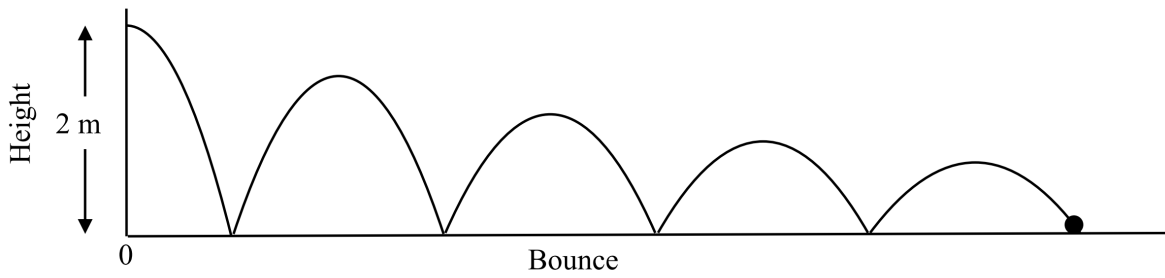


Question 1

(25 marks)

Mary threw a ball onto level ground from a height of 2 m. Each time the ball hit the ground it bounced back up to $\frac{3}{4}$ of the height of the previous bounce, as shown.



- (a) Complete the table below to show the maximum height, **in fraction form**, reached by the ball on each of the first four bounces.

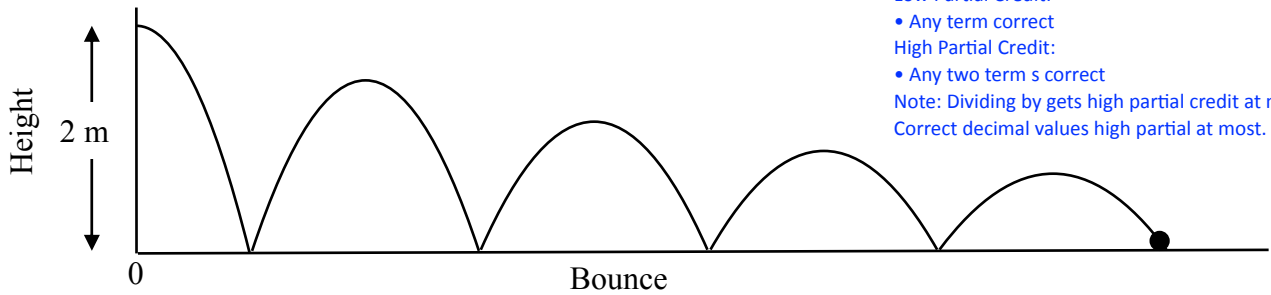
Bounce	0	1	2	3	4
Height (m)	$\frac{2}{1}$				

- (b) Find, in metres, the total vertical distance (up and down) the ball had travelled when it hit the ground for the 5th time. Give your answer in fraction form.
- (c) If the ball were to continue to bounce indefinitely, find, in metres, the total vertical distance it would travel.

Question 1

(25 marks)

Mary threw a ball onto level ground from a height of 2 m. Each time the ball hit the ground it bounced back up to $\frac{3}{4}$ of the height of the previous bounce, as shown.



(a) Scale 5C (0, 2, 4, 5)
 Low Partial Credit:
 • Any term correct
 High Partial Credit:
 • Any two terms correct
 Note: Dividing by gets high partial credit at most.
 Correct decimal values high partial at most.

- (a) Complete the table below to show the maximum height, **in fraction form**, reached by the ball on each of the first four bounces.

Bounce	0	1	2	3	4
Height (m)	$\frac{2}{1}$	$\frac{3}{2}$	$\frac{9}{8}$	$\frac{27}{32}$	$\frac{81}{128}$

- (b) Find, in metres, the total vertical distance (up and down) the ball had travelled when it hit the ground for the 5th time. Give your answer in fraction form.

$$2 + 2\left(\frac{3}{2} + \frac{9}{8} + \frac{27}{32} + \frac{81}{128}\right) = 2 + 2\left(\frac{525}{128}\right) = \frac{653}{64} = 10\frac{13}{64} \text{ m}$$

(b) Scale 10C (0, 4, 8, 10) – 1st solution
 Low Partial Credit:
 • Indicates addition of terms
 High Partial Credit:
 • Recognises double distance after first hop
 • Sum of all rises or drops

or

$$2 + 2\left(\frac{3}{2} + \frac{9}{8} + \frac{27}{32} + \frac{81}{128}\right) = 2 + 2S_4$$

$$= 2 + 2\left(\frac{\frac{3}{2}(1 - (\frac{3}{4})^4)}{1 - \frac{3}{4}}\right)$$

$$= 2 + \frac{525}{64} = \frac{653}{64} = 10\frac{13}{64} \text{ m}$$

(b) Scale 10C (0, 4, 8, 10) – 2nd solution
 Low Partial Credit:
 • Indicates addition of terms
 • Indicates Geometric Progression
 High Partial Credit:
 • Correct Geometric Progression formula with correct substitution

- (c) If the ball were to continue to bounce indefinitely, find, in metres, the total vertical distance it would travel.

$$\begin{aligned}2 + 2\left(\frac{3}{2} + \frac{9}{8} + \dots\right) &= 2 + 2\left(\frac{a}{1-r}\right) \\ &= 2 + 2\left(\frac{\frac{3}{2}}{1-\frac{3}{4}}\right) \\ &= 2 + 12 = 14 \text{ m}\end{aligned}$$

(c) Scale 10C (0, 4, 8, 10)

Low Partial Credit:

• Recognition of sum to infinity • formula

High Partial Credit

• Correct formula with correct substitution

• Sum of all rises or drops