An archer shoots an arrow with a speed of 200 ft/s, if the arrow travels 2 ft before being shoot, what was its acceleration (supposing it's constant)? Express in m/s^2... I got -30.78 m/s^2, is that correct?

Solution:

$S = 2\text{ft} = 0.61\text{m} - \text{distance, that arrow travels before being shoot;}$

$V = 61\frac{\text{m}}{\text{s}} - \text{speed of the arrow;}$

$a - \text{acceleration of the arrow;}$

$t - \text{time before arrow being shoot;}$

The equation of motion for the arrow along the X axis:

$$S = \frac{at^2}{2} \qquad (1)$$

The rate equation for the arrow along the X axis:

$$V = 0 + at$$

$$t = \frac{V}{a} \qquad (2)$$

$(2)\text{in}(1)$:

$$S = \frac{a\left(\frac{V}{a}\right)^2}{2} = \frac{V^2}{2a}$$

$$a = \frac{V^2}{2S} = \frac{\left(61\frac{\text{m}}{\text{s}}\right)^2}{2 \cdot 0.61\text{m}} = 3050\frac{\text{m}}{\text{s}^2}.$$

Answer: acceleration of the arrow is $3050\frac{\text{m}}{\text{s}^2}$.