Bilkent University

Quiz # 05
Math 101-Section 08 Calculus I
31 October 2019, Thursday
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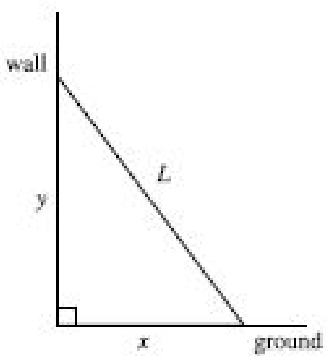
Solution Key

Q-1) The top of a ladder slides down a vertical wall at a rate of $5m/min$. At the moment when the bottom of the ladder is $12m$ from the wall, it slides away from the wall at a rate of $7m/min$. How long is the ladder?

Solution:



In the above figure, x and y are functions of time. We are given the following facts:

$$y'(t) = -5m/min, \quad x'(t_0) = 7m/min, \quad x(t_0) = 12m. \tag{$*$}$$

From the figure we see that

$$x^2(t) + y^2(t) = L^2 \tag{$**$}$$

Taking derivatives of both sides of this equation and setting $t = t_0$, we get (after cancelling out 2)

$$x'(t_0)x(t_0) + y'(t_0)y(t_0) = 0.$$

Putting in the values from $(*)$ we get

$$(7m/min)(12m) + (-5m/min)y(t_0) = 0,$$

which gives

$$y(t_0) = \frac{84}{5}m.$$

Putting in the values of $x(t_0)$ and $y(t_0)$ into $(**)$, we find

$$(12m)^2 + \left(\frac{84}{5}m\right)^2 = L^2,$$

which gives

$$L = \frac{12\sqrt{74}}{5}m \approx 20m\,65cm.$$