PROBLEM 5.67
For the beam and loading shown, determine (a) the magnitude and location of the resultant of the distributed load, (b) the reactions at the beam supports.

SOLUTION

(a) \( R_1 = \frac{1}{3}(1100 \text{ N/m})(6 \text{ m}) = 2200 \text{ N} \)

\( R_{\text{II}} = (900 \text{ N/m})(6 \text{ m}) = 5400 \text{ N} \)

\( R = R_1 + R_{\text{II}} = 2200 + 5400 = 7600 \text{ N} \)

\[ XR = \Sigma x R: \quad X(7600) = (2200)(1.5) + (5400)(3) \]

\[ X = 2.5658 \text{ m} \]

\( R = 7.60 \text{ kN} \quad X = 2.57 \text{ m} \)

(b) \( \Sigma M_A = 0: \quad B(6 \text{ m}) - (7600 \text{ N})(2.5658 \text{ m}) = 0 \)

\[ B = 3250.0 \text{ N} \]

\( B = 3.25 \text{ kN} \uparrow \)

\( \Sigma F_y = 0: \quad A + 3250.0 \text{ N} - 7600 \text{ N} = 0 \)

\[ A = 4350.0 \text{ N} \]

\( A = 4.35 \text{ kN} \uparrow \)
PROBLEM 5.69

Determine the reactions at the beam supports for the given loading.

SOLUTION

\[ R_1 = \frac{1}{2} (50 \text{ lb/in.})(12 \text{ in.}) \]
\[ = 300 \text{ lb} \]
\[ R_\Pi = (50 \text{ lb/in.})(20 \text{ in.}) \]
\[ = 1000 \text{ lb} \]

\[ + \sum F_y = 0: \quad A_y - 300 \text{ lb} - 1000 \text{ lb} + 400 \text{ lb} = 0 \]

\[ A = 900 \text{ lb} \uparrow \]

\[ + \sum M_A = 0: \quad M_A - (300 \text{ lb})(8 \text{ in.}) - (1000 \text{ lb})(22 \text{ in.}) + (400 \text{ lb})(38 \text{ in.}) = 0 \]

\[ M_A = 9200 \text{ lb} \cdot \text{in.} \uparrow \]
PROBLEM 5.76

Determine the reactions at the beam supports for the given loading when \( w_0 = 400 \text{ lb/ft} \).

SOLUTION

\[ R_1 = \frac{1}{2} w_0 (12 \text{ ft}) = \frac{1}{2} (400 \text{ lb/ft})(12 \text{ ft}) = 2400 \text{ lb} \]

\[ R_\Pi = \frac{1}{2} (300 \text{ lb/ft})(12 \text{ ft}) = 1800 \text{ lb} \]

\[ \Sigma M_B = 0: \quad (2400 \text{ lb})(1 \text{ ft}) - (1800 \text{ lb})(3 \text{ ft}) + C(7 \text{ ft}) = 0 \]

\[ C = 428.57 \text{ lb} \]

\[ \Sigma F_y = 0: \quad B + 428.57 \text{ lb} - 2400 \text{ lb} - 1800 \text{ lb} = 0 \]

\[ B = 3771 \text{ lb} \]

\[ C = 429 \text{ lb} \]

\[ B = 3770 \text{ lb} \]
PROBLEM 5.78

The beam \( AB \) supports two concentrated loads and rests on soil that exerts a linearly distributed upward load as shown. Determine the values of \( \omega_A \) and \( \omega_B \) corresponding to equilibrium.

SOLUTION

\[
R_I = \frac{1}{2} \omega_A (1.8 \text{ m}) = 0.9 \omega_A
\]
\[
R_B = \frac{1}{2} \omega_B (1.8 \text{ m}) = 0.9 \omega_B
\]

\[
\sum M_D = 0: \quad (24 \text{ kN})(1.2 - a) - (30 \text{ kN})(0.3 \text{ m}) - (0.9 \omega_A)(0.6 \text{ m}) = 0 \tag{1}
\]

For \( a = 0.6 \text{ m} \),
\[
24(1.2 - 0.6) - (30)(0.3) - 0.54 \omega_A = 0
\]
\[
14.4 - 9 - 0.54 \omega_A = 0 \quad \omega_A = 10.00 \text{ kN/m} \quad \text{v}
\]

\[
\sum F_y = 0: \quad -24 \text{ kN} - 30 \text{ kN} + 0.9(10 \text{ kN/m}) + 0.9 \omega_B = 0 \quad \omega_B = 50.0 \text{ kN/m} \quad \text{v}
\]