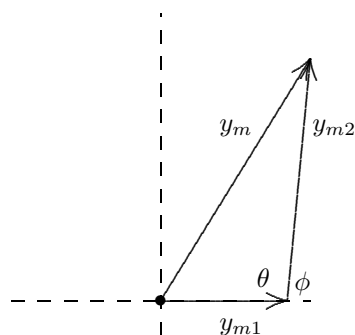


30. The phasor diagram is shown below. We use the cosine theorem:

$$y_m^2 = y_{m1}^2 + y_{m2}^2 - 2y_{m1}y_{m2} \cos \theta = y_{m1}^2 + y_{m2}^2 + 2y_{m1}y_{m2} \cos \phi .$$



We solve for $\cos \phi$:

$$\begin{aligned} \cos \phi &= \frac{y_m^2 - y_{m1}^2 - y_{m2}^2}{2y_{m1}y_{m2}} \\ &= \frac{(9.0 \text{ mm})^2 - (5.0 \text{ mm})^2 - (7.0 \text{ mm})^2}{2(5.0 \text{ mm})(7.0 \text{ mm})} \\ &= 0.10 . \end{aligned}$$

The phase constant is therefore $\phi = 84^\circ$.