

# EE5609 Assignment 3

KOLLI RAVI, EE20MTECH11017

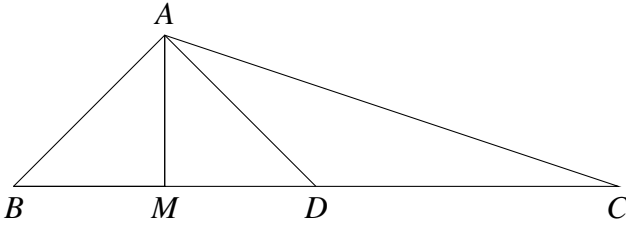
## 1 PROBLEM

$AD$  is the median of a  $\triangle ABC$  and  $AM \perp BC$ .  
prove that

$$AB^2 = AD^2 - BC \cdot DM + \left(\frac{BC}{2}\right)^2$$

## 2 SOLUTION

In a right angle triangle, square of the hypotenuse is equal to the sum of the squares of the other two sides. Also, a median divides the sides into two equal halves.



from the above figure

$$\|B - D\| = \|D - C\| \quad (2.0.1)$$

$$AM \perp BC \quad (2.0.2)$$

then as per the pythagoras theorem

$$\|A - B\|^2 = \|B - M\|^2 + \|A - M\|^2 \quad (2.0.3)$$

$$= \|B - M\|^2 + \|A - D\|^2 - \|M - D\|^2 \quad (2.0.4)$$

$$= (\|B - D\| - \|M - D\|)^2 + \|A - D\|^2 - \|M - D\|^2 \quad (2.0.5)$$

$$= \|B - D\|^2 + \|M - D\|^2 - 2\|B - D\|\|M - D\| + \|A - D\|^2 - \|M - D\|^2 \quad (2.0.6)$$

$$= \|B - D\|^2 - 2\|B - D\|\|M - D\| + \|A - D\|^2 \quad (2.0.7)$$

$$= \|A - D\|^2 + \left\|\frac{B - C}{2}\right\|^2 - 2\|B - D\|\|M - D\| \quad (2.0.8)$$

$$= \|A - D\|^2 + \left\|\frac{B - C}{2}\right\|^2 - 2\left\|\frac{B - C}{2}\right\|\|M - D\| \quad (2.0.9)$$

$$= \|A - D\|^2 + \left\|\frac{B - C}{2}\right\|^2 - \|B - C\|\|M - D\| \quad (2.0.10)$$

Hence proved.