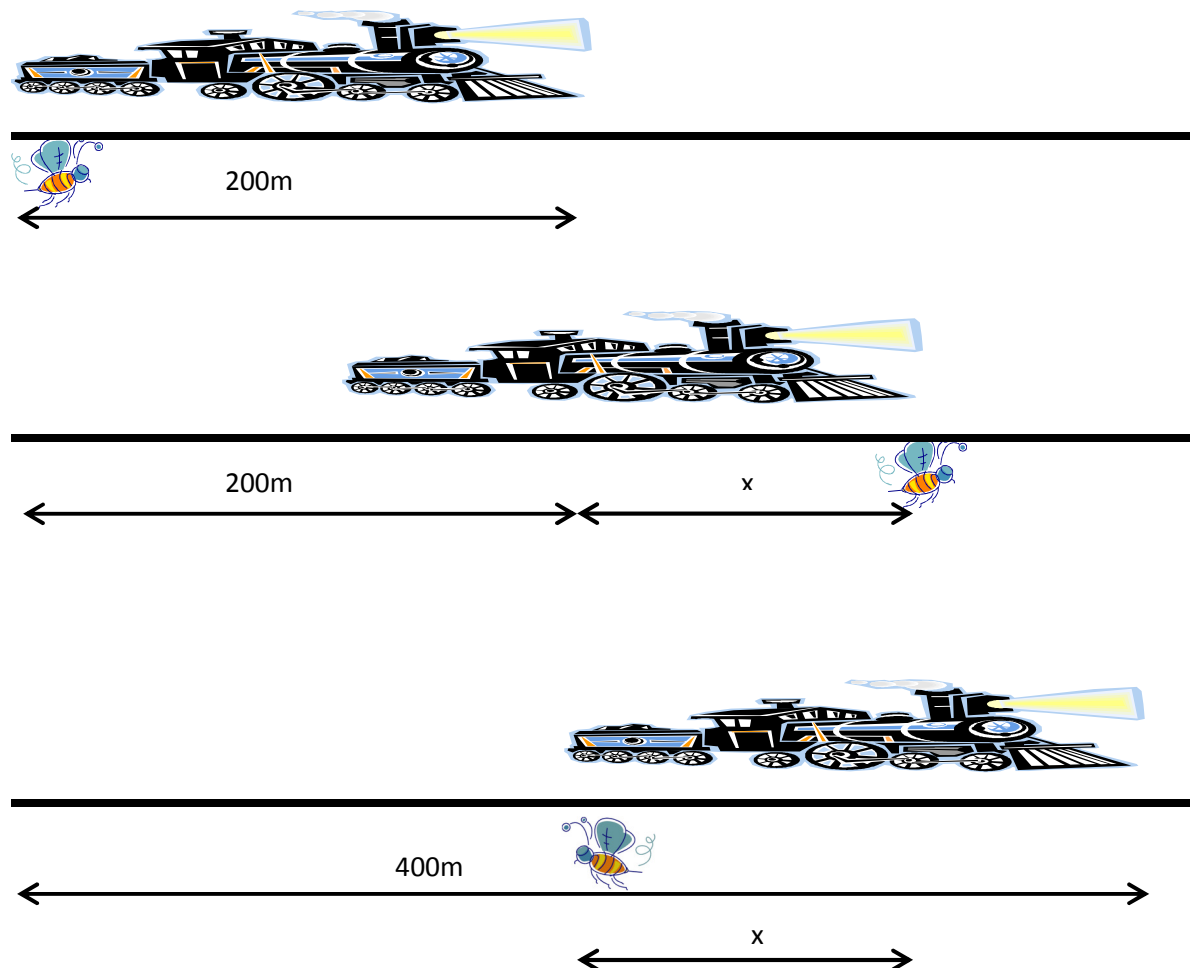


Bee-line 1

Question

A freight train 200m long travels along a straight track at constant speed. In the time it takes the train to move a distance equal to its own length, a bee, initially sitting at the rear of the train, flies forward to the front of the train, turns instantly and returns to the rear, flying at constant speed all the while. What is the total distance travelled by the bee?

Solution



Because the speeds of both bee and train are constant the distance travelled by the bee at a given time is proportional to the distance travelled by the train. That is:

$$d_{bee} = k \times d_{train} \quad (1)$$

where the constant of proportionality, k , is equal to the ratio of bee speed to train speed.

At the point where the bee just reaches the front of the train, we can see from the diagrams above that the train has moved x metres and the bee has moved $200+x$ metres. Putting these distances into equation (1) we have:

$$200 + x = k \times x \quad (2)$$

Again by looking at the diagrams we can see that by the time the bee returns to the back of the train it has travelled a total distance of $200+2x$ metres while the train has travelled 200 metres, so:

$$200 + 2x = k \times 200 \quad (3)$$

Dividing equation (2) by equation (3) to eliminate k , we obtain:

$$\frac{200 + x}{200 + 2x} = \frac{x}{200}$$

which we can simplify to: $2x^2 = 200^2$, from which we have $x = 100\sqrt{2}$ metres. Thus the total distance travelled by the bee is $200 + 2x = 200 + 200\sqrt{2} \approx 482.8$ metres.