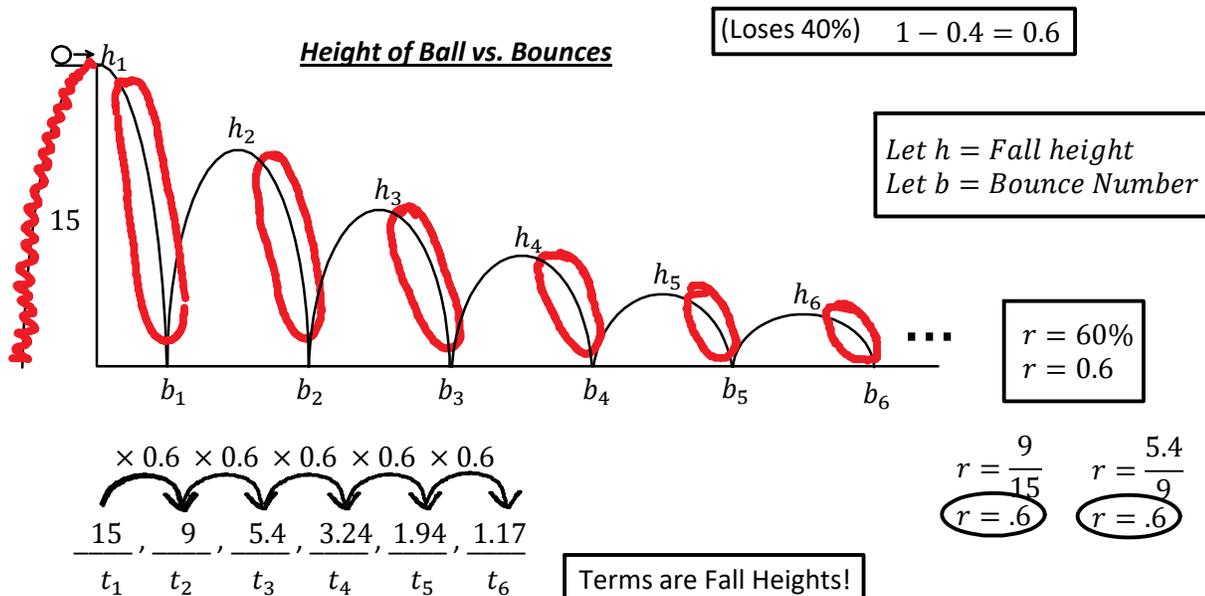


C11 - 1.8 - Bouncing Ball Notes (up 60%)

A ball rolls off a building 15 m tall. After each bounce, it rises to 60% of the previous height.



How high does the ball bounce after the 1st, 2nd bounce?

Height After 1st Bounce

$$15 \times 0.6 = 9 \text{ m}$$

Height After 2nd Bounce

$$9 \times 0.6 = 5.4 \text{ m}$$

$$\begin{matrix} 1 \rightarrow 2! \\ 2 \rightarrow 3! \end{matrix}$$

After 1st = t_2
After 2nd = t_3

How high does the ball bounce after the n th bounce? (Find the general formula)

$$t_n = t_1 r^{n-1}$$

$$t_n = t_1 r^{n-1}$$

$$t_n = 15(0.6)^{n-1}$$

How high does the ball bounce after the 4th bounce. t_5

$$t_n = t_1(r)^{n-1}$$

$$t_5 = 15(0.6)^{5-1}$$

$$t_5 = 15(0.6)^4$$

$$t_5 = 1.94 \text{ m}$$

$$4 \rightarrow 5!$$

After 4th bounce = t_5

How high does the ball bounce after the 10th bounce. t_{11}

$$t_n = t_1 r^{n-1}$$

$$t_{11} = 15(0.6)^{11-1}$$

$$t_{11} = 15(0.6)^{10}$$

$$t_{11} = 0.09 \text{ m}$$

$$10 \rightarrow 11!$$

After 10th bounce = t_{11}

What is the total vertical distance the ball has travelled when it hits the ground for the 5th bounce? $s_5 = ?$

$$s_n = \frac{t_1(1 - r^n)}{1 - r}$$

$$s_5 = \frac{15(1 - (.6)^5)}{1 - .6}$$

$$s_5 = \frac{15(0.87)}{.4}$$

$$s_5 = 34.6 \text{ m}$$

$$34.6 \times 2 - 15 = 54.2 \text{ m}$$

Count it

15
+ 9×2
+ 5.4×2
+ 3.24×2
+ 1.94×2
54.2

If it bounces forever, what is the total vertical distance travelled? $s_\infty = ?$

$$s_\infty = \frac{t_1}{1 - r}$$

$$h_\infty = \frac{h_1}{1 - r}$$

$$h_\infty = \frac{15}{1 - 0.6}$$

$$h_\infty = \frac{15}{0.4}$$

$$h_\infty = 37.5 \text{ m}$$

$$37.5 \times 2 - 15 = 60 \text{ m}$$

$$r = 0.6 \quad r < 1$$

Double it to account for rise heights and subtract the initial height (double counted)