Mathematics 1101Y – Calculus I: Functions and calculus of one variable
TRENT UNIVERSITY, 2011–2012

Assignment #3
My name is Blond, Thames Blond.*
Due on Wednesday, 7 December, 2011.

Thames Blond, playboy heir to the Pale River Ale fortune and not-so-secret agent of MI7, is cruising along one of Saskatchewan's famously straight roads in his BMW at its top speed of 200 *km/h*, approaching the point where one of Saskatchewan's famously straight railroads crosses the road at a right angle. The last car of a train is passing the crossing at a speed of 100 *km/h* just as Blond is 1 *km* away. At this instant, Blond spots the infamous Dr. Yes looking out the back of that last train car. He immediately swerves to follow†, keeping his BMW headed towards the last car of the train until he catches up.

1. If the train and Blond maintain their speeds of 100 *km/h* and 200 *km/h*, how far from the crossing does Blond catch up with the train? *[10]*

Hint: Supposing that the road lies along the x-axis and the railroad track along the y-axis, show that the BMW's path is the graph of a function satisfying the differential equation $2x\frac{d^2y}{dx^2} = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}$. Solve this equation (`Maple`'s `dsolve` command for solving differential equations may come in handy), assuming that $y = 0$ and $\frac{dy}{dx} = 0$ when $x = 1$, and take it from there ...

* Apologies in advance to Ian Fleming and a certain prairie province.

† Remember that Saskatchewan is famously flat ...