

LC 2015 (SET B): PAPER 1

QUESTION 1 (25 MARKS)

Question 1 (a)

Bounce 1 is obtained by multiplying 2 m by $\frac{3}{4}$ to give a height of $\frac{3}{2}$ m.

This process is repeated up until the fourth bounce.

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

MARKING SCHEME NOTES

Question 1 (a) [Scale 5C (0, 2, 4, 5)]

2: • Any term correct

4: • Any two terms correct

Note: Dividing by $\frac{3}{4}$ gets high partial credit at most. Correct decimal values high partial at most.

Question 1 (b)

Add up the distances travelled by the ball going up and down. Make sure you multiply the distances moved by the bounced balls by 2 (up and down).

$$S = 2 + 2\left(\frac{3}{2} + \frac{9}{8} + \frac{27}{32} + \frac{81}{128}\right) = \frac{653}{64} \text{ m [Using calculator]}$$

or

$$S = 2 + 2\left(\frac{3}{2} + \frac{9}{8} + \frac{27}{32} + \frac{81}{128}\right) = 2 + \left(3 + \frac{9}{4} + \frac{27}{16} + \frac{81}{64}\right)$$

$$[a = 3, r = \frac{3}{4}, n = 4]$$

$$S = 2 + S_4 = 2 + \frac{3(1 - (\frac{3}{4})^4)}{1 - \frac{3}{4}} = \frac{653}{64} \text{ m}$$

FORMULAE AND TABLES BOOK

Sequences and series:

Geometric series [page 22]

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

a is the first term

r is the common ratio

MARKING SCHEME NOTES

Question 1 (b) [Scale 10C (0, 4, 8, 10)] **NOTE:** two solutions

1st solution

4: • Indicates addition of terms

8: • Recognises double distance after first hop
• Sum of all rises or drops

or

2nd solution

4: • Indicates addition of terms

• Indicates Geometric Progression

8: • Correct Geometric Progression formula with correct substitution

Question 1 (c)

$$S_{\infty} = 2 + \left(3 + \frac{9}{4} + \frac{27}{16} + \frac{81}{64} + \dots\right) \leftarrow \text{This bracket is an infinite geometric series with } |r| < 1.$$

$$[a = 3, r = \frac{3}{4}]$$

$$S_{\infty} = 2 + \frac{3}{1 - \frac{3}{4}} = 14 \text{ m}$$

FORMULAE AND TABLES BOOK**Sequences and series:****Geometric series** [page 22]

$$S_{\infty} = \frac{a}{1-r}, |r| < 1$$

a is the first term

r is the common ratio

MARKING SCHEME NOTES**Question 1 (c) [Scale 10C (0, 4, 8, 10)]**

- 4:**
- Recognition of sum to infinity
 - S_{∞} formula
- 8:**
- Correct formula with correct substitution
 - Sum of all rises or drops