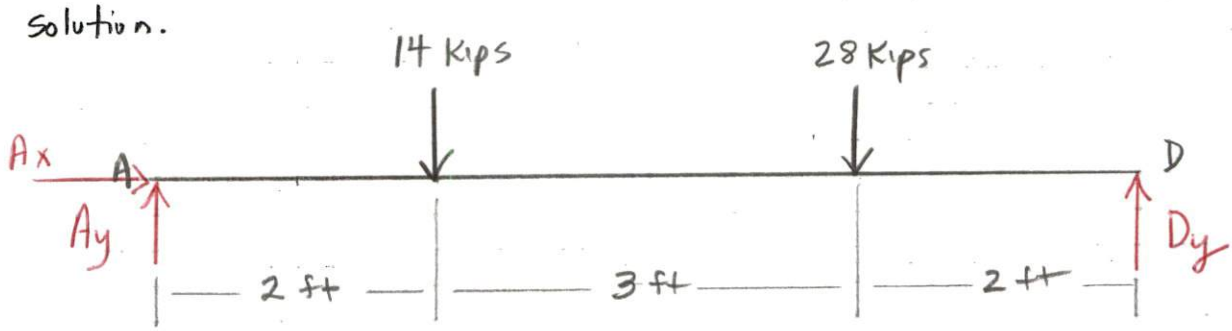
Due: End of Class Today

Name: Solution

1. Determine the reactions at the supports A and D. Draw the Loading, Shear, and Bending Moment diagrams on the following page. Locate the section with zero shear force and determine the bending moment at that section.



Solution.



FBD – Entire Beam

Equilibrium Equations

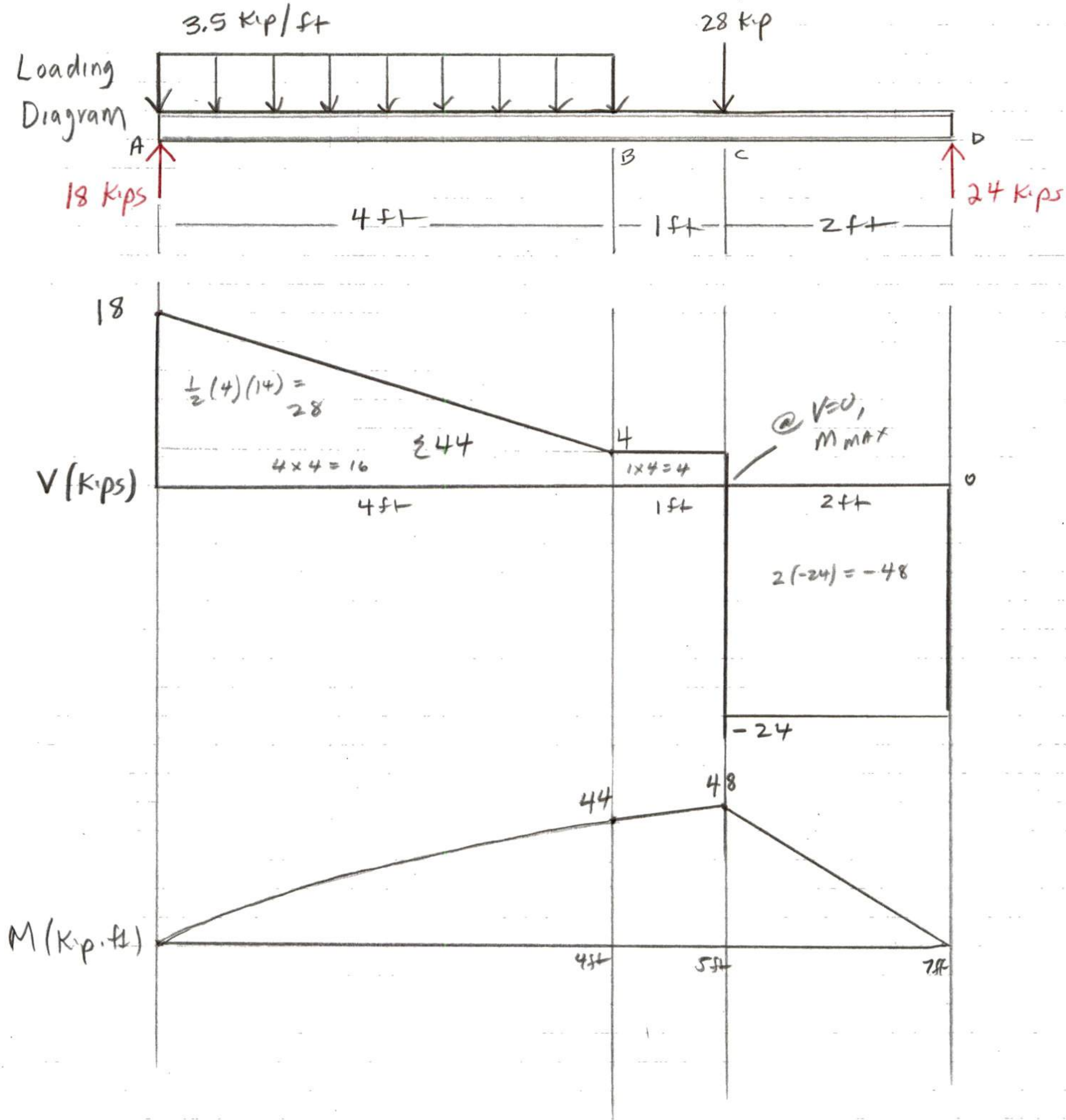
$[\Sigma F_x = 0]$ $\quad A_x = 0$

$+\circlearrowleft [\Sigma M_A = 0]$ $\quad -14 \text{ Kips}(2\text{ ft}) - 28 \text{ kips}(5\text{ ft}) + D_y(7\text{ ft}) = 0$

$$D_y = \frac{168 \text{ Kip}\cdot\text{ft}}{7\text{ ft}} = 24 \text{ Kip} \uparrow$$

$[\Sigma F_y = 0]$ $\quad A_y - 14 \text{ Kips} - 28 \text{ Kips} + D_y = 0$

$$A_y = 42 \text{ Kips} - 24 \text{ Kips} = 18 \text{ Kips} \uparrow$$



3.5 Kip/ft
28 Kip
Loading Diagram
A
B
C
D
18 Kips
24 Kips
4 ft
1 ft
2 ft
18
½(4)(14) = 28
Σ44
4
4×4=16
1×4=4
@ V=0, M MAX
V (Kips)
0
4 ft
1 ft
2 ft
2(-24) = -48
-24
44
48
M (Kip·ft)
4ft
5ft
7ft

2. A 4-in x 6-in nominal size rectangular beam has a 25-ft simple span. The beam is subjected a 2 lb/ft uniform load applied to the entire span and a concentrated load P at midspan. Determine the maximum value of P for an allowable deflection of L/240. E = 1.3 x 10^3 ksi

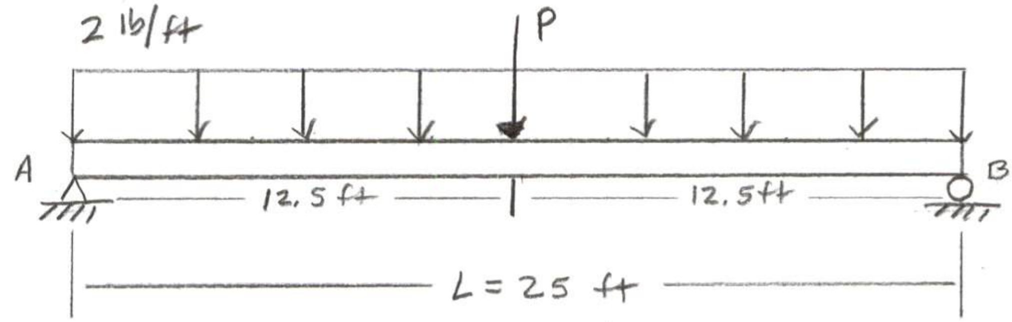


Table A-6(A)

4x6 $I = 48.5 \text{ in}^4$

$L = 25 \text{ ft} \times \frac{12 \text{ in}}{\text{ft}} = 300 \text{ in}$

$w = 2 \text{ lb/ft}$

$E = 1300 \text{ ksi}$

$\delta_{allow} = \frac{L}{240} = \frac{300 \text{ in}}{240} = 1.25 \text{ in}$

Table 16-1, Case 5 and Case 7 (Superposition)

$$\delta_{allow} = \delta_{MAX} = \frac{PL^3}{48EI} + \frac{5wL^4}{384EI} = 1.25 \text{ in}$$

$$P = \left[1.25 \text{ in} - \frac{5wL^4}{384EI}\right]\frac{48EI}{L^3}$$

$$= \left[1.25 \text{ in} - \frac{5(2 \text{ lb/ft})\left(\frac{\text{kip}}{1000 \text{ lb}}\right)\left(\frac{\text{ft}}{12 \text{ in}}\right)(300 \text{ in})^4}{384(1300 \text{ ksi})(48.5 \text{ in}^4)}\right]\frac{48(1300 \text{ ksi})(48.5 \text{ in}^4)}{(300 \text{ in})^3}$$

(6750 000; 24 211 200; 3 026 400)

$$= (1.25 \text{ in} - 0.279 \text{ in})(0.112 \text{ kip/in})$$

$$= 0.971 \text{ in}(0.112 \text{ kip/in})$$

$$= 0.109 \text{ kip}$$

$$= 109 \text{ lb}$$