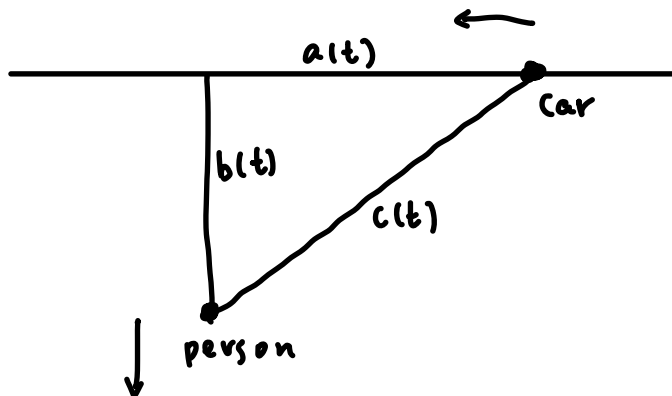


Total time: 15 minutes.

Problem 1 (10 points). A person is 300m away from a straight road, and walking away from it at a speed of 2m/s. A car is traveling on the road. At this moment it has distance 500m from the person, and is traveling towards the person (while being on the road) at a speed of 10m/s. How fast is the distance between the person and the car changing? Please indicate whether they are getting closer or farther.



$$a(t)^2 + b(t)^2 = c(t)^2$$

$$2a(t)a'(t) + 2b(t)b'(t) = 2c(t)c'(t)$$

At t_0 , we know (pay attention to signs of derivatives!)

$$b(t_0) = 300, \quad b'(t_0) = 2, \quad c(t_0) = 500, \quad a'(t_0) = -10$$

and we get $a(t_0) = \sqrt{c(t_0)^2 - b(t_0)^2} = 400$. Therefore

$$2 \cdot 400 \cdot (-10) + 2 \cdot 300 \cdot 2 = 2 \cdot 500c'(t_0)$$

$$c'(t_0) = \frac{400 \cdot (-10) + 300 \cdot 2}{500} = -\frac{34}{5}$$

Therefore the person and the car is getting closer, at a speed of $\frac{34}{5}$ m/s.