Task. Find the value of $ab + bc + ac$ if $a + b + c = 10$ and $a^2 + b^2 + c^2 = 40$

Solution. Notice that

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac = (a^2 + b^2 + c^2) + 2(ab + ac + bc).$$

Substituting known values we get

$$10^2 = 40 + 2(ab + bc + ac),$$

whence

$$ab + ac + bc = \frac{10^2 - 40}{2} = \frac{100 - 40}{2} = \frac{60}{2} = 30.$$

Answer. 30