Now according to 1st Law of thermodynamics we may write

$$dQ' = dU + dW$$

or $$C_p dT = C_v dT + p dV$$ (By using eq^n (ii), (iii), (iv))

or $$C_p dT - C_v dT = p dV$$

or $$(C_p - C_v) dT = p dV \quad \text{—(v)}$$

Since for one mole of an ideal gas we have

$$PV = RT$$

on differentiating both sides we get

$$p dV = R dT \quad \text{—(vi)} \quad \begin{pmatrix} p = \text{const.} \\ R = \text{const.} \end{pmatrix}$$

putting the value of eq^n (vi) in (v) we get

or $$(C_p - C_v) dT = R dT$$

or $$\boxed{(C_p - C_v) = R} \quad \text{—(vii)}$$

This eq^n (vii) is also known as Mayer's relation.

<u>Note</u>: Here C_p, C_v & R all are expressed in the same unit.