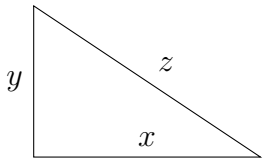
MA 16010: Quiz 8

10/5/2018

(1) (3 points) Two people start walking from the same point. One walks North, the other walks East. After 1 hour, the first person is 3 miles away and walking at 3 mi/hr, while the second person has stopped for a snack 4 miles away. How fast is the distance between them changing at that moment?

Solution



Want: $\frac{dz}{dt}$

When: $y = 3$ and $x = 4$

Given: $\frac{dy}{dt} = 3\,\text{mi/hr}$ and $\frac{dx}{dt} = 0\,\text{mi/hr}$.

Formula: $z^2 = x^2 + y^2$

Derivative: $2z\frac{dz}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt} \implies z\frac{dz}{dt} = x\frac{dx}{dt} + y\frac{dy}{dt}$

Plug in:

First calculate z : $z^2 = 4^2 + 3^2 = 16 + 9 = 25 \implies z = 5$

Then $5\,\frac{dz}{dt} = 4 \cdot 0 + 3 \cdot 3 = 9 \implies \frac{dz}{dt} = \frac{9}{5}$.

(2) (2 points) Find the critical numbers of $y = x^3 - 3x^2 - 9$.

Solution

Take the derivative and set it equal to 0.

$$y' = 3x^2 - 6x = 0$$
$$3x(x-2) = 0$$
$$x = 0, 2\,.$$