



Bilkent University

Quiz # 03  
Math 101-Section 12 Calculus I  
20 October 2022 Thursday  
Instructor: Ali Sinan Sertöz  
**Solution Key**

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**Q-1)** The sides  $x$  and  $y$  of a right triangle are changing as functions of time. When  $x = 3$  and  $y = 4$ , we observe that  $x' = 2$ ,  $y' = 1$ ,  $x'' = -4$  and  $y'' = -2$ . Denoting the hypotenuse of this triangle by  $h$ ,

(a) find  $h'$  at that given time,

(b) find  $h''$  at that given time.

*Show your work in detail. Correct answers without detailed explanation do not get any credit.*

Grading: 5+5=10 points.

**Solution:** Our basic equation is

$$h^2 = x^2 + y^2. \quad (1)$$

Differentiating both sides of this equation with respect to time, and dividing by 2, we get

$$hh' = xx' + yy'. \quad (2)$$

Differentiating once more we get

$$(h')^2 + hh'' = (x')^2 + xx'' + (y')^2 + yy''. \quad (3)$$

Putting  $x = 3$ ,  $y = 4$  into (1) we get  $h = 5$ . Now solving (2) we get  $h' = 2$ .

Putting these into (3) and solving we get  $h'' = -\frac{19}{5}$ .