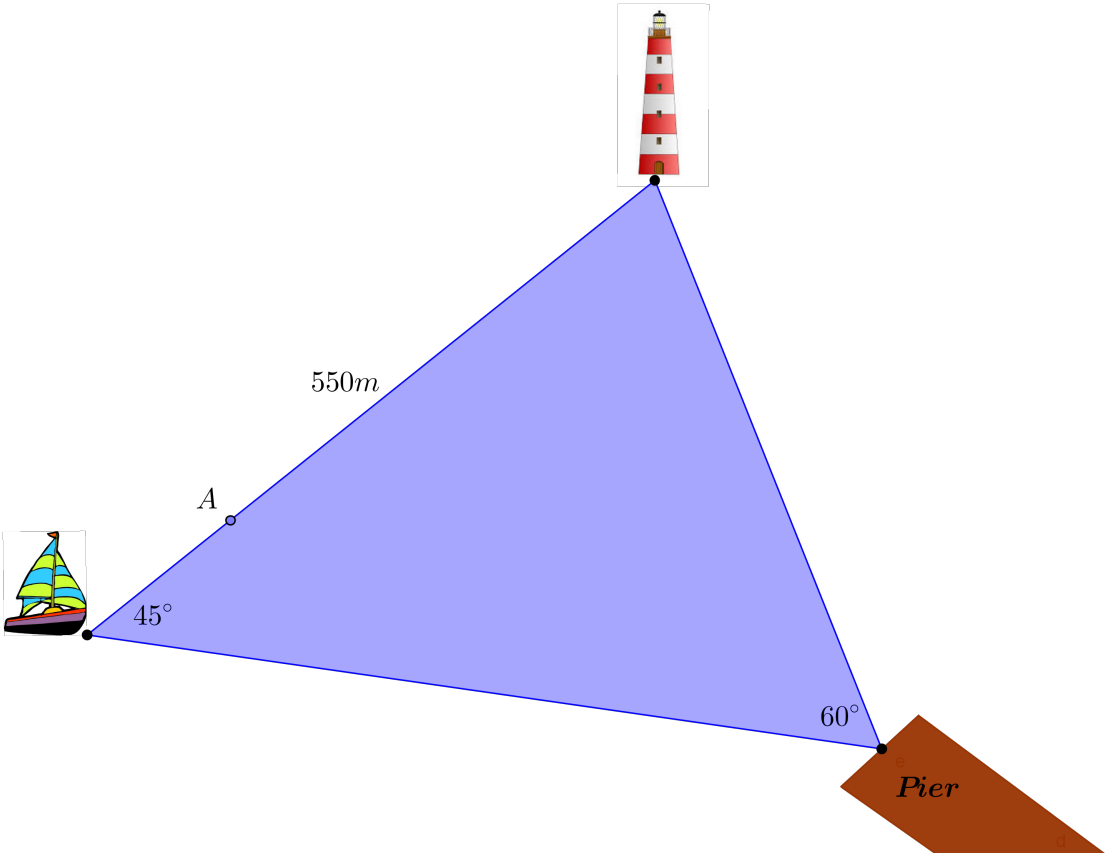
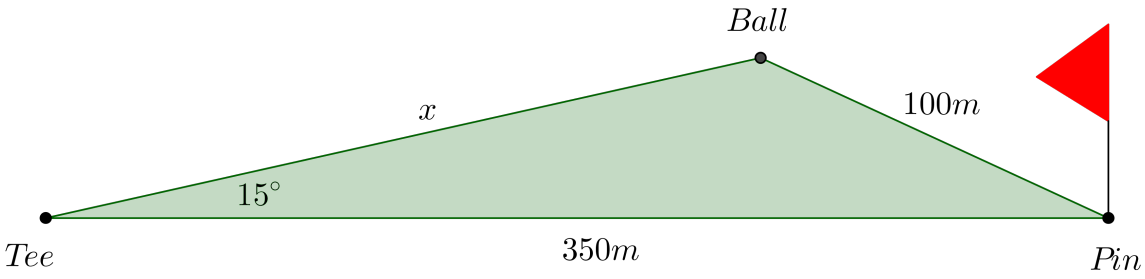
Sine/Cosine Rule in Context

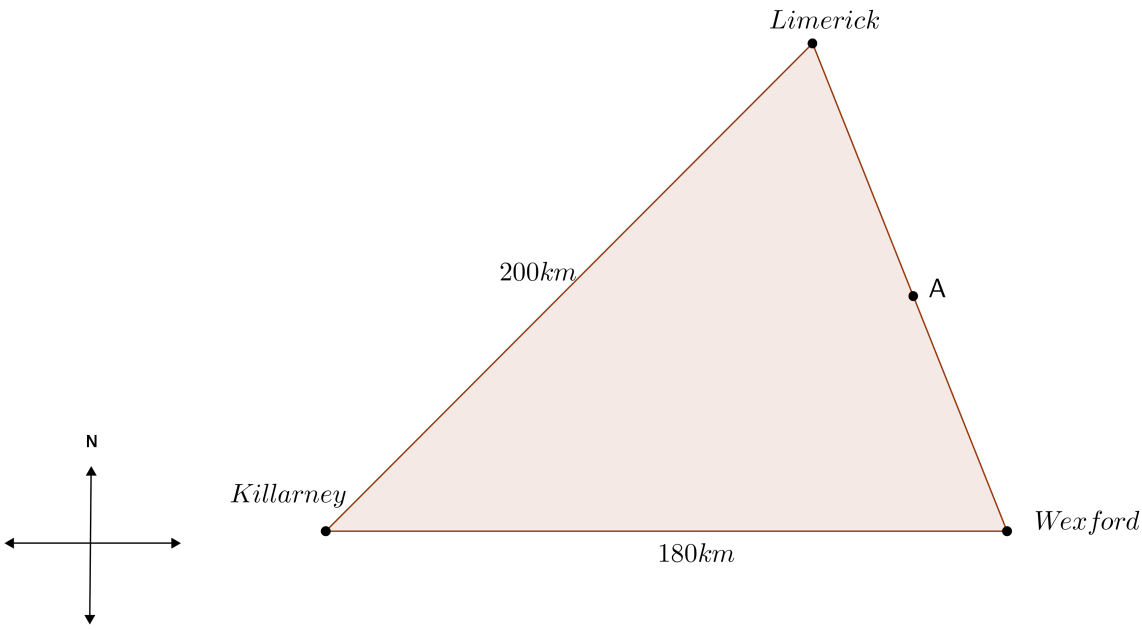
1. Standing at the edge of a pier, an observer watches a boat head directly towards a lighthouse. Given that the boat is 550m away from the lighthouse, using the angle measurements seen in the figure below, calculate(to the nearest metre or second),
   (i) How far the boat is from the pier?
   (ii) How far the lighthouse is from the pier?
   (iii) The boat is travelling at 14km/hr, how long until it reaches the lighthouse?
   (iv) 50m into the boats journey (point A), the weather worsens and the captain decides to head for the pier. What distance does the boat now have to travel?
   (v) With the wind the boat can now travel at 20km/hr, how long until it reaches dry land?



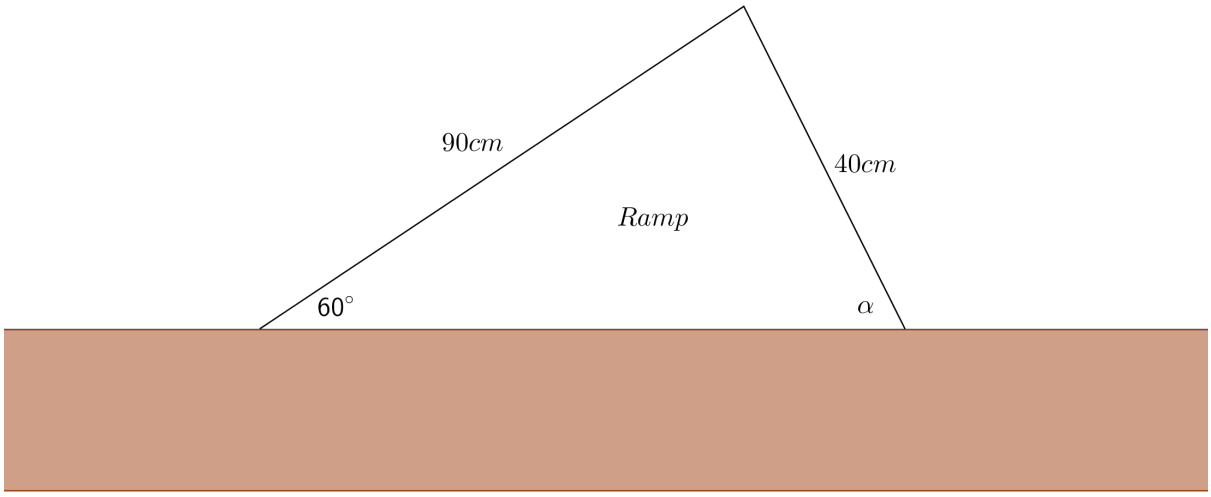
2. A golfer's caddie informs him that the pin on a certain hole is 350m from the tee. The golfer fluffs his first shot and the ball travels with a trajectory 15° off desired and ends up $100m$ from the pin. How far does the golfer have to walk to reach his ball to the nearest m?(Hint: Be careful with the obtuse angle at the top of the triangle.)



3. A group of swallows from Killarney cannot decide whether to fly to Wexford or Limerick for the weekend. Given that Wexford is twenty kilometers closer, they head due East. Upon realising there isn't much to do in Wexford, they decide to make the journey towards Limerick.
(i) Given that Limerick is exactly North-East of Killarney, how far is Wexford from Limerick?
(ii) Halfway from Wexford to Limerick (at point A), one of the swallows feels ill and decides to head home to Killarney, how far a journey will he have?



4. Tom and Jerry want to build a bicycle ramp in their back garden. They have two planks of wood, one 90cm and the other 50cm and want the incline to be 60°.
(i) Use the sine rule to show how the configuration below is an impossible feat.
(ii) Suggest an alternative method to build the ramp.



5. A space station in Peru can collect the following measurements (where Mm is 1000km).
(i) Using the Cosine rule, show that the distance x must satisfy the quadratic equation $3x^2 - 2x - 4 = 0$.
(ii) Solve this quadratic to the nearest two decimal places, explaining which answer is correct.