

Mathematics 1100Y – Calculus I: Calculus of one variable

TRENT UNIVERSITY, Summer 2010

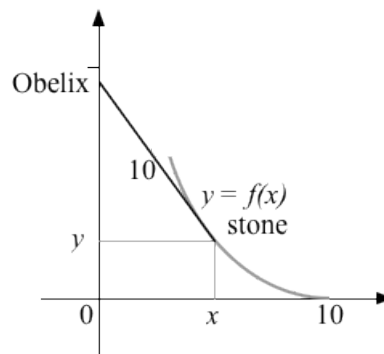
Assignment #11

Tractorix?

Due on Wednesday, 28 July, 2010.

Asterix asks his friend Obelix to move a *very* large stone, one so large that even Obelix can't lift it. Obelix attaches a rope to the stone, stretches it out, grabs the rope 10 m from the stone, and starts moving in a straight line perpendicular to the initial direction of the rope, dragging the stone along. Assuming the rope doesn't stretch or break, what is the curve traced by the stone?

We'll set up our coordinate system so that initially Obelix is at the origin and the stone at (10,0), and so that Obelix subsequently moves along the positive y -axis, as in the diagram below.



1. Show that if the stone move along the curve $y = f(x)$, then we must have $f(10) = 0$ and $\frac{dy}{dx} = -\frac{\sqrt{10^2 - x^2}}{x}$. [4]

Hint: If the stone is at (x, y) at some instant, consider the right-triangle with sides parallel to the axes whose hypotenuse is the rope, and observe that the rope must be tangent to the curve traced by the stone.

2. Use Maple to help solve the differential equation given in 1 for $y = f(x)$. [6]