

Mathematics 1100Y – Calculus I: Calculus of one variable

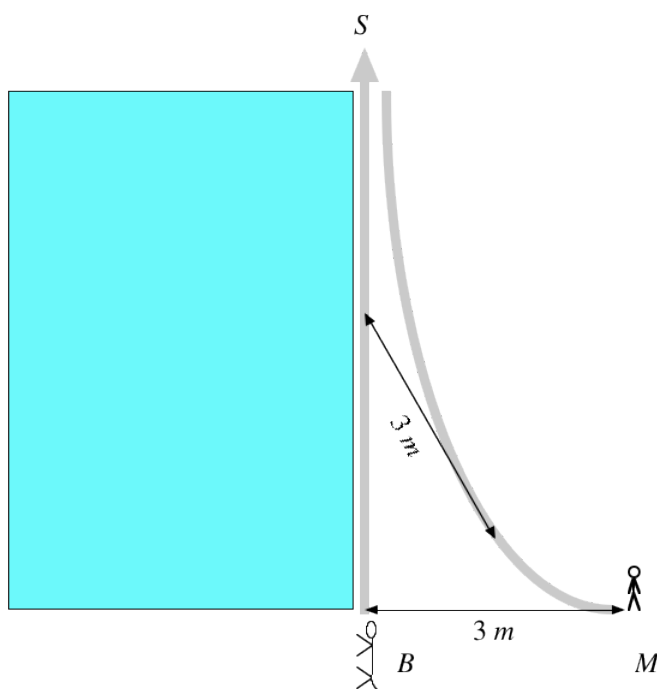
TRENT UNIVERSITY, SUMMER 2011

Assignment #10

Differential Dog Drag

Due on Monday, 18 July, 2011.

Little human M is trying to walk big dog B in a backyard with a rectangular pool*. With B keeping the 3 m leash fully extended, they approach one corner of the pool. At the instant that B reaches the corner, the leash is extended in the direction of one of the sides, but then B spots squirrel S and runs off along the other side of the pool, dragging M along. At any given instant, the leash is fully extended and tangent to the curve that M is being dragged along.



Suppose we set up a Cartesian coordinate system so that the positive y -axis is on the edge of the pool that B runs off along, the origin is at the corner of the pool that B starts running from, and M is at $(3, 0)$ when B starts running.

1. Find a function $f(x)$ whose graph is the curve that M is dragged along, with the coordinate system set up as described above. [10]

HINT: If M is at (x, y) at some instant, where $y = f(x)$, the y -intercept of the tangent line always 3 m from (x, y) . Recall, too, that the tangent line at (x, y) has slope $m = \frac{dy}{dx} = f'(x)$. Use all this to set up an equation involving $\frac{dy}{dx}$ and then solve it for y .

* The names and situation have been changed slightly to protect the innocent set this problem up.