Boat-river problem

Questions

1. When the boat leaves the bank normally ($\theta = 90^o$), how does the drift change with increasing velocity of the boat (v_{boat})?
2. When the boat leaves the bank normally ($\theta = 90^o$), how does the drift change with increasing velocity of water in the river (v_{water})?
3. When the boat leaves the bank normally ($\theta = 90^o$), how does the time taken to cross the river change with increasing (v_{boat})?
4. When the boat leaves the bank normally ($\theta = 90^o$), how does the time taken to cross the river change with increasing (v_{water})?
5. When $v_{water} \neq 0$, at what angle w.r.t. the velocity of water (θ) should the boat start to reach the opposite bank in shortest time?
6. How does the least time taken to cross the river depend on velocity of boat?
7. How does the least time taken to cross the river depend on velocity of water?
8. When $v_{water} \neq 0$, at what angle should the boat start to reach the opposite bank along the shortest distance?
9. How does the above angle depend on v_{boat} and v_{water}?
10. If $v_{boat} < v_{water}$, then can the boat, starting at point A reach the opposite point B on the other bank?

Note :

While simulations help to provide valuable insights and visualizations, a rigorous mathematical solution should always be considered as a benchmark, demonstrating not just familiarity with the concept, but a deep understanding of the underlying principles.

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