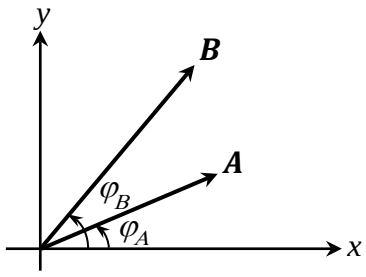
Problem 1-11) Define the xy-plane as the plane of the two vectors $\boldsymbol{A}$ and $\boldsymbol{B}$. Each vector has a magnitude and an orientation-angle in the xy-plane, that is,

$$\boldsymbol{A} = |\boldsymbol{A}|(\cos\varphi_A\,\hat{\boldsymbol{x}} + \sin\varphi_A\,\hat{\boldsymbol{y}}),$$
$$\boldsymbol{B} = |\boldsymbol{B}|(\cos\varphi_B\,\hat{\boldsymbol{x}} + \sin\varphi_B\,\hat{\boldsymbol{y}}).$$



Therefore,

$$\begin{aligned}\boldsymbol{A}\cdot\boldsymbol{B} &= A_xB_x + A_yB_y \\ &= |\boldsymbol{A}|\,|\boldsymbol{B}|(\cos\varphi_A\cos\varphi_B + \sin\varphi_A\sin\varphi_B) \\ &= |\boldsymbol{A}|\,|\boldsymbol{B}|\cos(\varphi_A - \varphi_B).\end{aligned}$$