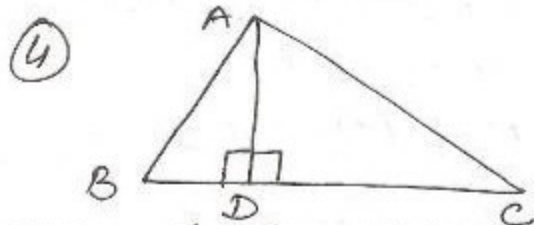


③ given - In fig $\angle ABC > 90^\circ$
 $AD \perp CB$ produced
 To Prove $AC^2 = AB^2 + BC^2 + 2BC \cdot BD$

Proof In rt. ΔADC
 $AC^2 = AD^2 + DC^2$ (Pythagoras th.)
 $= AD^2 + (DB + BC)^2$
 $= (AD^2 + DB^2) + BC^2 + 2DB \cdot BC$
 $= AB^2 + BC^2 + 2DB \cdot BC$
 [Pythagoras theorem]

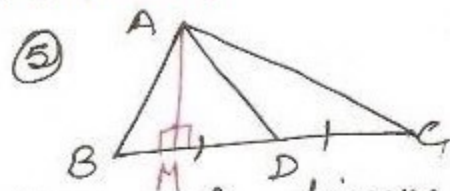
$$\therefore AC^2 = AB^2 + BC^2 + 2BC \cdot BD$$



④ given - In fig. $\angle B < 90^\circ$, $AD \perp BC$
 To prove - $AC^2 = AB^2 + BC^2 - 2BC \cdot BD$

Proof - In rt. ΔADC
 $AC^2 = AD^2 + DC^2$ (Py. th.)
 $= AD^2 + (BC - BD)^2$
 $= AD^2 + BC^2 + BD^2 - 2BC \cdot BD$
 $= AB^2 + BC^2 - 2BC \cdot BD$
 [$AD^2 + BD^2 = AB^2$ Py. th.]

$$\therefore AC^2 = AB^2 + BC^2 - 2BC \cdot BD$$



⑤ given - In figure AD is median to BC, $AM \perp BC$
 To Prove (i) $AC^2 = AD^2 + BC \cdot DM + \left(\frac{BC}{2}\right)^2$
 (ii) $AB^2 = AD^2 - BC \cdot DM + \left(\frac{BC}{2}\right)^2$

$$(iii) AC^2 + AB^2 = 2AD^2 + \frac{1}{2}BC^2$$

Proof In rt ΔAMB
 $AB^2 = AM^2 + BM^2$ (Py. th.)
 $= AM^2 + (BD - DM)^2$
 $= AM^2 + BD^2 + DM^2 - 2BD \cdot DM$
 $= (AM^2 + DM^2) + BD^2 - 2BD \cdot DM$
 $= AD^2 + \left(\frac{BC}{2}\right)^2 - 2 \times \frac{BC}{2} \cdot DM$

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

In rt ΔAMC
 $AC^2 = AM^2 + MC^2$ (Py. th.)
 $= AM^2 + (MD + DC)^2$
 $= (AM^2 + MD^2) + DC^2 + 2MD \cdot DC$
 $= AD^2 + DC^2 + 2MD \cdot DC$ [Py. th.]
 $= AD^2 + \left(\frac{BC}{2}\right)^2 + 2MD \cdot \frac{BC}{2}$

[$\because D$ is midpt. of BC]

$$\therefore AC^2 = AD^2 + \left(\frac{BC}{2}\right)^2 + DM \cdot BC \quad \dots (ii)$$

$$(i) + (ii)$$

$$AC^2 + AB^2 = 2AD^2 - BC \cdot DM + DM \cdot BC$$

$$\Rightarrow AC^2 + AB^2 = 2AD^2 + \frac{BC^2}{4} + \frac{BC^2}{4}$$

$$\Rightarrow AC^2 + AB^2 = 2AD^2 + \frac{1}{2}BC^2$$