3rd

$\rightarrow \cos(\theta - \varphi) = 0$

$\Rightarrow \varphi = \pi/2 + \theta \rightsquigarrow b = \sin\theta, \quad d = -\cos\theta$

$\varphi = 3\pi/2 + \theta \rightsquigarrow b = -\sin\theta, \quad d = \cos\theta$

So $A = \begin{pmatrix} \cos\theta & \sin\theta \\ \sin\theta & -\cos\theta \end{pmatrix}$ or $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$

reflection — rotation.

Generally:

Thm: $R_\alpha R_\beta = R_{\alpha+\beta}$

$R_\alpha M_\beta = M_{\alpha+\beta}$

$M_\alpha R_\beta = M_{\alpha-\beta}$

$M_\alpha M_\beta = R_{\alpha-\beta}$

How to show these?

Multiply the relevant matrices.

Classify:

- identity
- rotation
- reflection
- translation
- glide

$\cos(\theta \mp \varphi) = \cos\theta\cos\varphi \pm \sin\theta\sin\varphi$

$\sin(\theta \mp \varphi) = \sin\theta\cos\varphi \mp \cos\theta\sin\varphi$