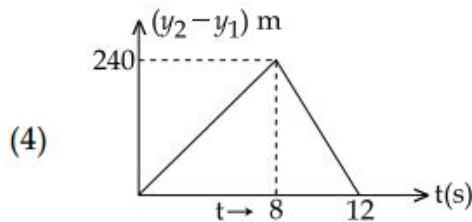
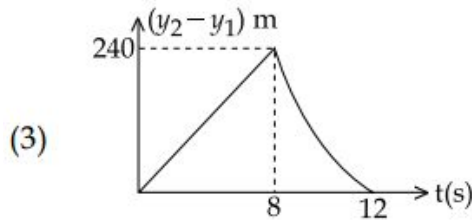
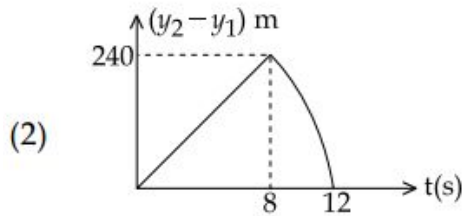
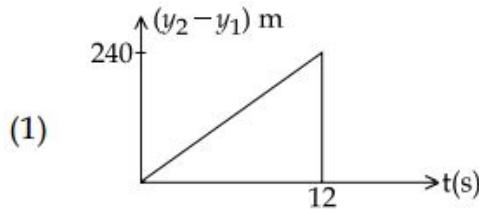


### Question

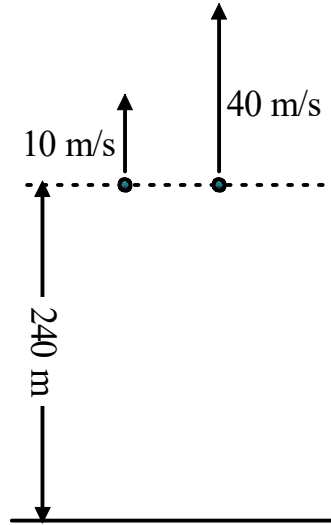
Two stones are thrown up simultaneously from the edge of a cliff 240 m high with initial speed of 10 m/s and 40 m/s respectively. Which one of the following graph best represents the time variation of relative position of the second stone with respect to the first?

(Assume stones do not rebound after hitting the ground and neglect air resistance, take  $g = 10 \text{ m/s}^2$ )

(The figures are schematic and not drawn to scale)



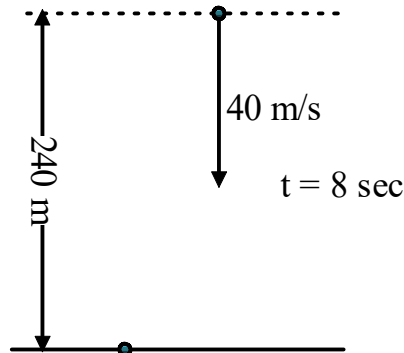
### Solution



$$y_2 = u_2 t - \frac{1}{2} g t^2 \quad \& \quad y_1 = u_1 t - \frac{1}{2} g t^2$$

$$\therefore y_2 - y_1 = (u_2 - u_1)t = 30t \quad \text{which is linear}$$

$240 = 30t$  or at  $t = 8$  sec the first stone hits the ground while the second stone is still in the air.



Let us say this instant of  $t = 8$  as  $T = 0$ .

$$y_2' = 240 - \left( 40T + \frac{1}{2} g T^2 \right) \quad \& \quad y_1' = 0$$

$$\therefore y_2' - y_1' = 240 - 40T - \frac{1}{2} g T^2$$

As  $T$  increases  $y_2' - y_1'$  decreases at a rapid rate. Hence, the parabola should be as shown in Option (2).