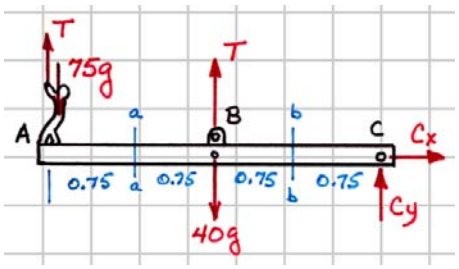
1-56

Next, from a free-body diagram of the man standing on the beam, the equations of equilibrium give



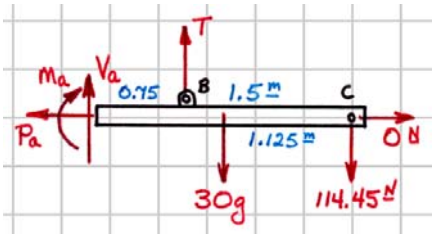
$$\rightarrow \Sigma F_x = 0: \qquad C_x = 0$$

$$\uparrow \Sigma F_y = 0: \qquad T - 75(9.81) + T - 40(9.81) + C_y = 0$$

$$\circlearrowleft \Sigma M_C = 0: \quad 3\left[75(9.81)\right] + 1.5\left[40(9.81)\right] - 3T - 1.5T = 0$$

$$T = 621.300 \text{ N} \qquad C_y = -114.450 \text{ N}$$

Next, draw a free-body diagram of the portion of the beam between section *a–a* and the right end of the beam. Note that since one-fourth of the beam has been "cut away," only three-fourths of the total beam weight is included on the free-body diagram. The equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \qquad -P_a + 0 = 0$$

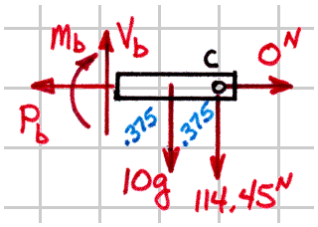
$$\uparrow \Sigma F_y = 0: \qquad V_a + (621.3) - 30(9.81) - 114.450 = 0$$

$$\circlearrowleft \Sigma M_a = 0: \quad -M_a + 0.75(621.3) - 1.125\left[30(9.81)\right] - 2.25(114.450) = 0$$

$P_a = 0$ N ..... $V_a = -213$ N ..... **Ans.**

$M_a = -122.6$ N·m ..... **Ans.**

Finally, draw a free-body diagram of the portion of the beam between section *b–b* and the right end of the beam. This time three-fourths of the beam has been "cut away" and only one-fourth of the total beam weight is included on the free-body diagram. The equations of equilibrium give



$$\rightarrow \Sigma F_x = 0: \qquad -P_b + 0 = 0$$

$$\uparrow \Sigma F_y = 0: \qquad V_b - 10(9.81) - 114.450 = 0$$

$$\circlearrowleft \Sigma M_b = 0: \quad -M_b - 0.375\left[10(9.81)\right] - 0.75(114.450) = 0$$

$P_b = 0$ N ..... $V_b = 213$ N ..... **Ans.**

$M_b = -122.6$ N·m ..... **Ans.**

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