



2.11.2 Project: Performance Task: The Parallax

Project **Problem**

Geometry Sem 1

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Points possible: 120

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The Scenario: You're looking for a sponsor to pay for you to participate in a sailboat race. Now that you've solved the parallax problem, use the same skills you used there to write a proposal that shows that you can win the race.



The Project: Use the information provided in the performance task to estimate your travel costs and to calculate your average speed and the speed of last year's winner. Use the questions below to help you gather information to write your proposal.

Part I: Your City (8 points)

1. Which city did you pick and why? (2 points)

I picked San Francisco because driving and hotel expenses are the cheapest.

2. What is one common boating hazard in this city? **(2 points)**

There is lots of shipping traffic.

3. What are your total travel expenses? **(4 points:** 2 points for airfare/hotel. 1 point for total)

Total travel expenses are \$1750.

Part II: Your Boat (10 points)

1. Which boat did you choose and why? **(2 points)**

I chose the Catamaran because it has the fastest race time in San Francisco.

2. What is one advantage of your boat? **(2 points)**

The 2 thin hulls reduce drag and increase power from the sail.

3. What is one disadvantage of your boat? **(2 points)**

It is harder to steer and turn.

4. For the city and boat you picked above, what were the speeds of your last three races (in knots)? (**2 points**)

5.6, 10.5, and 10.5.

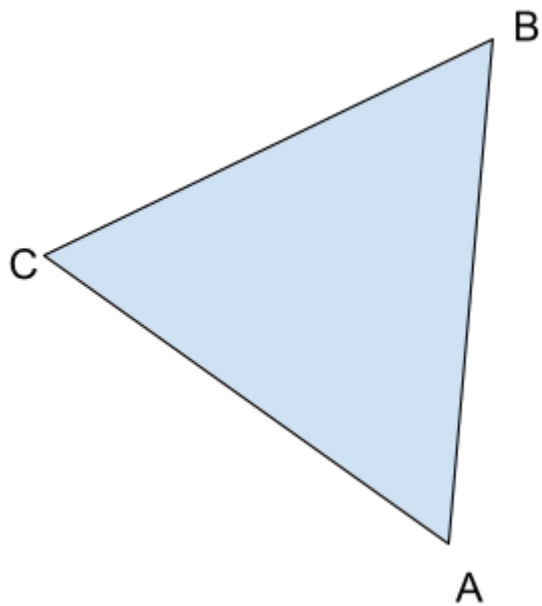
5. What is your average race speed? (**2 points**)

8.9 knots.

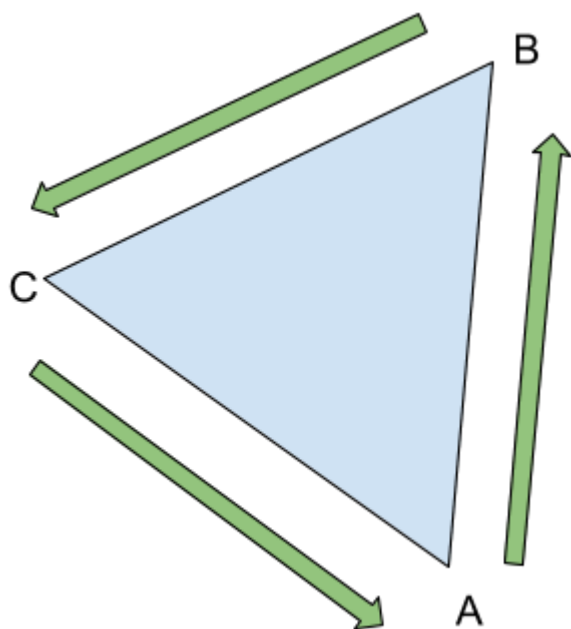


Part III: The Olympic Triangle (22 points)

1. Draw a sketch of the short course triangle below, labeling the points *A*, *B*, and *C*. Don't draw it on your master map yet! (**3 points**)



2. Draw the arrows to represent your path along the course. (3 points)



3. Where do you start? **(3 points)**

Point A.

4. What are the measures for angles B and C ? **(3 points)**

60 degrees.

5. What is the measure for angle A ? **(3 points)**

60 degrees.

6. What do you know about the distance between each buoy? **(3 points)**

The distances are unknown.

7. The wind is blowing opposite to leg AB . Given the fact that you're traveling in a wind-powered boat, which leg of the course will take you the longest? Why? **(4 points)**

Leg AB will take the longest because the wind is blowing in the opposite direction.



Part IV: Last year's winner (17 points)

1. What was the winning time of last year's race for your city and boat? (**2 points**, one for each leg)
16.25 minutes.

2. Do you know how fast last year's winner was traveling? (**2 points**)

No.

3. What information do you need to know in order to calculate last year's winning speed? (**2 points**)

Length of the race.

4. What is the *definition* of a knot when referring to boat speeds? (**2 points**)

A knot is one nautical mile per hour, or 6076 feet.

5. How many feet are in a nautical mile? (**2 point**)

6076 feet.

6. If you are traveling at 1 knot, how many feet per minute are you traveling? Remember that there are 60 minutes in an hour. Round to the nearest foot. (**4 points**: 3 points for setting up the problem, 1 for the answer)

$$6076/60=101$$

101 feet per minute.

7. You will use this number to calculate your speed. If you travel 1000 feet in 5 minutes, what is your speed in knots? (**3 points**: 1 point for finding the speed in feet/min, 1 point for converting to knots)

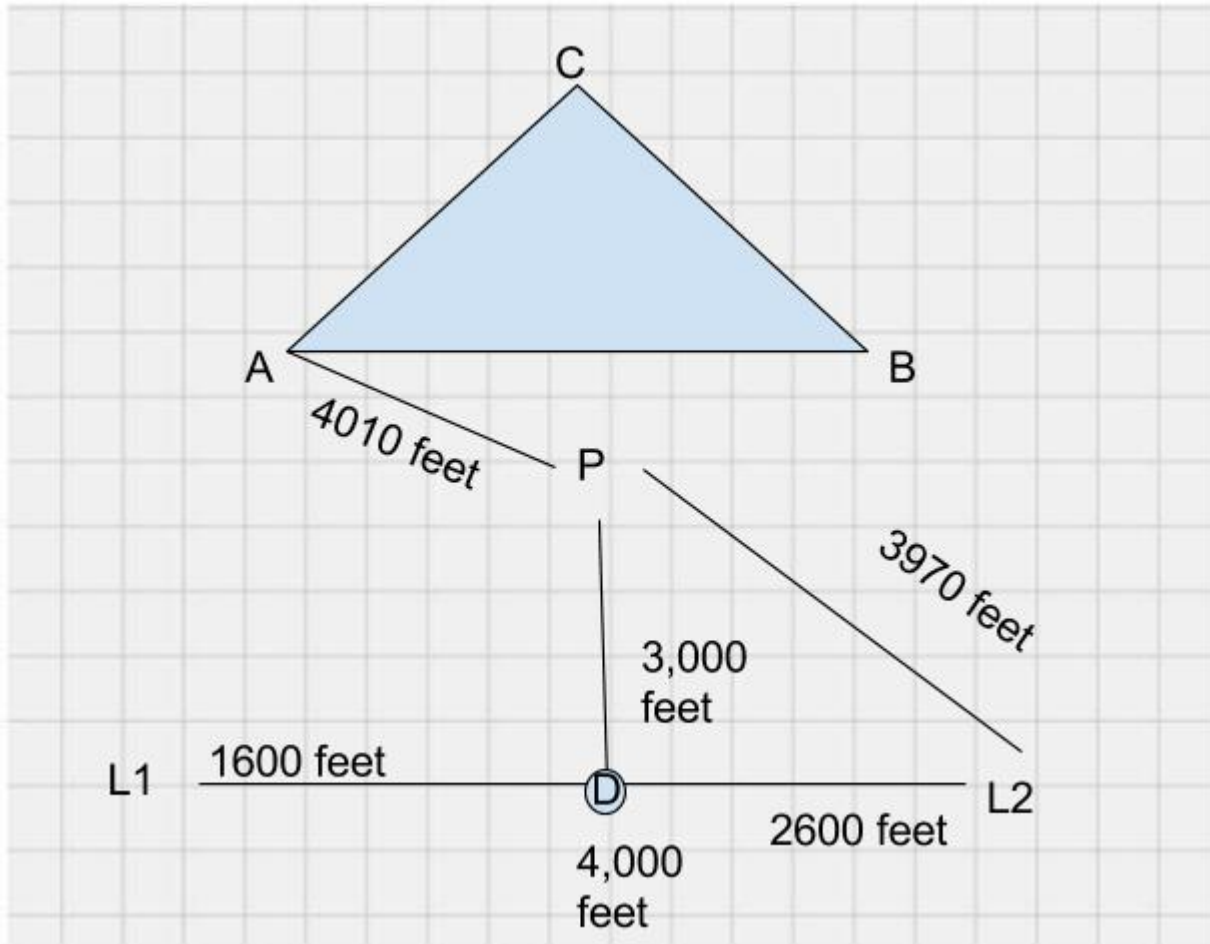
200 feet per minute. 12000 feet per hour

1.97 knots.



Part V: The Map (20 points)

Now you're going to use your knowledge of parallax to find the distance of the race course. Below is a grid to draw your Master map on. Use this to draw your parallax triangles and distances. Don't worry about drawing your map to scale. The grid is there to help you draw straighter lines.



1. What are the two landmarks from your city that you'll use for parallax? **(2 points)**

The South Tower and North Tower.

2. What is the distance between your two landmarks? **(2 points)**

4200 feet.

3. Call the North Landmark *L1* and the South Landmark *L2*. Sketch the points *L1* and *L2* on your map. **(2 points)**

4. What is the fixed point in the water that you will use for parallax? **(2 points)**

The Hazard buoy.

5. Call your fixed point P . Sketch the point P onto the map. **(2 points)**

6. What is the distance from your fixed point P to the line between L_1 and L_2 (called L_1L_2)? **(2 points)**

3000 feet.

7. Draw the line from your fixed point P to the line L_1L_2 and add to the length of this line. **(2 points)**

8. Label the point of intersection between line L_1L_2 and the new line as point D . **(2 points)**

9. What is the distance from L_1 to D ? That is, what is the measure of the line segment L_1D ? Hint: review the diagram in "The Race Course" section of the Performance Task. **(2 points)**

L_1 to D is 1600 feet.

10. What is the distance from L_2 to D ? That is, what is the measure of the line segment L_2D ? **(2 points)**

L_2 to D is 2600 feet.

Part VI: Solving the problem.

Draw the Olympic triangle on your map. (10 points)

1. Buoy marker A was set so that it's in a perfect line of sight with the hazard buoy and the landmark L_2 . Draw buoy A so that it's in the proper line. You can choose the position of buoy A . **(2 points)**

2. The first leg of the racing triangle AB runs parallel to the bridge. Draw this line. **(2 points)**
3. Buoy marker B was set so that it's in a perfect line of sight with the hazard buoy and the landmark $L1$. Draw buoy B so that it's on the parallax line. **(2 points)**
4. Sketch buoy marker C , remembering what you know about the Olympic triangle. Don't worry if your drawing is not to scale. **(2 points)**
5. What is the distance from the hazard buoy to racing buoy A ? Hint: review the diagram in "The Race Course" section of the Performance Task. Write this distance on your map. **(2 points)**

Part VII: Calculate the distances. (23 points)

1. What is the distance from the hazard buoy P to the southern landmark $L2$? Use this formula:

$$d^2 = (DL2)^2 + (PD)^2$$

, where d is the distance from P to $L2$, $DL2$ is the distance from D to $L2$, and PD is the distance from P to D . Round to the nearest foot. **(5 points)**

$D=3970$ feet.

2. What triangles are similar? How do you know? **(5 points)**

Triangle ABP and triangle $L1L2P$ are similar because they are formed from the same lines.

3. What is the distance between buoy A and B ? **(5 points)**

4010 feet because each of the angles are 60 degrees it is an equilateral triangle.

4. What are the lengths of the other two triangle legs? **(4 points: 2 points each)**

Remember what you know about the shape of the Race Course.

4010 feet.

5. What is the total length of the race course? (**4 points**: 3 for calculation, 1 for answer)

$$4010 \times 3 = 12030$$

The total length of the course is 12,030 feet.

Part VIII: Calculate the winner's speed. (10 points)

1. What was the winner's speed during last year's race? (5 points. 3 points for speed. 2 points for conversion to knots).

16.25 min to go 12030 feet

$$12030 / 16.25 = 740.31 \text{ (foot per min)}$$

$$740.51 / 101$$

The winner's speed was about 7.31 knots.

2. How does the winner's speed compare with your average speed? How much faster or slower are you? (5 points)

I am 1.4 knots faster than last years winner.