Introduction: Do dogs know calculus?

Do some research on the article, *Do dogs know calculus?* by Timothy Pennings (College Math. Journal, May 2003) and answer the following questions.

Outline

Question 1

Suppose a dog can run with a velocity v_l on the land and can swim with a velocity of v_w. You and the dog are standing on the shore of a lake and you throw a ball in the water. The ball lands a meters off shore and b units to your right. What route should the dog take to reach the ball fastest?

Justify your answer.

Question 2

Pick reasonable values for v_l, v_w, a and b and compute the time for this optimal path. Also, compute the time for the direct (swimming only) route and the "right angle" route.

Show all calculations.

Question 3

Set up your own test case. Have a starting line in the grass and a finish line on a sidewalk. Have the runner (a person, probably) start carrying a heavy object. The person can drop the object when (s)he reaches the sidewalk.

a. Test the person's running speed with and without the weight.
b. Run numerous trials with different routes.
c. Use calculus to compute the best route.
d. Compare your theoretical and experimental results.

Include photos or videos of the test case.

Mark Allocation

Criteria	Weight
Question 1	5
Question 2	15
Question 3	20
Total	**40**

Additional Information

- All work must be done on your own.
- Belgium Campus have software that can **scan for plagiarism** and a student caught doing this will get 0 for this assignment.
- Late assignments will not be accepted; missing the deadline is an automatic 0.
- Round off to 4 decimal figures (4.d.p).