

PHYSICS 211 EXAM 3, QUESTION 4: OBLIGATORY DOG QUESTION

This is not the full exam; this is part 4 of 5. The full instructions are in part 1; read them before you begin.

Finn is a water-loving and very strong dog who has gotten good at jumping off of a boat to catch a Frisbee floating in the water. He's got a mass of $m = 25$ kg. When he jumps, his muscles are able to produce 450 J of energy. For simplicity, let's think about Finn jumping horizontally from the side of a boat, just so we don't have to do any trigonometry. You may approximate Finn as a single point, even though that's not quite realistic.



a) Suppose that Finn jumps horizontally from a very massive boat (so massive that it will not move) as fast as he can from a height of $h = 1$ meter. What velocity v_0 will Finn have once he jumps? (*5 points*)

b) If this boat is floating 2.5 m away from a Frisbee in the water, will Finn be able to jump on top of it? (*5 points*)

c) Now, suppose that Finn jumps horizontally from a much lighter canoe with the same mass as Finn (25 kg), also from a height of $h = 1$ meter. (The canoe is floating in the water, and is free to move.) Recall that Finn's muscles can only produce $E = 450$ J of energy in a jump, which must be shared between the canoe and Finn.

Determine the velocities of Finn and the canoe after he jumps. (*10 points*)

d) If this canoe is floating 2.5 m away from the same Frisbee, and Finn is again jumping from a height of $h = 1$ m, will Finn be able to jump on top of the Frisbee? (*5 points*)