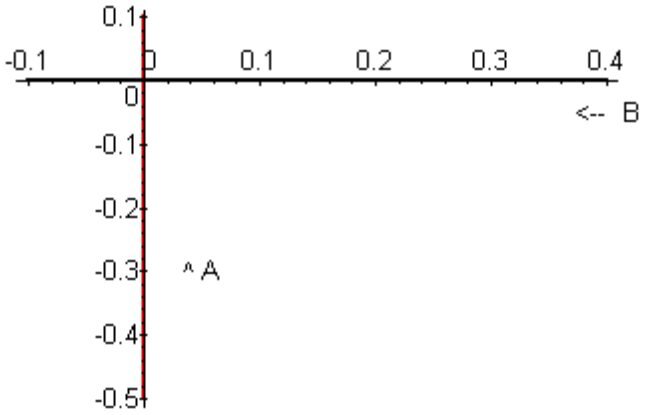
(801, #38) Car A is traveling north on Highway 16 at 90 km/h. Car B is traveling west on Highway 83 at 80 km/h. Each car is approaching the intersection of these highways. How fast is the distance between the cars changing when car A is 0.3 km from the intersection and car B is 0.4 km from the intersection?

Solution: The cars are positioned as follows:



Let x(t) be the position of car B at the time t. We are given that x' (t) = -80. Similarly, if y(t) is the position of car A then y' (t)= 90. We are also given that
x(0) = 0.4 and y(0) = -0.3. Thus x(t) = 0.4 -80t and y = -0.3 +90t, assuming that the autos are at the specified position at the time t = 0.

We have $D(t)=\sqrt{x^2+y^2}$ and wish to find D'(0). To that end,

$$D'(t)=\frac{x}{\sqrt{x^2+y^2}}\frac{dx}{dt}+\frac{y}{\sqrt{x^2+y^2}}\frac{dy}{dt}=\frac{1}{\sqrt{x^2+y^2}}(x(-80)+y(90))$$

Next, when x = 0.4 and y = -0.3 $\sqrt{x^2+y^2}=1/2$ so

$$D'(0)=2(-80*0.4+90*(-0.3)=-118 km/h$$