Solutions to #4

$$\text{Pose}_B = \begin{bmatrix} 150 \\ 60 \\ -30^\circ \end{bmatrix}$$

Bomb at: $r_g = 215$ m. $\phi_g = -60^\circ$ } range & bearing

$$\begin{bmatrix} r \\ q \end{bmatrix}_B = \begin{bmatrix} r_g \cos(\phi_g) \\ r_g \sin(\phi_g) \end{bmatrix} = \begin{bmatrix} 107.5 \\ -180.1955 \end{bmatrix}$$

$$\begin{bmatrix} s \\ l \end{bmatrix}_{IR} = \underbrace{\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}}_{R} \begin{bmatrix} r \\ q \end{bmatrix}_B \quad ; \theta = -30^\circ$$

only rotation

$$= \begin{bmatrix} 0 \\ -215 \end{bmatrix} \Rightarrow$$ after rotation; now apply translation.

$$\begin{bmatrix} s \\ l \end{bmatrix}_{IRT} = \begin{bmatrix} 150 \\ 60 \end{bmatrix} + \begin{bmatrix} 0 \\ -215 \end{bmatrix} = \begin{bmatrix} 150 \\ -155 \end{bmatrix}$$

rotation + translation

Now convert the above to Robot A's axis.

First, apply the translation. Robot A's location

$$\begin{bmatrix} s \\ l \end{bmatrix}_I = \begin{bmatrix} s \\ l \end{bmatrix}_{IRT} - \begin{bmatrix} -175 \\ 90 \end{bmatrix} = \begin{bmatrix} 325 \\ -245 \end{bmatrix}$$

Apply reverse rotation $\Rightarrow$ $R^{-1} = R^{t}$

$$= \begin{bmatrix} \cos(\theta) & \sin(\theta) \\ -\sin(\theta) & \cos(\theta) \end{bmatrix}$$

$$= \begin{bmatrix} \cos(45^\circ) & \sin(45^\circ) \\ -\sin(45^\circ) & \cos(45^\circ) \end{bmatrix}$$ → Robot A's pose angle.

$$\begin{bmatrix} r \\ q \end{bmatrix}_A = R^{-1} \begin{bmatrix} s \\ l \end{bmatrix}_I = \begin{bmatrix} & \\ & \end{bmatrix} \begin{bmatrix} 325 \\ -245 \end{bmatrix}$$

$$= \begin{bmatrix} 56.5685 \\ -403.0509 \end{bmatrix}$$

this can be checked with straight trigonometry <u>BUT you cannot solve it that way</u>!

⇓

This can be further converted to a LIDAR reading for Robot A, if needed!