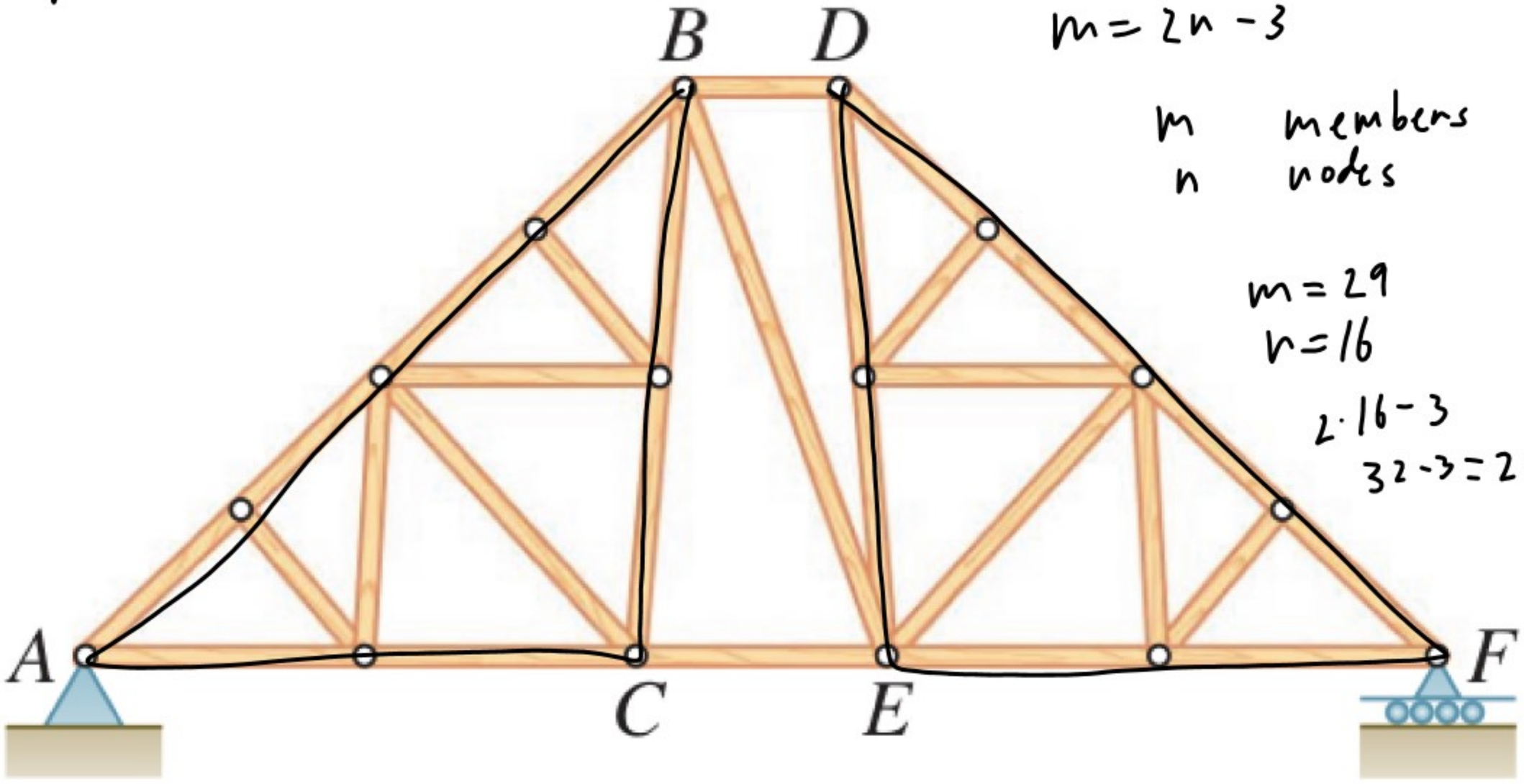
Compound trusses



$m = 2n - 3$

m members
n nodes

$m = 29$
$n = 16$

$2 \cdot 16 - 3$
$32 - 3 = 29$ ✓

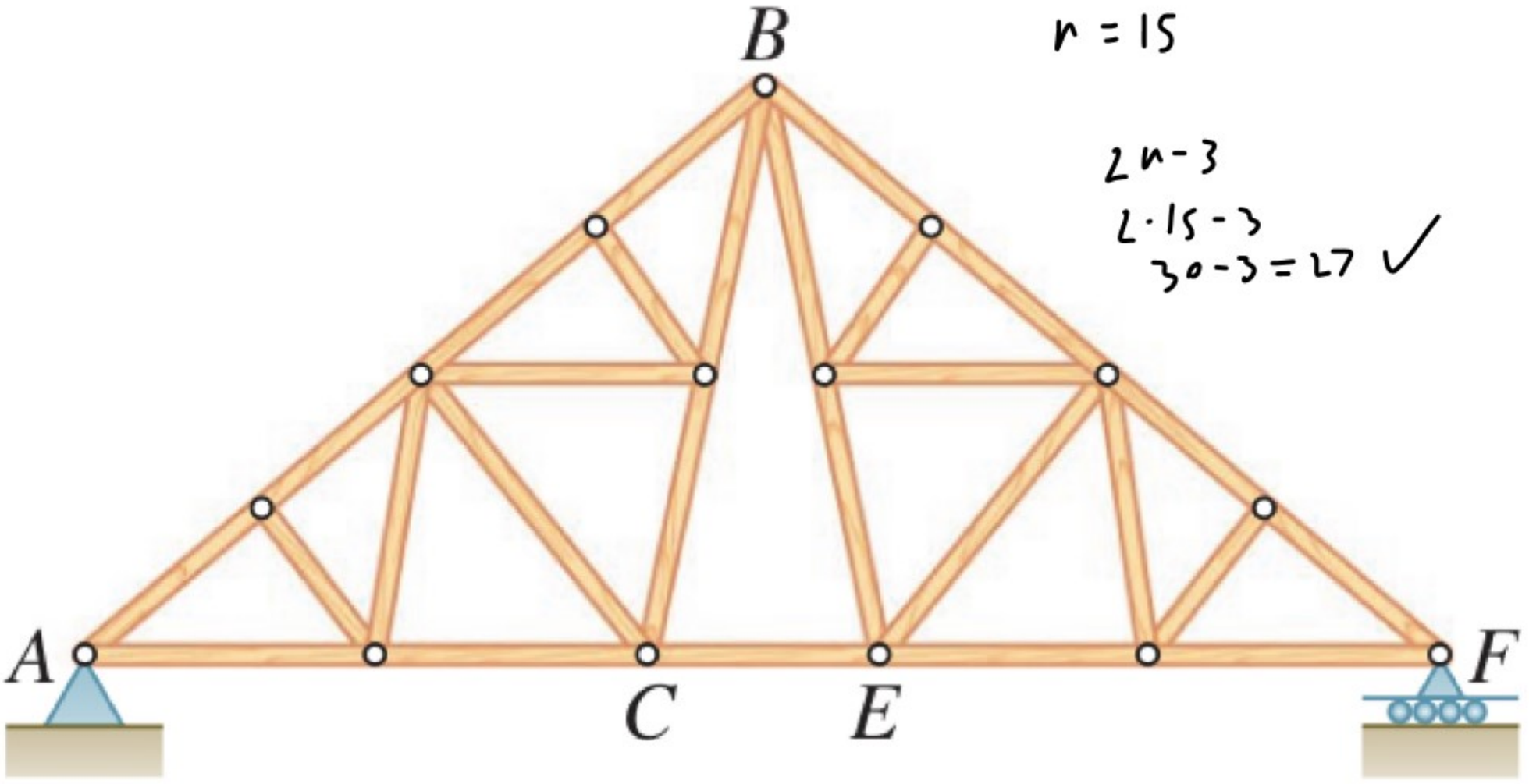
$m = 27$

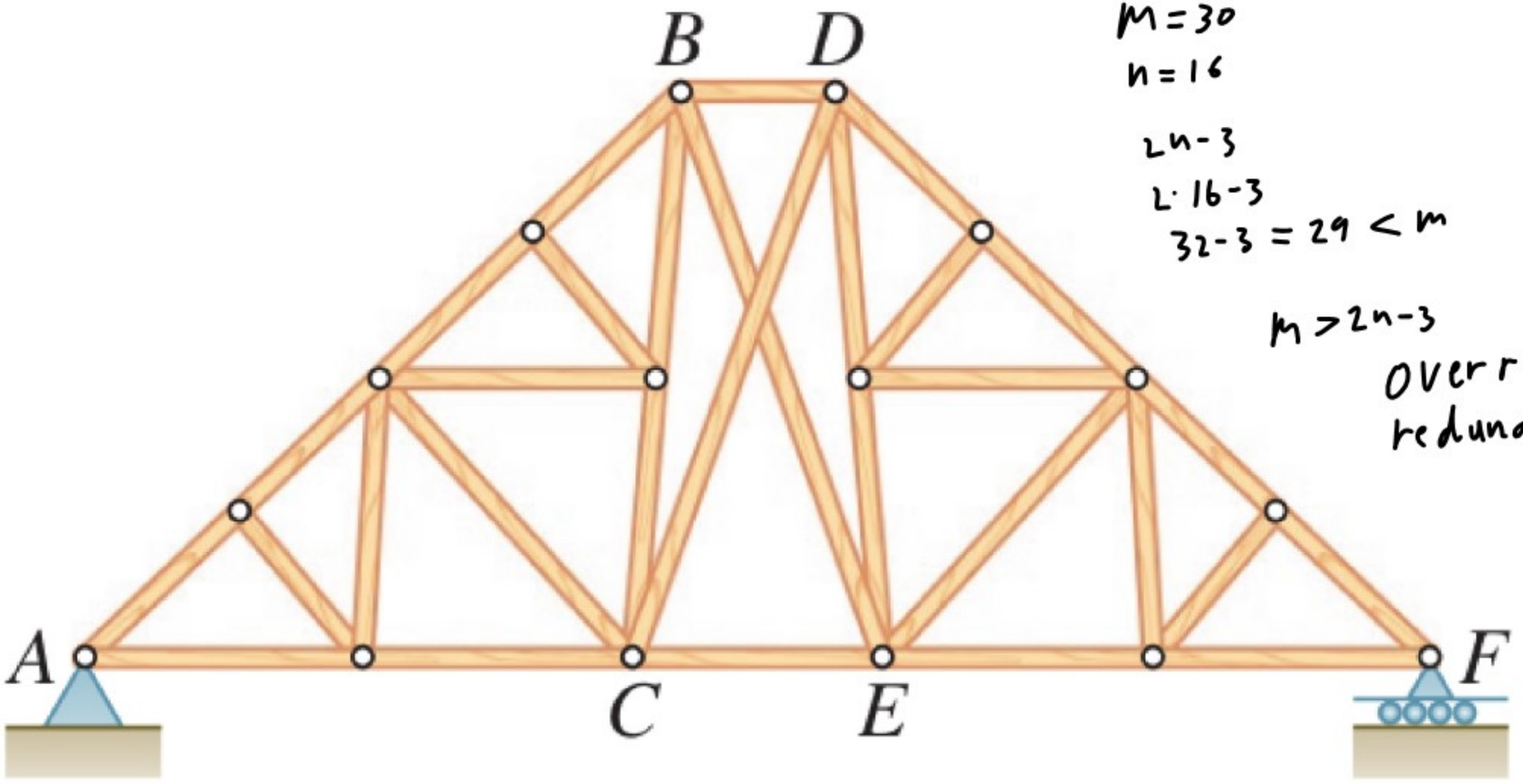
$n = 15$

$2n - 3$

$2 \cdot 15 - 3$

$30 - 3 = 27$ ✓





$m = 30$

$n = 16$

$2n - 3$

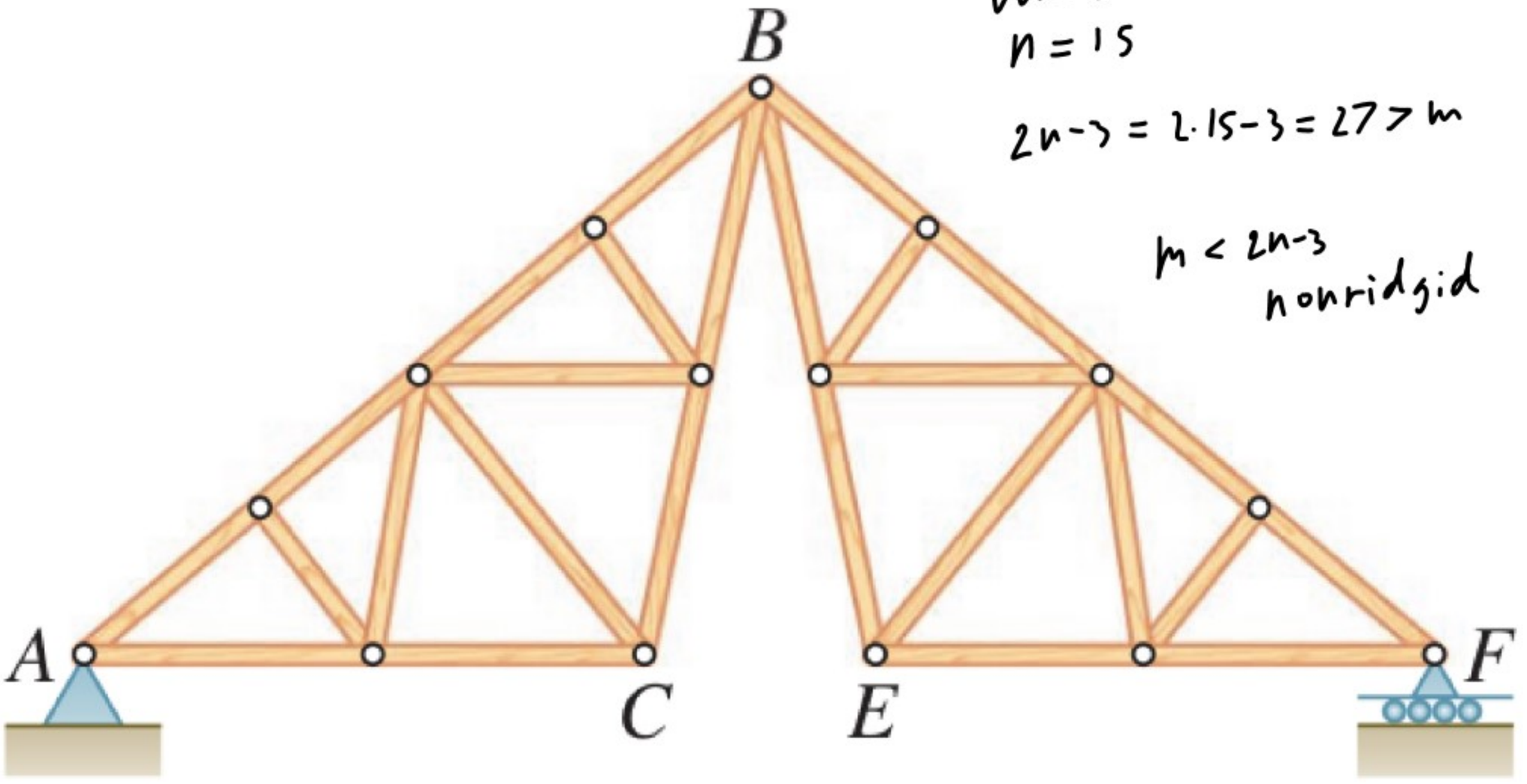
$2 \cdot 16 - 3$

$32 - 3 = 29 < m$

$m > 2n - 3$

overridgid

redundant



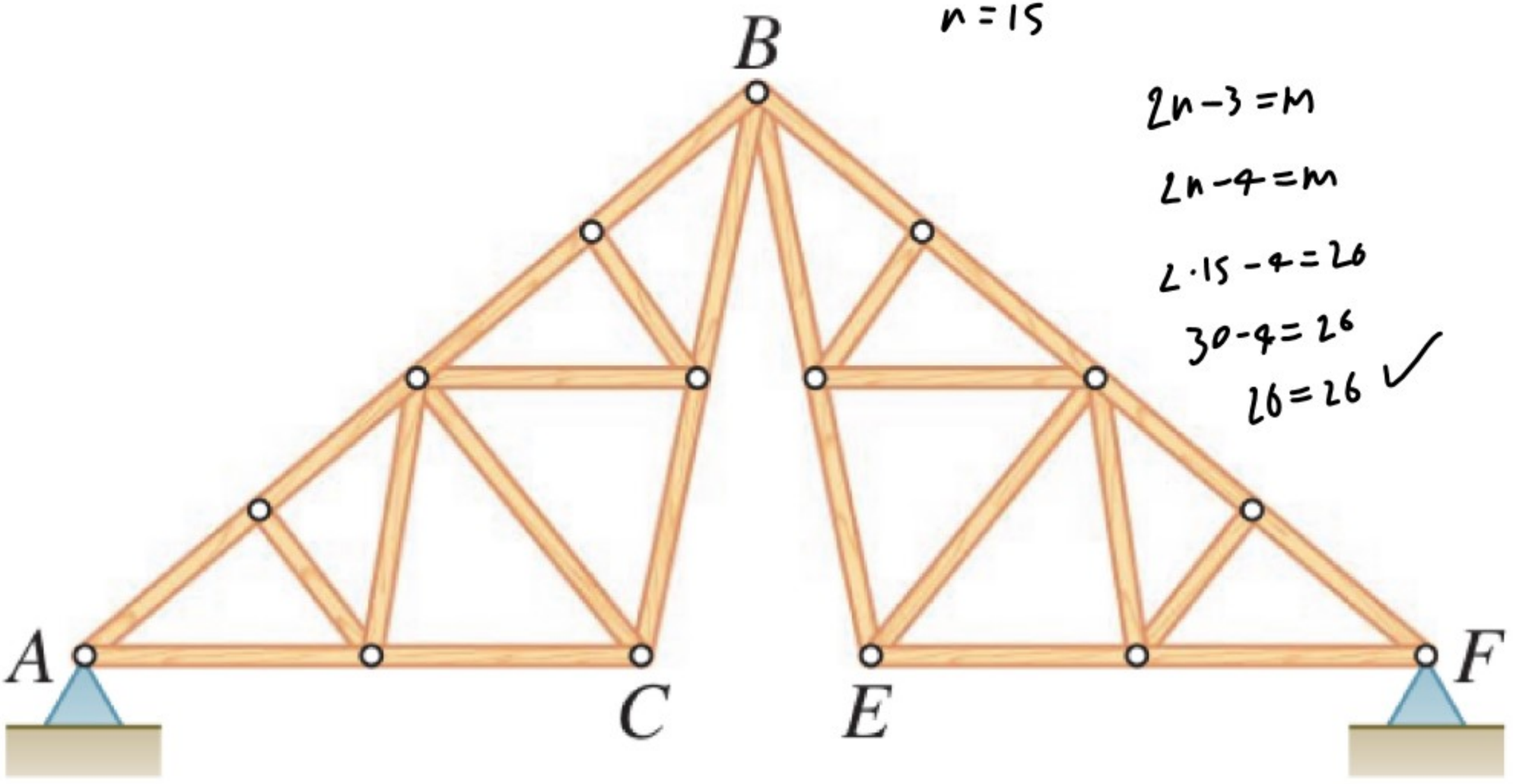
$m = 26$

$n = 15$

$2n-3 = 2 \cdot 15 - 3 = 27 > m$

$m < 2n-3$

nonridgid



$m = 26$

$n = 15$

$2n - 3 = m$

$2n - 4 = m$

$2 \cdot 15 - 4 = 26$

$30 - 4 = 26$

$26 = 26$ ✓

$M = r F_{AB} \sin\theta$

3.13 and 3.14 It is known that the connecting rod AB exerts on the crank BC a 2.5-kN force directed down and to the left along the centerline of AB. Determine the moment of the force about C.

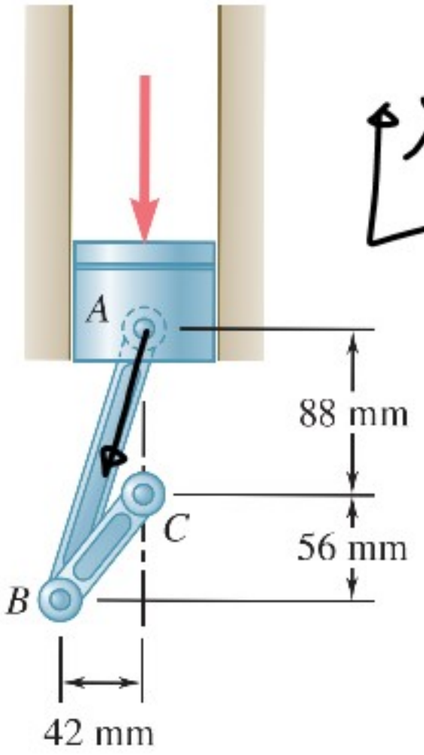


Fig. P3.14

$F_{ABy} = 2.5$

$\vec{F}_{AB} = -0.73\,i - 2.5\,j$

$\vec{r} = -.42\,i - .56\,j$ $\quad \vec{M}_C = \vec{r} \times \vec{F}_{AB}$

$\vec{AB} = -.42\,i - .149\,j$

$AB = \sqrt{.42^2 + .149^2} = .150$

$\lambda = \frac{-.42}{.150} i - \frac{.149}{.150} j$

$F_{AB} = \frac{F_{ABy}}{\lambda_y} = \frac{2.5}{-.149/.150} = 2.6 \text{ kN}$

$F_{ABx} = F_{AB} \lambda_x = 2.6 \frac{-.42}{.150}$

$= -0.73 \text{ kN}$

$$\vec{r} \cdot \overrightarrow{AB} = r\,AB\cos\theta$$

$$\frac{\vec{r} \cdot \overrightarrow{AB}}{r \cdot AB} = \cos\theta$$

$$\cos^{-1}\left(\frac{\vec{r} \cdot \overrightarrow{AB}}{r \cdot AB}\right) = \theta$$

$\vec{r} = -42i - 56j$

$\overrightarrow{AB} = -42i - 144j$

$AB = 150$

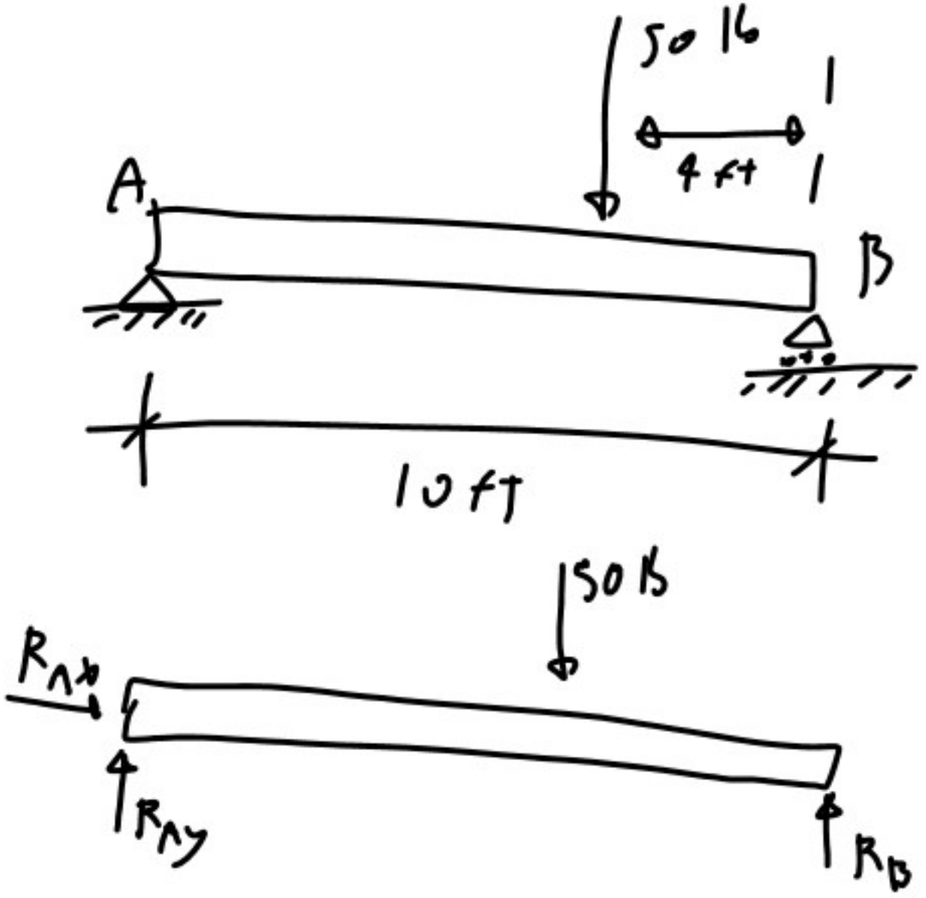
$r = \sqrt{42^2 + 56^2} = 70$

$\vec{r} \cdot \overrightarrow{AB} = -42(-42) - 56(-144) = 9828$

$$\cos^{-1}\left(\frac{9828}{70 \cdot 150}\right) = \cos^{-1}(0.936) = 20.6^\circ$$

$M = Fd$

Find reaction at B



$$\Sigma F_x = R_{Ax} = 0$$

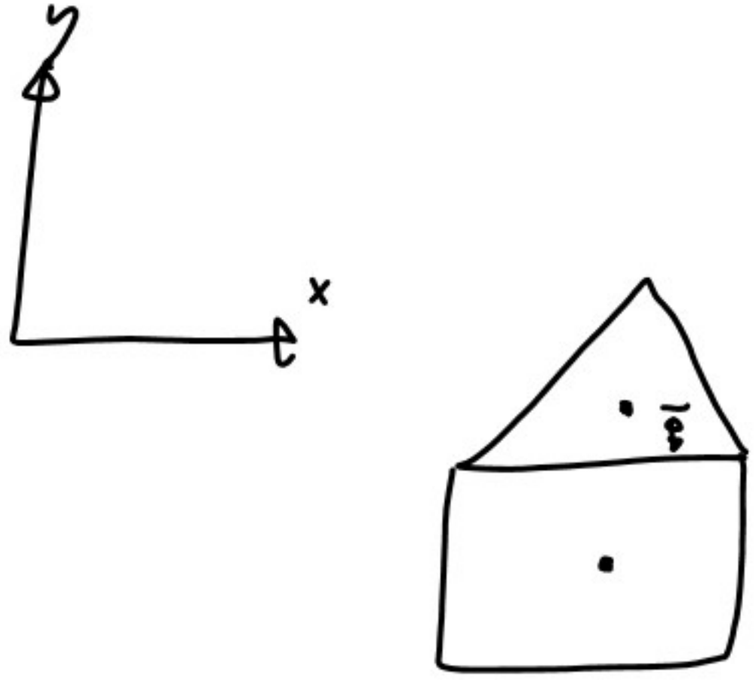
$$\Sigma F_y = R_{Ay} + R_B - 50 = 0$$

$$\Sigma M_A = R_{Ax} \cdot 0 + R_{Ay} \cdot 0$$

$$-50 \cdot 6 + R_B \cdot 10 = 0$$

$$-50 \cdot 6 + R_B \cdot 10 = 0$$

Centroids



Unit Vectors

Tension in cable T_{AB} $\overrightarrow{AB}$

$\vec{\lambda}$ in the direction of $\overrightarrow{AB}$

$$T_{ABx} = T_{AB}\lambda_x$$

$$\sum F_x = 0$$

$$\sum F_y = 0$$

⋮