Q- Two resistors connected in series have an equivalent resistance of 690 Ω. When they are connected in parallel, their equivalent resistance is 150 Ω. Find the resistance of each resistor.

Let the resistances are R_1 and R_2.

When the resistances are connected in series, their equivalent resistance is equal to the sum of the individual resistances and hence

$Rs = R_1 + R_2 = 690\ \Omega.$ ---------- (1)

When the resistances are connected in parallel, inverse of their equivalent resistance is equal to the sum of inverse of their individual resistances and hence

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{150}$$

Or $$\frac{R_1 R_2}{R_1 + R_2} = 150$$ ---------- (2)

Substituting from equation 1 we have

$$R_1 R_2 = 150 * 690 = 103500$$

Substituting value of R2 from equation 1 again we have

$$R_1 \left(690 - R_1\right) = 103500$$

Gives $R_1^2 - 690 R_1 + 103500 = 0$

Or $$R_1 = \frac{690 \pm \sqrt{690^2 - 4*1*103500}}{2} = 469.6\ \Omega \text{ or } 220.4\ \Omega$$

Hence R_1 and R_2 are **469.6Ω and 220.4Ω** respectively.