Task. A platinum resistance thermometer has resistance of $R_0 = 52.5$ ohms and $R_1 = 9.75$ ohms at $T_0 = 0$ degrees Celsius and $T_1 = 100$ degrees Celsius respectively. Find the temperature when the resistance is 8.25 ohms.

Solution. It is known that the dependence of the resistance on temperature is given by the formula:

$$R = R_0(1 - \alpha(T - T_0),$$

where $R_0 = 52.5$ ohms is the resistance at temperature $T_0 = 0$ degrees Celsius. Let $R_1 = 9.75$ ohms be the resistance at $T_1 = 100$ degrees Celsius. So

$$R_1 = R_0(1 - \alpha(T_1 - T_0))$$

This allows to find α:

$$\frac{R_1}{R_0} = 1 - \alpha(T_1 - T_0)$$

$$\alpha = \frac{1 - R_1/R_0}{T_1 - T_0}$$

Substituting values we get:

$$\alpha = \frac{1 - 9.75/52.5}{100 - 0} = \frac{0.81429}{100} = 0.0081429.$$

Therefore the temperature T_2 connresponding to resistance $R_2 = 8.25$ ohms can be found by the following formula:

$$R_2 = R_0(1 - \alpha(T_2 - T_0))$$

$$T_2 = T_0 + \frac{1 - R_2/R_0}{\alpha}$$

Thus

$$T_2 = T_0 + \frac{1 - R_2/R_0}{\alpha} = 0 + \frac{1 - 8.25/52.5}{0.0081429} = \frac{0.84286}{0.0081429} = 103.51\,^\circ C.$$