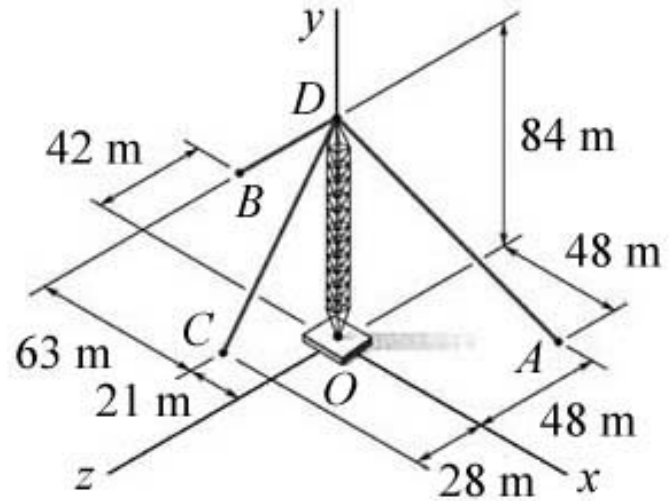A tower OD is guyed with three cables as shown. If the resultant force exerted by these cables on the tower at D is $\mathbf{R} = -45.8\mathbf{j}$ kN, determine the tension in each cable.

$$A(48,0,-48) \text{ m} \qquad B(-84,0,-42) \text{ m} \qquad C(-21,0,28) \text{ m}$$

$$D(0,84,0) \text{ m} \qquad\qquad \mathbf{R} = -45.8\mathbf{j} \text{ kN}$$

$$\overrightarrow{DA} = 48\mathbf{i} - 84\mathbf{j} - 48\mathbf{k}, \ \overline{DA} = 108, \ \mathbf{F}_{DA} = \frac{F_{DA}}{9}(4\mathbf{i} - 7\mathbf{j} - 4\mathbf{k}) \ \text{②}$$

$$\overrightarrow{DB} = -84\mathbf{i} - 84\mathbf{j} - 42\mathbf{k}, \ \overline{DB} = 126, \ \mathbf{F}_{DB} = \frac{F_{DB}}{3}(-2\mathbf{i} - 2\mathbf{j} - \mathbf{k}) \ \text{②}$$

$$\overrightarrow{DC} = -21\mathbf{i} - 84\mathbf{j} + 28\mathbf{k}, \ \overline{DC} = 91, \ \mathbf{F}_{DC} = \frac{F_{DC}}{13}(-3\mathbf{i} - 12\mathbf{j} + 4\mathbf{k}) \ \text{②}$$

Since $\mathbf{F}_{DA} + \mathbf{F}_{DB} + \mathbf{F}_{DC} = -45.8\mathbf{j}$, ① we write

i: $\quad \dfrac{4}{9}F_{DA} - \dfrac{2}{3}F_{DB} - \dfrac{3}{13}F_{DC} = 0 \qquad\qquad | \quad \dfrac{11}{9}F_{DA} + \dfrac{9}{13}F_{DC} = 45.8$

j: $\quad -\dfrac{7}{9}F_{DA} - \dfrac{2}{3}F_{DB} - \dfrac{12}{13}F_{DC} = -45.8 \quad | \quad \dfrac{1}{9}F_{DA} - \dfrac{20}{13}F_{DC} = -45.8$

k: $\quad -\dfrac{4}{9}F_{DA} - \dfrac{1}{3}F_{DB} + \dfrac{4}{13}F_{DC} = 0 \qquad\qquad | \qquad \dfrac{229}{13}F_{DC} = 549.6$

Thus, we obtain

$$\boxed{F_{DA} = 19.8 \text{ kN}} \qquad \boxed{F_{DB} = 2.4 \text{ kN}} \qquad \boxed{F_{DC} = 31.2 \text{ kN}} \quad \text{③}$$