

**Week 1 Challenge Homework Solutions**

Deserted on a deserted Island you spot a slightly exposed tin can under a tree. Upon opening it you find it's instructions to a treasure. It reads: "Ten paces from this very tree in a direction twenty degrees south of west lies the first location. Ten paces from this very tree in a direction sixty degrees north of east lies the second location. Walk from this tree exactly the distance and direction you would walk from the first location to the second location and you will find ye treasure. Yar"

- (a) (a) What are the coordinates of treasure?
- (b) (b) Use a physical representation in conjunction with the *Related Quantities* sense-making technique to check the validity of your answer.

RELEVANT PHYSICS

$$\Delta \vec{r} = \vec{r}_f - \vec{r}_i$$

VECTORS

$$r_{1x} = -|\vec{r}_1| \cos \theta_1$$

$$= -10 \cos 20^\circ$$

$$r_{1y} = -|\vec{r}_1| \sin \theta_1$$

$$= -10 \sin 20^\circ$$

$$r_{1x} \approx -9.3969 \text{ PACES}$$

$$r_{1y} \approx -3.4202 \text{ PACES}$$

$$\vec{r}_1 = \langle -9.3969, -3.4202 \rangle \text{ PACES}$$

$$r_{2x} = |\vec{r}_2| \cos \theta_2$$

$$= 10 \cos 60^\circ$$

$$r_{2y} = |\vec{r}_2| \sin \theta_2$$

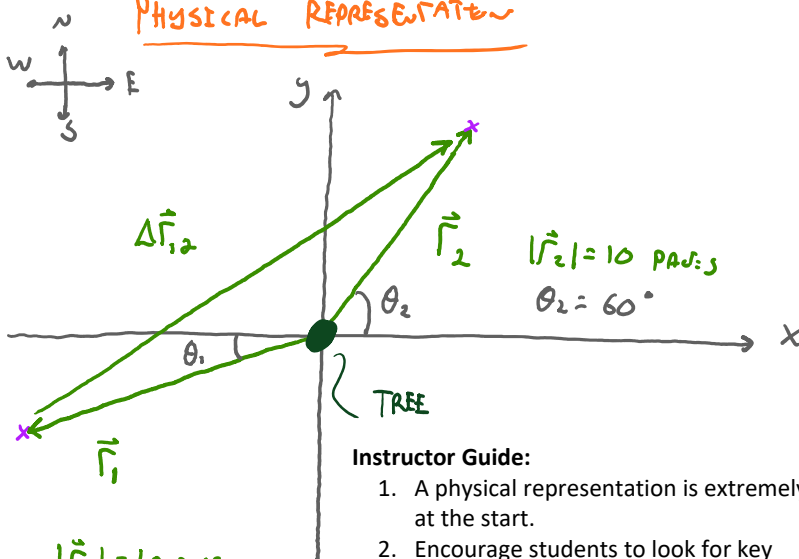
$$= 10 \sin 60^\circ$$

$$r_{2x} \approx 5 \text{ PACES}$$

$$r_{2y} \approx 8.6603 \text{ PACES}$$

$$\vec{r}_2 = \langle 5, 8.6603 \rangle \text{ PACES}$$

PHYSICAL REPRESENTATION



**Instructor Guide:**

1. A physical representation is extremely important at the start.
2. Encourage students to look for key words/quantities to help identify the relevant physics: here distances and directions are given, along with more than one location, so it might be related to the definition of displacement.

RELEVANT PHYSICS

$$\Delta \vec{r}_{1,2} = \vec{r}_2 - \vec{r}_1$$

MATH

$$\begin{aligned}\Delta \vec{r}_{12} &= \langle 5, 8.6603 \rangle - \langle -9.3969, -3.4202 \rangle \\ &= \langle 14.3969, 12.0805 \rangle \text{ PAGES}\end{aligned}$$

$$\Delta \vec{r}_{12} = \langle 14.4, 12.1 \rangle \text{ PAGES}$$

SO THE COORDINATES OF THE TREASURE FROM THE TREE  
ARE  $\langle 14.4, 12.1 \rangle$  PAGES

