Condition:

A ball drops from 180 metres and rebounds one-third of its previous height on each bounce.
i) Find the total distance it travels before it comes to rest.
ii) Find the total distance traveled uptill the time the ball strikes the ground fifth time.

Solution:

i) H=180 m, $h_{after} = \frac{1}{3} h_{before}$

$$S = H + \frac{1}{3}H + \frac{1}{3}H + \frac{1}{9}H + \frac{1}{9}H + \frac{1}{27}H + \cdots$$

$$= H\left(1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \cdots\right) + H\left(\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} + \cdots\right)$$

$$= \{\text{infinite geometric series}\} = H * \frac{1}{1 - \frac{1}{3}} + H * \frac{\frac{1}{3}}{1 - \frac{1}{3}} = \frac{3}{2}H + \frac{1}{2}H$$

$$= 2H = 2 * 180 = 360 \ m$$

ii) $L = H + \frac{1}{3}H + \frac{1}{3}H + \frac{1}{9}H + \frac{1}{9}H + \frac{1}{27}H + \frac{1}{27}H + \frac{1}{81}H + \frac{1}{81}H = H\left(1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \right.$

$\left. \frac{1}{81}\right) + H\left(1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \frac{1}{81} - 1\right) = H\frac{\frac{1}{243}-1}{\frac{1}{3}-1} + H\frac{\frac{1}{243}-1}{\frac{1}{3}-1} - H = 2 * H * \frac{\frac{242}{243}}{\frac{2}{3}} - H = 2 *$

$H * \frac{121}{81} - H = \frac{161}{81}H = \frac{161*180}{81} = \frac{28980}{81} = 357{,}778 \ m$

Answer:
i) 360 m

ii)$\frac{28980}{81} = 357{,}778 \ m$