

## Bot aim

Given the bot's pose and the goal's pose, what should the bot's heading be to be able to score?

For brevity, call the bot's pose  $B$  and the goal's pose  $G$ . Then, our desired heading,  $\theta$ , is the angle at which the bot is *perpendicular* to the goal.



Since we want the angle to the horizontal, let  $P$  be the point with coordinates  $(G_x, B_y)$ , forming a right-angled triangle.



Hence, we can use trigonometry to find  $\theta$ :

$$\tan \theta = \frac{\text{Opp}}{\text{Adj}}$$

Then, calculate the length of the opposite, Opp, and the adjacent, Adj:

$$\begin{aligned} \text{Opp} &= |G_y - B_y| \\ \text{Adj} &= |G_x - B_x| \end{aligned}$$

Hence,

$$\theta = \arctan \left( \frac{|G_y - B_y|}{|G_x - B_x|} \right)$$

However, when  $B_x > G_x$ , then the heading must be corrected as  $180^\circ - \theta$ , since the triangle will be mirrored.