

Dead Reckoning Travels

Name: __Answer Guide__

Lesson 18

Date: _____

Vocabulary

Dead Reckoning - a way to estimate the position of a ship based on its previous position and distance traveled

Vector - a quantity such as velocity that includes magnitude and direction, represented by an arrow

Speed - distance traveled divided by the time of travel

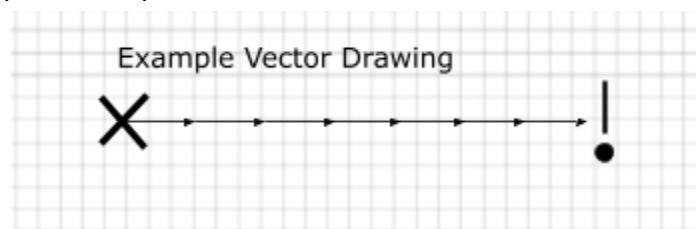
Activity 1

Voyage Vector Drawing

1

You'll be navigating the high seas and tracking your speed, position, and distance of travel using dead reckoning calculations. You can travel 373.3 nautical miles Southeast in **3 diagonal blocks** on the grid to reach your destination in your expected time.

- A. Your ship begins at the **X** marking.
- B. Draw connecting vectors showing the segments of travel to your destination. Vectors should be drawn as arrows.
- C. Draw an **!** at the spot where you will reach landfall.



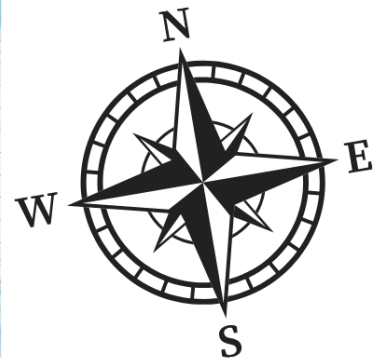
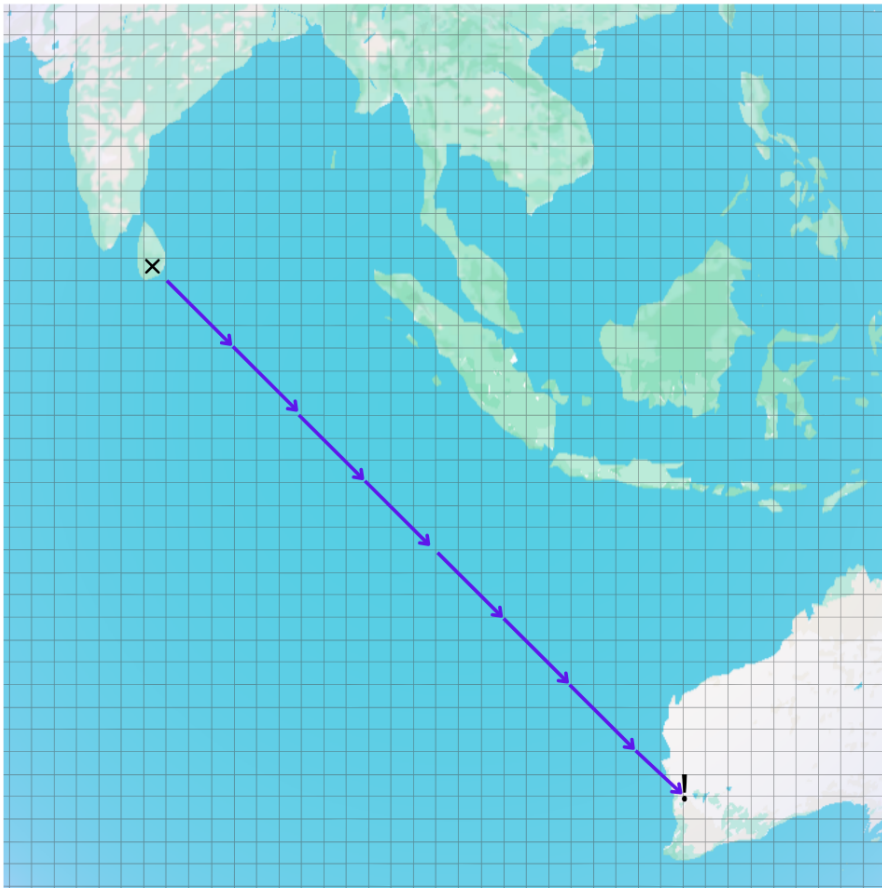
Orient your Ari to the compass provided on the navigation map with Ari set to the **On a Map** setting.

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2

If you are able to travel 373.3 nautical miles in 12 hours, calculate your speed of each segment of travel using the distance formula - **Distance = Speed x Time**.

Distance Formula Example

Distance = Speed x Time

$$100 \text{ nautical miles} = \text{Speed} \times 5 \text{ hours}$$

$$\frac{100 \text{ nautical miles}}{5 \text{ hours}} = \text{Speed}$$

$$20 \text{ nautical miles per hour} = \text{Speed}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$373.3 \text{ nautical miles} = \text{Speed} \times 12 \text{ hours}$$

$$\frac{373.3 \text{ nautical miles}}{12 \text{ hours}} = \text{Speed}$$

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12 hours

31.1 nautical miles per hour = Speed

3

Based on the quantity of vectors drawn in Part 1, calculate the total distance traveled and the total time of travel between the start and ending destinations.

Total Distance = Sum of Distance Segments

Total Distance = $373.3 + 373.3 + 373.3 + 373.3 + 373.3 + 373.3 + 373.3 + 373.3$

Total Distance = 2986.4 nautical miles

Total Time Traveled = Sum of Time Segments

Total Time Traveled = $12 + 12 + 12 + 12 + 12 + 12 + 12 + 12$

Total Time Traveled = 96 hours

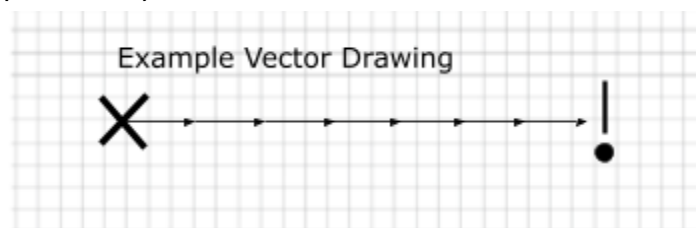
Activity 2

1

During your next voyage, you'll experience natural weather elements that will affect your navigation. Your vector drawing will reflect these changes.

Beginning at the **X** marking, you'll begin traveling East. You can travel 15 hours per square on the grid.

- D. After 30 hours, the *ocean currents* shift your course **2 blocks south**, after which time, you're able to regain your original course.
- E. After an additional 60 hours of travel, the *wind changes* dramatically tilting your course **3 diagonal blocks Northeast**.
- F. You're able to realign your course back to traveling East until you reach landfall.
- G. Draw connecting diagonal and straight vectors showing the segments of travel to your destination. Vectors should be drawn as arrows.
- H. Draw an **!** at the spot where you will reach landfall.



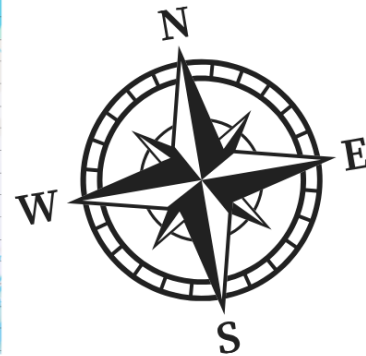
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2

If you are traveling at a rate of 5 nautical miles per hour every 15 hours, calculate the distance that you travel during that time. Calculate your Distance of each segment of travel using the distance formula: **Distance = Speed x Time.**

Distance Formula Example

Distance = Speed x Time

Distance = 21 nautical miles per hour x 3 hours

Distance = 63 nautical miles

Distance = Speed x Time

Distance = 5 nautical miles per hour x 14 hours

Distance = 70 nautical miles

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3

Based on the quantity and length of vectors drawn in Part 1, calculate the total distance traveled and the total time of travel between the start and ending destinations.

Total Distance = Sum of Squares Traveled

Total Distance = $75 + 75 + 75 + 75 + 75 + 75 + 75 + 75 + 75 + 75 + 75 + 75 + 75$

Total Distance = 1050 nautical miles

Total Time Traveled = Sum of Time Segments

Total Time Traveled = $15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 + 15$

Total Time Traveled = 210 hours

Exit Ticket

Please respond to the following prompts.

1. Aside from environmental factors mentioned in Activity 2, what other factors do you believe could affect a ship's navigation?

A ship could be rerouted or have to change their course based on other ships' courses and availability of waterways. In addition to other waterway traffic, ships could be deterred by any issues with their vessel or weather events other than wind.

2. What other tools and equipment could be used to perform similar dead reckoning calculations to the ones calculated in Activity 1 and Activity 2?

Global positioning systems (GPS) can be used to help navigate and plot courses as well as to determine distances traveled and expected time of arrival at a destination. When a GPS stops working, a captain would need to rely on dead reckoning calculations.