

Mathematics 1100Y – Calculus I: Calculus of one variable

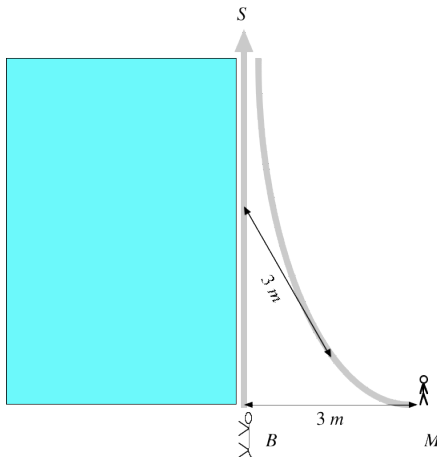
TRENT UNIVERSITY, Summer 2012

Assignment #10

Differential Dog Day Drag

Due on Wednesday, 25 July, 2012.

Little Max is trying to walk big dog Beau in a backyard with a rectangular pool*. With Beau keeping the 3 m leash fully extended, they approach one corner of the pool along a straight line extending one side of the pool. At the instant that Beau reaches the corner, the leash is extended straight out in the direction of that side, but then Beau spots squirrel S — real name unknown! — and runs off along the other side of the pool, pulling Max after him. At any given instant, the leash is fully extended and tangent to the curve that Max 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 Beau runs off along, the origin is at the corner of the pool that Beau starts running from, and Max is at $(3, 0)$ when Beau starts running.

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

HINT: If Max 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 basic situation really happened, but no children, pets, or wildlife were harmed or forced to solve differential equations.