The difference in S.I. and C.I. for 2 years on a sum of money is Rs.160. If the S.I. for 2 years be Rs.2880, the rate percent is?

Solution:

SI (Simple Interest)	**Rs.2880**
n, t (Time)	**2 years**
Difference in Compound Interest and Simple Interest	**Rs.160**
Rate	**?**

If I denotes the interest on a principal P at an interest rate of r per year for t years, then we have $I = \frac{P \cdot r \cdot t}{100}$. The sum of the principal and interest after t years called accumulated amount and is given by $A = P + I = P\,(1 + t\,\frac{r}{100})$

Compound interest is earned interest that is periodically added to the principal and there after itself earns interest at the same rate. The formula of accumulated amount is $A = P + CI, => A = P\,(1 + \frac{r}{100})^t$

$$A = P + CI, => CI = A - P = P\left(1 + \frac{r}{100}\right)^t - P = P[\left(1 + \frac{r}{100}\right)^t - 1]$$

$$CI(\text{Compound interest}) = P \cdot [(1 + \frac{r}{100})^t - 1]$$

In our case we have difference between Compound Interest and Simple Interest in two years equal Rs.160. So, we can find rate:

$$CI(\text{Compound interest}) - (\text{SI})\text{Simple Interest} = 160$$

Substitute in the equation formulas:

$$P \cdot \left[\left(1 + \frac{r}{100}\right)^t - 1\right] - \frac{P \cdot r \cdot t}{100} = 160$$

$$2880 \cdot \left[\left(1 + \frac{r}{100}\right)^2 - 1\right] - \frac{2880 \cdot r \cdot 2}{100} = 160$$

$$2880 \cdot \left[\left(\frac{100 + r}{100}\right)^2 - 1\right] - \frac{2880 \cdot r \cdot 2}{100} = 160$$

$$2880 \cdot \left[\left(\frac{100 + r}{100}\right)^2 - 1 - \frac{2r}{100}\right] = 160$$

$$2880 \cdot \left[\frac{10000 + 200r + r^2 - 10000 - 200r}{10000}\right] = 160$$

$$2880 \cdot \left[\frac{r^2}{10000}\right] = 160$$

$$\frac{288 \cdot r^2}{1000} = 160$$

So, rate equal $R = \sqrt{\frac{160000}{288}} = \sqrt{555.556} = 23.57\%$

Also we can check receiving solution:

1. Sum of the principal and interest after two years (accumulated amount) $=2880 \cdot \left(1 + \frac{23.57}{100} \cdot 2\right) = 2880 \cdot (1 + 0.2357 \cdot 2) = 4237.63$
2. Accumulated amount if we consider the Compound Interest = $2880 \cdot \left(1 + \frac{23.57}{100}\right)^2 = 4397.63$
3. Difference between Compound Interest and Simple Interest $=4397.63 - 4237.63 = 160$

Answer: The rate percent is 23.57%