A hurricane is traveling due north at a speed of 20 knots (nautical miles per hour). A boat with a maximum speed of 12 knots is located 10 nautical miles north and 5 nautical miles east of the hurricane.

1. If the boat takes a heading of due north, determine how close the hurricane will get to the boat and the time when this occurs.
   Hint: No calculus required!
2. If the boat takes a heading of due east, determine how close the hurricane will get to the boat and the time when this occurs.
   Hint: Calculus required!
3. If the boat takes a heading of northeast, determine how close the hurricane will get to the boat and the time when this occurs.
4. If the boat takes a heading of θ (measured as an angle from due east), determine how close the hurricane will get to the boat and the time when this occurs. These will both be functions of θ.
5. If the captain wants to maximize the minimum distance between the hurricane and the boat, what heading should he choose?