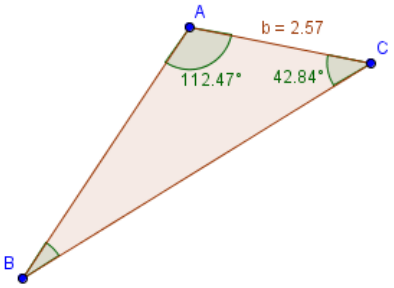
SM3 8.2 Law of Sines

Problems: Find the missing measurements to the nearest hundredth using the Law of Sines:

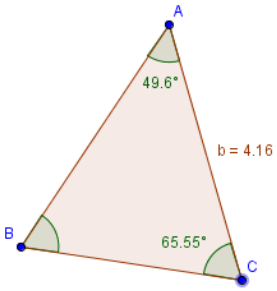
1)

$m\angle B = 24.69°$
$a = 5.69$
$c = 4.18$



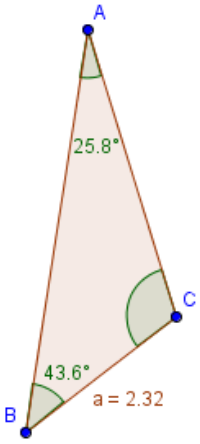
2)

$m\angle B = 64.85°$
$a = 3.5$
$c = 4.18$



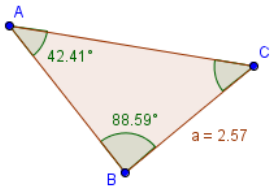
3)

$m\angle C = 110.6°$
$b = 3.68$
$c = 4.99$

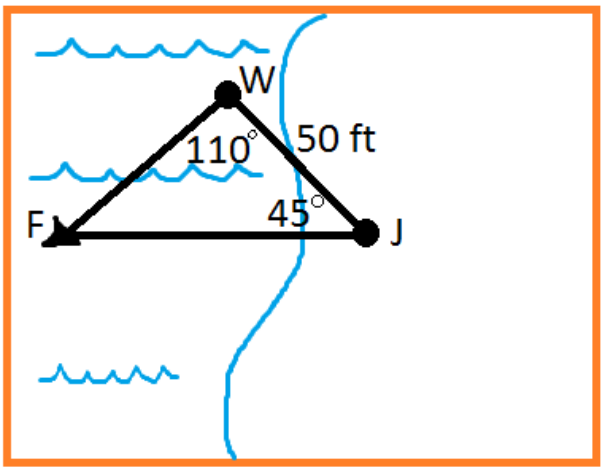


4)

$m\angle C = 49°$
$b = 3.81$
$c = 2.88$



5) Josie, Mckenna, and Whitney take a trip to the California coastline during the summer to enjoy some time at the beach (and to work on their summer calculus homework in a more pleasant environment). Whitney wants to go for a swim, Josie fancies a nap on the beach, and Mckenna decides to study limit notation in their hotel room. Josie and Whitney walk down to the shore and Josie finds a suitable spot to doze off. Whitney runs due northwest from Josie, splashing into the water. As Whitney gets about 50 feet from Josie, Josie notices a rather large fin the in water, due west! Josie screams for Whitney to look out and points toward the fin, and Whitney looks back to Josie then turns 110 degrees clockwise and spots the fin. Whitney is frozen in fear; the perceived shark pauses, anticipating its next move.



- Draw a point in the water that represents Whitney's location.
- Connect Josie's point and Whitney's point with a line segment.
- Draw a fin in the water.
- Connect the fin to the both points with line segments.
- Appropriately label the vertices and sides of the triangle.
- Add known information to the picture.

Use the Law of Sines to determine how far apart the fin and Whitney are.

$j = 83.66ft$

6) Hearing a scream, Mckenna walks onto the patio outside of her well-built hotel room on the 8th floor (approximately 80 feet above the ground). Mckenna sees the fin in the water near her classmate. The angle of depression she can view the fin with is 50 degrees. Mckenna finds a new solution to the question "when will I ever use this?" by summoning superhuman strength and hurling her calculus book from the patio, over the beach, at the base of the fin (assume the textbook travels in a straight line)!

- Sketch the triangular relationship between Mckenna's position, the fin's position, and the base of the hotel.
- Label the points and sides of the triangle. Add known information to the picture.
- Use the Law of Sines to determine how far Mckenna threw the textbook.

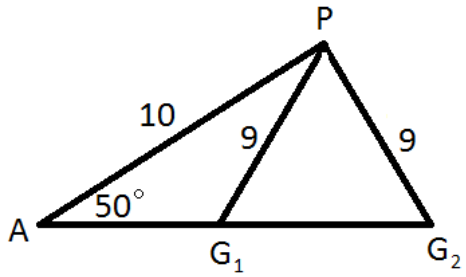
$h = 104.43ft$

- Problem 6 is doable for a basic geometry student. Explain why this is the case.

Angle H measures 90 degrees. So, SOHCAHTOA gives $\cos 40 = \frac{80}{h}$.

7) Andrew is warming up for a racquetball match and notices a pipe in an unfinished part of the high ceiling. Having excellent aim, Andrew serves the ball at a 50 degree upward angle and the ball travels 10 meters toward the pipe. As the pipe is a curved surface, the ball ricochets back downward and travels 9 meters before it strikes the ground.

- Sketch the triangular relationship between Andrew's position, the pipe's position, and the points where the ball hit the ground.



- Label the points and sides of the triangle. Add known information to the picture.
- Which style of known information is given (SSA, ASA, AAS, SAS, SSS) ? SSA
- Why does this problem have two solutions?

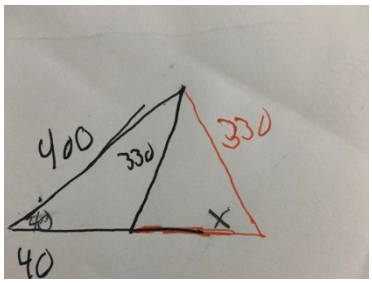
This is a SSA problem where the side opposite the known angle is smaller than the adjacent side.

- How far in front of Andrew did the ball hit the ground? Use the Law of Sines to approximate both solutions.

$G_1 \approx 1.70\text{m}, G_2 \approx 11.15\text{m}$

8) Grant wants to ask his crush out on a date after school, but considers approaching her with her entire soccer team unnerving. So, his scheme is to attach an invitation to a drone, which he can fly via remote control. The drone takes off from the ground and flies at a $40°$ angle of elevation and travels 400 meters until it is directly above the field. Then, Grant triggers a release mechanism and the invitation drops down to its destination. He then flies the drone 330 meters to the ground. Assume there is no lateral movement in either flight path (i.e., from above the path of the drone is linear).

Sketch a reasonable representation of the flight of the drone.

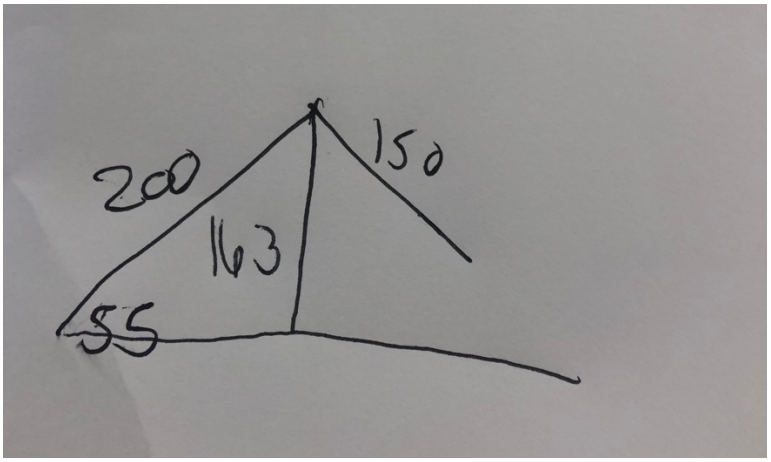


How far from the launch site does the drone land?

About $513.3m$ or $99.6\ m$

9) While sharing his heroic tale of asking out a girl that was practicing soccer with a dozen other girls, one of Grant's rivals claims that he too employed a drone to accomplish the same goal. Because Grant knows that a player is never truly done improving his skills in the game, he inquires about the measurements of the rival's flight plan. The rival says that his drone left at a $55°$ angle of elevation, travelled 200 meters, and then flew another 150 meters before landing. When Grant asked whether the drone experienced any lateral movement, the rival said that there was none.

Sketch a reasonable representation of the rival's drone's flight path.



How far from the launch site does the rival's drone land?

No solution

What should Grant learn from the rival's description of the event?

It is inaccurate, according to his rival description the drone never would have landed on the ground.

While at an outdoor rifle range with our class (it's a pretend field trip, don't ask), Sofia sneezes before squeezing the trigger and winds up launching a bullet upward at a 42 degree angle. The bullet travels for 700 feet before striking Calculusman, an obscure superhero that flies around looking for students struggling with related rates problems so that he can remind them not to plug in known information until they've differentiated. Fortunately, Calculusman's only weakness is undone homework, so the bullet harmlessly reflects off of him and travels 1200 feet back to the ground, landing in front of Sofia. Calculusman doesn't appreciate being shot, so he lands near the class to ask a few questions:

"How many locations could the bullet have landed?", asks Calculusman. 1

"How far in front of you did the bullet land?" $c \approx 1625\text{ft}$

"If the evaluation of a limit from the right side of 2 is ∞ and from the left side of 2 is $-\infty$, then what do we know about the function at $x = 2$?". And with that, Calculusman leaps into the sky.

There may be a vertical asymptote at $x = 2$.