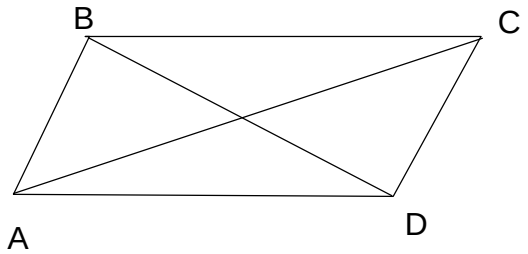
6.(i)



$AB^2 + BC^2 + CD^2 + DA^2 - AC^2 - BD^2 = (b-a)^2 + (c-b)^2 + (d-c)^2 + (a-d)^2 - (c-a)^2 - (d-b)^2$

$= a^2 + b^2 + c^2 + d^2 - 2ab - 2bc - 2cd - 2ad + 2ac + 2bd = (a-b)^2 + (c-d)^2 - 2bc - 2ad + 2ac + 2bd$

$= (a-b)^2 + (c-d)^2 + 2c(a-b) - 2d(a-b) = (a-b)^2 + (c-d)^2 + 2(a-b)(c-d)$

The solution will be valid for

$= ((a-b) + (c-d))^2 = (BA+DC)^2 = (BA-CD)^2 = 0$ since BA=CD

(ii) Conjecture $\left|AB^2 - AD^2\right|$ is the area of the rectangle whose sides are a diagonal of the parallelogram and the projection of the other diagonal on it.

$AB^2 - AD^2 = (b-a)^2 - (d-a)^2 = b^2 - d^2 - 2ab + 2ad = (d-b)(b+d-2a) = (b-d)(b-a+d-a)$

$= DB(AB+AD) = BD.AC =$ conjectured area.

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