

Take-Home Quiz 6

Math 131 Section 22

Due Monday, November 21, 2005

These problems illustrate how we can take the material we've learned to do even fancier things—higher order implicit differentiation and a totally awesome related rates problem.

Problem 1. (6 points). Consider the equation $x^2 + y^2 = 1$. Using implicit differentiation gives a formula for the slope of the tangent line to (x, y) on the circle with radius one, namely:

$$2x + 2y \frac{dy}{dx} = 0,$$

so the tangent line to the point (x, y) has slope $-x/y$.

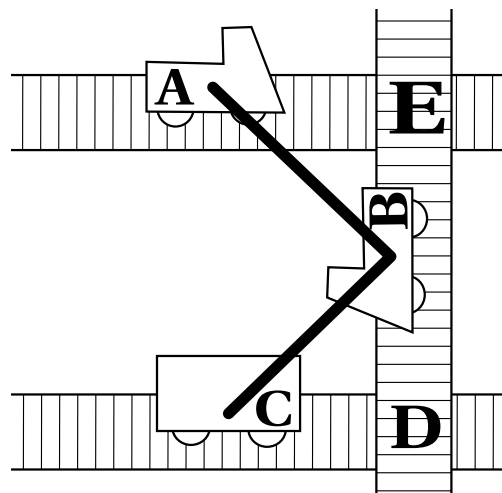
Use implicit differentiation on this equation to get a formula for d^2y/dx^2 . Do some algebraic manipulation so your formula for y'' only depends on y .

Problem 2. (6 points).

On the Island of Sodor,¹ Clarabel is stuck on her track. Thankfully, Clarabel's track intersects Bertram's track (at switch D), and there is a 50 foot steel cable welded to Bertram and Clarabel. Now Bertram is also stuck, but Bertram's track intersects Arthur's track (at switch E), and there is a 50 foot iron chain welded to Bertram and Arthur.

Arthur is travelling away from switch E at a speed of 10 feet per minute, and is currently 30 feet from switch E. Bertram is 40 feet from switch E and 30 feet from switch D. Clarabel is currently 40 feet from switch D.

Be "Really Useful" by computing how fast Clarabel is moving toward switch D.



¹Not coincidentally, Thomas the Tank Engine lives there.