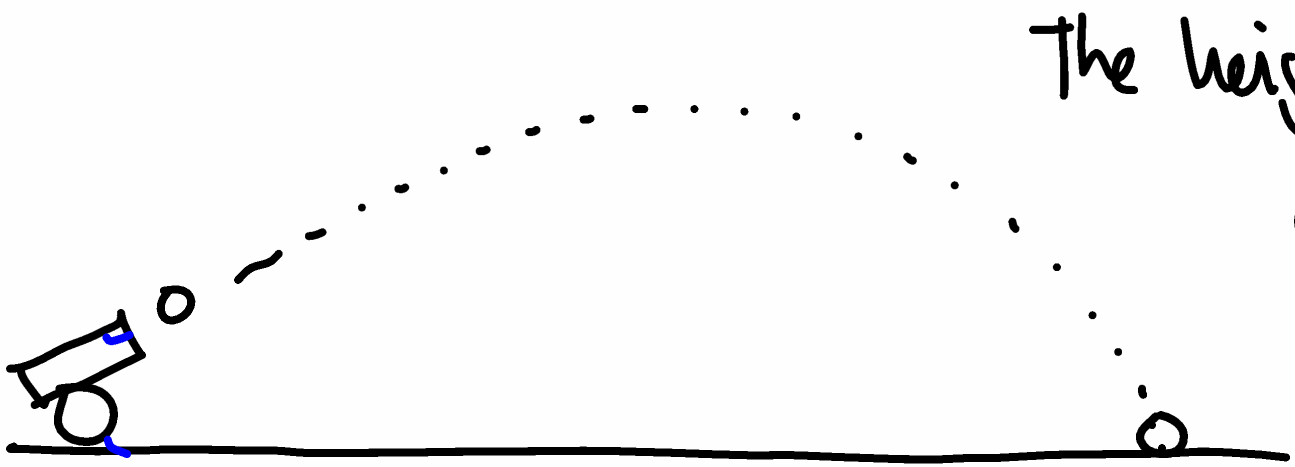
Tue 8 January 2019



The height of the cannon ball at each time is given by

$$h(t) = 1.5 + 2t - \frac{1}{2} \cdot 9.8 \cdot t^2$$

The horizontal position is given by

$$x(t) = 2t$$

a) Height at $t=0$?

Ans: $h(0) = 1.5$

b) At what time hits the ball the ground?

Translating into "math":

What's the time t that makes $h(t) = 0$?

$$1 = 2 \cdot t$$

$$\frac{1}{2} = t$$

$$0 = \underbrace{1.5}_{c} + \underbrace{2}_{b}t - \underbrace{\frac{1}{2}9.8}_{a}t^2$$

$$t = \frac{-2 \pm \sqrt{2^2 - 4(-4.9)1.5}}{2(-4.9)}$$

$$t = \frac{-2 \pm \sqrt{4 + 29.4}}{-9.8}$$

$$\frac{9.8}{2} = 4.9$$

$$\therefore \cancel{4} \cdot \frac{9.8}{\cancel{2}} \frac{3}{\cancel{2}} = 29.4$$

$$t = \frac{-2 \pm \sqrt{33.4}}{-9.8} \approx \frac{-2 \pm 5.7}{-9.8}$$

← Quadratic equation
We need to solve for t

⇓

Quadratic formula

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{-2 \pm 5.7}{-9.8} = \begin{cases} + & \frac{+3.7}{-9.8} = -\text{Negative} \\ - & \frac{+7.7}{+9.8} \approx 0.785 \text{ sec} \end{cases}$$

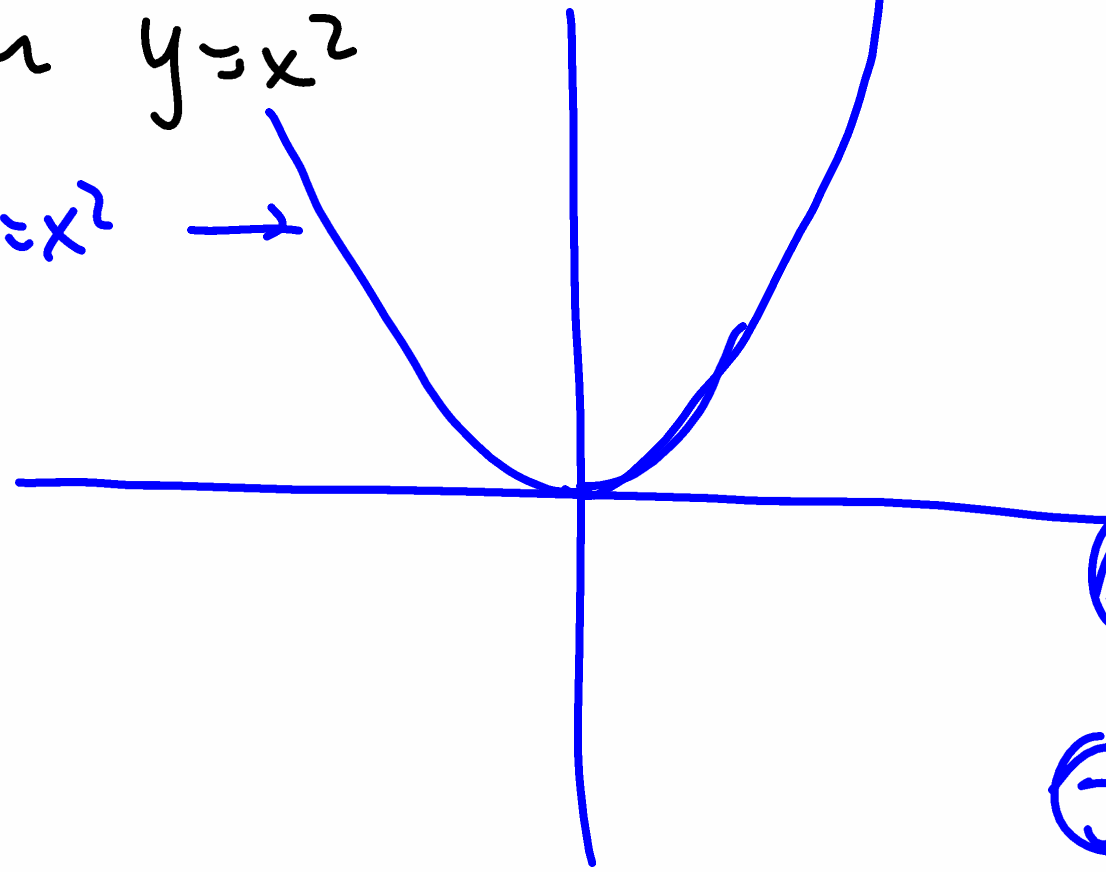
c) At what distance from the cannon does the cannonball hit the ground?

the horizontal position is given by $X(t) = 2 \cdot t$
hence we're looking for X when $t = 0.785$ sec

$X(0.785) = 1.57$ m

Determine the graph of $y = 3(x-2)^2 + 3$

Explain the transformations involved relative to the base function $y = x^2$



1) list transformations

① horizontal compression or vertical stretch by a factor of 3

② horizontal translation by 2 units → right

③ vertical translation by 3 units up